Alert DIVER

DAN: Your Dive Safety Association

Spring 2014, Vol 6 No 2

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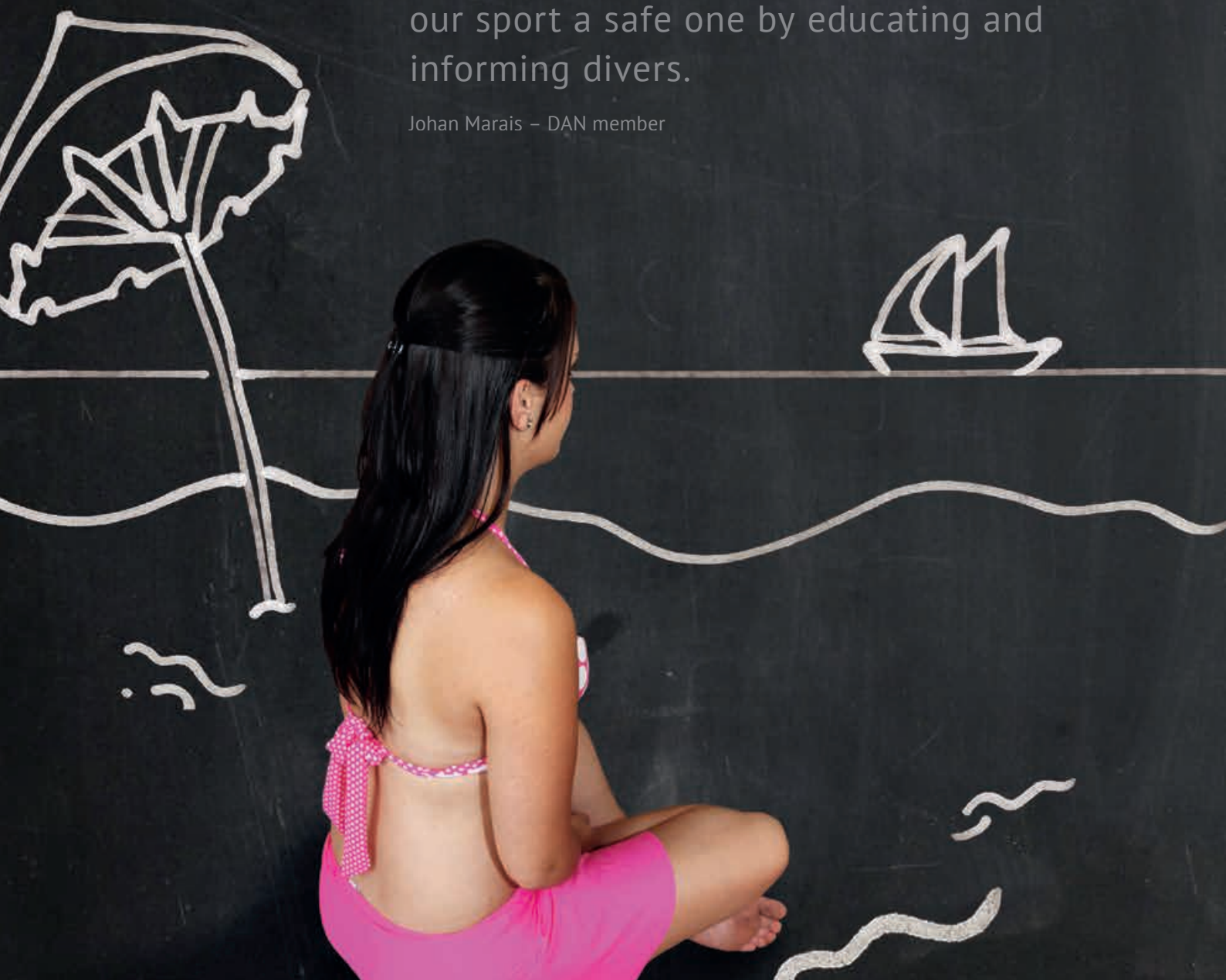

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Spring 2014

FRONT COVER

Image by Stephen Frink.

Informing Divers

DAN HAS THE IMPORTANT FUNCTION OF BRINGING THE DIVE SAFETY MESSAGE TO THE DIVING PUBLIC. WE DO THIS THROUGH VARIOUS INITIATIVES AND KEEPING OUR MEMBERS UPDATED.

FROM THE CEO'S DESK

Why have a DAN Divers' Day? Well, for many reasons. There is so much more to DAN-SA than the occasional call to our hotline or for the purpose of applying for membership. DAN-SA wants to network actively with you; create opportunities to meet key players in the diving safety industry; present the latest cutting edge information on diving safety, fitness, equipment and medical issues; and tell you what DAN-SA is up to and how you can become more involved to improve diving safety in your region.

Starting in 2013, we have held several DAN Divers' Days around the country. We plan to continue doing so for the foreseeable future. By drawing from our own staff and expert medical team and also by inviting commercial enterprises and public institutions to contribute, we plan to offer access to the latest information of common interest to all divers.

In addition, DAN Divers' Days offer you a unique opportunity to bring your questions and suggestions forward, face-to-face, at an event where there are many knowledgeable people gathered together in one venue to answer them. These may include questions on the ever-changing technological advances in diving, diving practices, accident prevention, and search and recovery techniques and equipment. So, please do come along and join us at an event near you this year.

Other topics of current interest are travel advisories and DAN-SA membership cover endorsements. DAN-SA is neither a travel agency nor a security advisory service. Still, we have an ear to the ground and are often made aware of areas of civil unrest or other potential risks that may affect our members who are travelling abroad. When we are notified, we consider it our responsibility to inform you of this to spare you the disappointment, distress or danger of travelling there. However, our members must keep two important things in mind.

Firstly, travel advisories are provided by governments and civil organisations, not by DAN-SA. We simply draw your attention to this information – irrespective of how accurate it may be. As such, we ask that you make your own safety assessments whenever you are planning a trip.

Secondly, our insurers have definite exclusion criteria for injuries or travel disruptions directly related to civil unrest. This means that we may not have access to coverage to assist divers who have been injured as a direct result of civil unrest. Also, general access to emergency medical and evacuation services may be affected by states of emergency. This does not affect diving or normal medical emergency cover. These remain in place. It is only injury or disruption as a direct result of civil unrest that are affected.

The last part of this message is an important appeal related to the length of your stay outside of your official, registered country of residence. DAN-SA membership benefits for international travel (i.e. outside of your country of residence) are restricted to a total length of 90 consecutive days. This means that no single "journey" may exceed 90 days; you are expected to return home within 90 days for your cover to remain valid. This restriction is imposed by insurers to avoid being classed as a medical aid under the Medical Schemes Act and to prevent people from abusing travel insurance as an inexpensive alternative to a proper medical aid. Usually, the underlying motive of the person buying cover is to ensure access to repatriation and medical evacuation and treatment to a hospital in their registered country of residence and away from the country where they are actually living and working. As a result, there are now legal restrictions to avoid abuse or fraud of this nature and DAN-SA is subject to these rulings by its insurer. Having said that, divers can certainly enjoy all the benefits of both diving and non-diving medical emergency cover for periods of up to 90 days at a time. However, for those travelling abroad for more than 90 consecutive days, for purposes other than employment (i.e. non-working), it may be possible to apply to DAN-SA for an extension of the diving medical emergency benefits only. This must be done in writing (or by email) and you will receive a reply stating the endorsement. For working divers (e.g. dive instructors) who are living and working outside of the Southern Africa region, we strongly advise finding a suitable insurance product to cover you once the initial 90-day membership benefit period ceases. We also encourage you to contact our office to clarify any of these issues and for advice on possible alternative insurance products.

Safe diving!

Francois Burman
CEO DAN Southern Africa

FROM THE MEDICAL DIRECTOR'S DESK

Another exciting edition of the *Alert Diver*! We aim to cover questions that are frequently asked via the hotline and hope that you will find the articles interesting and of benefit to you. I need to thank the team for putting together an excellent piece of work and a special thanks to everyone who offered their time to write and review these articles.

To begin, I want to use this opportunity to stress the importance of calling the hotline in the case of a real or perceived diving-related emergency, whether this is for advice or medical support. There are two important reasons for this. First, DAN-SA is not an insurance company and cannot pay for medical expenses that are not authorised via the diving doctors supporting the DAN-SA hotline; and second, DAN-SA is a uniquely specialised organisation and therefore in an excellent position to make judgments on the type, probability of and optimal response to a given diving-related problem. So, let us examine these two components more carefully.

DAN-SA is not an insurance

In terms of the Medical Schemes Act of South Africa, DAN-SA is not allowed to offer the services of a medical scheme. As such, DAN-SA is not allowed to cover medical and health care-related claims in the normal sense of the word. In fact, individual DAN-SA members do not have personal accident insurance. The reason for this is that DAN-SA is actually the insured party; the DAN-SA group insurance policy covers the decisions taken and the medical services engaged by the diving doctor on call for the DAN-SA hotline. In other words, DAN-SA actually submits claims on behalf of its members. The terms and conditions of the policy are in accordance with the rules and limitations placed on DAN-SA by the underwriters; these then become the membership benefits that are extended to the members of DAN-SA. For this reason, all DAN-SA calls are recorded as they form an integral part of the subsequent claim for the services authorised via the DAN-SA hotline. Once a DAN-SA member has received the authorised evacuation and medical services for which payment needs to be made, DAN-SA will submit the relevant information to the underwriters for payment. Importantly, however, if any of these services are undertaken without the direct involvement of the DAN-SA hotline and are therefore not duly authorised by the diving doctors serving the DAN-SA hotline, the insurers are under no obligation to pay for these costs. The net result is that DAN-SA is then unable to extend the benefits to the member. Let me stress this again: Membership benefits can only be provided via the hotline; they cannot be claimed retrospectively.

Specialised advice and medical support

DAN is the leading international organisation on matters relating to recreational scuba diving medicine and safety. There is no other organisation that rivals the experience and dedication DAN has in serving its mission of assisting injured recreational scuba divers and preventing diving injuries. DAN operates a large network of call centres around the world; these centres have vast experience and efficient access to emergency transport, medical services and recompression facilities. For this reason, DAN is in a privileged position to determine the optimal solution to a given diving emergency. Having said that, however, there are three primary challenges DAN-SA faces in all diving emergencies:

- Co-operation of the injured diver and the support of the fellow divers and dive operators
- Reliable communication and proper medical assessment
- Local availability of evacuation and medical services with cover or insurance to pay for them

Some of the most important issues are discussed briefly below.

Co-operation

We find that some DAN-SA members refuse outright to follow the advice given to them via the DAN-SA hotline – especially when they are instructed to visit a clinic in a remote area where they may not be able to speak English or when they feel that the perceived level of care is inadequate. Proper assessment is required for proper treatment. Also, bear in mind that divers ignoring the formal advice offered on the recorded DAN-SA hotline call could become grounds for refusing a claim, particularly if this results in costly complications or if the diver decides to avail themselves of unauthorised services.

Communication and assessment

When looking at the extent of hotline support, DAN-SA members must realise the ethical and practical limitations placed on the DAN-SA doctors (also in terms of their professional registration). Medical treatment may not be prescribed without proper physical examination. This examination can be performed by another health care professional, by proxy, but tele-medical consultation alone is not considered a valid medical assessment. Therefore, all doctors, including our DAN-SA doctors, are required to act in accordance with strict ethical and statutory policies and guidelines. For this reason, medical examination at the closest medical facility is a prerequisite for all significant diving medical problems and emergencies. The goal is to leverage the expert knowledge and experience of the DAN-SA doctors, with the eyes, hands and other professional medical resources that are available on-site.

Availability of services and cover

Remember to inform the hotline when you plan to travel outside of your country of residence for a period exceeding three months. Membership benefits cease after a period of 90 days, unless specifically agreed to by the underwriters. Also, please let us know if you are planning to go diving in a very remote location. We want to do some emergency planning beforehand so that in case you should call us we are ready to respond.

The purpose of this diving medical message is to add even greater confidence in your DAN-SA membership. We want to ensure that you get the best benefit of your membership at all times.

With that, we want to thank you for your membership and support of DAN-SA. Without this, we would not be able to offer any of these services.

Until next time, safe (and happy) diving!

Dr Jack Meintjes
Medical Director DAN Southern Africa

Membership Corner

DAN-SA member benefits

By Morné Christou

IN AN EFFORT TO HELP OUR MEMBERS BETTER UNDERSTAND THE BENEFITS OF BEING A MEMBER OF DAN-SA, WE DISCUSS WHAT THE EMERGENCY EVACUATION BENEFITS OFFER OUR MEMBERS.

AS a start, DAN-SA is not an insurance company and it does not sell insurance. DAN-SA is a diving emergency assistance organisation that uses a group insurance policy to extend emergency medical cover benefits to its members for certain travel, medical and diving related emergencies in support of its mission. As part of your DAN-SA membership, DAN-SA automatically provides cover according to the respective membership levels.

WHAT DO THE EMERGENCY EVACUATION BENEFITS ENTAIL?

As a DAN-SA member, you are entitled to the benefits of our emergency medical programme. This includes evacuation in a medical emergency when you travel more than 100 km from home or when you are on a dive trip. In addition, the benefits extend to include non-diving, emergency medical expenses when you are travelling outside your country of permanent, registered residence for a maximum period of three months (applicable to Plus and Master members only).

BENEFIT NOTES

DAN-SA must be contacted in the event of a medical emergency to access the benefits and in the event of any diving injury. You must advise DAN-SA if you are travelling outside your country of residence for longer than 90 days as international cover is limited to 90 days from the date of departure. If you are a non-working diver and require a limited extension, you must contact DAN-SA in order to ensure that you qualify.

DAN-SA benefits are secondary coverage. Wherever possible, DAN-SA will arrange for expenses to be covered first by any other travel or medical insurance(s) you may have.

Lost or damaged diving gear is only covered if it was lost or damaged as a direct result of a valid, DAN-SA registered accident or evacuation. To ensure cover of such gear, DAN-SA must be contacted in the event of any covered emergency or loss.

DAN-SA works hard to be there for our members and we work just as hard to make sure the programmes and services we provide meet our members' evolving needs. Your membership fees support medical research and diver education which support the DAN mission. Our "Divers Helping Divers" pledge is the cornerstone of our organisation. DAN-SA pledges to continually do what is in the best interest of its members and we ask for the input of our members. If you have any specific question for us, please do not hesitate to contact the DAN office on +27 11 266 4900 or at mail@dansa.org AD

Diving Emergency	Non-Diving Emergency	Travel Assistance/Evacuation
Valid for all DAN-SA members.	Valid for Plus and Master members only.	Valid for all DAN-SA members and their registered non-diving family members.
Diving medical benefits include coverage for emergency medical expenses, e.g.: – Ear barotrauma – Decompression sickness – Arterial gas embolism Terms and conditions apply.	Non-diving medical benefits apply whenever you travel outside of your country of residence. Benefits include emergency medical expenses.	Actual costs of an evacuation are covered. Benefits apply whenever you travel more than 100 km from home or are on a dive trip. International cover is limited to 90 days from the date of departure. Extensions may be granted on request for non-working members at the discretion of the underwriters. Coverage for evacuation to the nearest appropriate medical facility in a medical emergency is covered. If it was a diving injury, refer to column 1. If it was not a diving injury, refer to column 2.
Valid worldwide.	Inside your country of residence, you need to use your own medical aid.	Valid worldwide for 90 days at a time.

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DAN®
SOUTHERN AFRICA

Who are you going to call in a diving emergency?

24-Hour Emergency Hotline
Medical Advice
Help in Diving Emergencies
Specialised Diving Physician Referrals
Access to Evacuation in a Medical Emergency

DMO PROFILE

Dr Imraan Khallil

IMRAAN Khallil is a Durban-based medical doctor who is comfortable in both scrubs and scuba gear. Prompted by a long-standing passion for the sea, he has been a recreational diver for nine years now. He finds that the peace and quiet of the underwater world allow him to relax and get away from the stresses of the "real" world. "The only sound you hear is your own breathing; you get to be a part of the incredible marine universe. Diving makes me feel like a privileged member of an elite society. It is an awesome, indescribable feeling that can only be understood by fellow divers," says Imraan about diving. He goes on to describe the exhilarating feeling of "great accomplishment after successfully executing a dive."

Imraan explains how diving is also very educational, since you learn about the marine world. It also keeps you in shape due to the physical exercise involved, especially the shore entries around Durban. There is also the thrill of discovery in this underwater paradise that keeps him going back for more. Another thrill described by Imraan is "watching nature unfold right in front of me". His favourite dive spot is Aliwal Shoal which has a fascinating reef and marine life that appeals to him.

In 2007, Imraan completed his BScMedScHons degree in underwater medicine at Stellenbosch University. This degree allowed him to combine his passion for diving with his passion for medicine. He also holds a post graduate degree in occupational medicine and he has a certificate in travel medicine.

> "SINCE DAN-SA INTRODUCED THE HAZARD IDENTIFICATION AND RISK ASSESSMENT (HIRA) PROGRAMME, IMRAAN HAS FOUND AN ADDITIONAL AVENUE FOR PARTICIPATING IN DAN-SA'S WORK.

Imraan has been a member of DAN-SA ever since he started diving. He enjoys his association with DAN-SA and is grateful for the peace of mind DAN-SA offers him and enjoys reciprocating this by, in turn, providing his expertise to divers through the 24 hour DAN-SA hotline. Also, since DAN-SA introduced the Hazard Identification and Risk Assessment (HIRA) programme, Imraan has found an additional avenue for participating in DAN-SA's work. "Risk assessments are the 'heart' of occupational medicine and it is great to be able to support this invaluable programme." (For more information on HIRA, see the Spring 2012 issue of *Alert Diver*).

Thanks for being part of the DAN-SA team, Imraan. It is a privilege to have you on board!

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HOTLINE PROFILE

Jens Dehnke

AFTER national service, Jens started his career at the Centurion Fire Department in 1992. Amongst the various emergency medical services (EMS) and fire training courses, he completed the Ambulance Emergency Assistance qualification in 1994 and left the fire department as a senior fireman in 1998. From there, he joined the Alberton Crisis Centre to gain more experience in the emergency and disaster management field.

One of the most critical issues in emergency medicine is effective communication. As a result, he developed an interest in information technology (IT) and eventually started installing local area networks at various companies. Emergency medicine remained his primary interest, but IT added another dimension to the mix and he developed a keen interest.

In 2002, he started at the Netcare 911 Contact Centre. After being the resource planning manager for three years prior, he worked his way up to be the National Resource Management Centre manager in 2006. In addition to the normal day-to-day dealings of being the head of department, he also had the opportunity to be involved in several other projects within the company. These included IT development, customer relationship management development, standard operating procedures, budget management and the overall company telephony administration. "One of the highlights of my time with Netcare was being a member of the team managing the 2004 tsunami disaster from a Netcare 911 perspective," says Jens.

In 2010, he joined ER24 EMS in the capacity of resource and project manager. Here, he was able to use the skills obtained at Netcare 911 as well as his experience in the IT network industry. He implemented numerous reporting, human resource and call flow processes. Disaster management and telephony administration remained part of his portfolio and expanded towards the development of other communication platforms utilised in the private EMS sectors. Collectively, he ended up with 10 years' experience in the AVAYA PABX administration and was responsible for setting up a complex emergency interactive voice response (IVR) process at Netcare 911 and ER24; both of which are currently still in use.

On 1 April 2014, he became a member of DAN-SA's staff after serving on-call for two years.

He is qualified as an ambulance emergency assistant (AEA) and holds a diploma in operation management and he has completed courses ranging from AVAYA administration to advanced driving.

On a more personal note: Apart from EMS and IT, his other interests include programming (especially VBA), all types of music (as long it does not include an accordion) and building whatever he can out of wood. The most important interest and love he has is for his two children, Jens (20) and Alicia (16). Other things people do not generally know about him is that he is a marksman shooter; he is very pedantic (sometimes to his detriment) with regards to how he does things; and he holds a Grade 8 in playing the piano. He also has a love for animals and is the proud papa of two spaniels and two cats.

"So why did I join DAN? Well, a better working environment would be hard to find. Working at DAN-SA with a dynamic DAN team is a treat, not to mention the fact that I have the privilege to work with my 'life partner' Laurel. As they say – wanting more would just be greedy!" AD

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DAN Letters & Comments

How did DAN help you?

Send us your stories via email or our blog
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PROFESSIONAL AND THOROUGH SERVICE

My husband and I recently completed our Advanced Open Water qualification. After flying back to Cape Town, I began feeling strange (dizzy spells, an ache in my knee and tingling in my leg). I have never experienced these symptoms before, so naturally I was worried it could be related to the diving and flying (although the two were more than 48 hours apart) as there was lots of turbulence during the flight and, as a result, lots of altitude changes.

My husband took me to the nearest emergency room, taking my dive computer along, and I was immediately put on 100% oxygen and an IV. Since there were no specialist doctors at the hospital, they contacted DAN-SA who immediately referred me to Dr Cronjé and set up the appointment at the hyperbaric chamber. On arrival, Dr Cronjé and Surita Fitchat did an amazing job in making the ordeal less traumatic. They were extremely professional and thorough in going through my previous dives, surface intervals, signs and symptoms until ultimately concluding that, to my relief, I was not exhibiting the typical symptoms of decompression illness. In addition, a complete physical exam was conducted to be 100% sure that everything was okay.

We would like to extend our sincere thanks to DAN-SA (particularly Laurel Reyneke) for all your assistance throughout the ordeal, providing professional advice and following up during the examination. Once again, a big thank you to Dr Cronjé and Surita for everything.

Lauren and Ryan Williams

RENEWAL PROCESS A BREEZE

Thanks for the quick response in my renewal. As always, I am delighted by the efficiency and speed of the renewal process.

Thanks also to DAN-SA for their ongoing fantastic service to the South African diving community. This is a service which I personally consider to be indispensable and which I always recommend to any new divers I meet.

Neil Wiltshire

INSTRUCTOR AND TRAINEES PLEASED

My trainees all qualified last weekend – there were no glitches and it was an awesome experience.

They were all most impressed with the efficiency of DAN-SA. They all spoke about the messages they received from DAN-SA prior to their trip. I just thought you should know that your efforts are being noticed.

Dave Bennett

DAN IS THERE FOR ME

It is so brilliant having you (Sel-Marie Pereira) there at DAN-SA's offices. Every time I have needed advice, your response has always been so prompt, helpful and immediate.

Whenever my family or I have been fortunate to go somewhere exotic, we have always gone knowing that DAN-SA was there in the background in case of any emergency.

So once again, thank you!

Gordon Hockey

WORLD-CLASS SERVICE

I am a paid-up member and wanted to share some positive feedback.

I wanted to read all five apnoea articles written by Dr Schneider (published in the *Alert Diver* Magazine). Morné Christou was immediate with his assistance. I received an email with all the articles attached within the same day and was told I could collect the magazines at the DAN office.

This is world-class service that shows the great, professional attitude towards DAN-SA's members. I also trust that this same service can be expected for all of the emergency services and products that you provide.

Thank you again.

Nicky Bernhard

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EVERYONE SHOULD HAVE DAN

My name is Pam and I used to run the Aliwal Dive Centre in Umkomaas. My head instructor, who is also my partner, Mark Shaw, had a diving incident which, if it was not for DAN-SA, I do not know where he would be today.

My story begins Sunday, 22 July 2012, on a much needed day off. I received a call that "Mark is down". Needless to say, I was at the office within two minutes and found Mark on the floor still in his wetsuit with one of my instructors and a diver medical technician (DMT) attending to him. They had him on oxygen and my assistant was on the phone to the doctor. Her first instruction is always to call DAN-SA, which she did. Mark was retching continuously, his eyes were shaking from side to side and he was really battling. We got his wetsuit off and had him on the second bottle of oxygen when the ambulance arrived.

We rushed him through to St Augustine's where the hyperbaric chamber is located. Because DAN-SA had already pre-alerted them, Dr Mike Marshall was already waiting for him. He was in the Trauma Unit while I had to do the paperwork, which you can imagine at this time I was not very interested in doing. I knew I wanted to be with Mark but also knew that this needed to be done. Wow! Laurel Reyneke of the DAN-SA hotline had everything under control. She had spoken to Dr Marshall and I was able to hand over all the administration between the hospital and DAN-SA to her to focus my attention on Mark as all the hassles of authorisations were taken off my shoulders

Mark was in the chamber for just under six hours on that Sunday, with me pacing up and down in my slippers. Dr Marshall and the two full-time paramedics (Tarryn and Tristan) were amazing. They even had to clear the chamber to get a bed wheeled in as he could not sit up.

Mark was then taken up to high care. For the next week he was in the chamber every day, went for a magnetic resonance imaging (MRI) scan, went to an ear, nose and throat (ENT) specialist, and went for a hearing test. During that week, we were able to get him into a wheelchair and eventually he managed to start walking.

You can imagine this was one of the worst times of our lives. We owe a great debt of gratitude to DAN-SA for co-ordinating all the necessary resources and staff who took such good care of Mark. His medical bills were all paid for in full, no questions asked.

As to what happened to Mark in the water? He had a cold two weeks before his dive. He did a casual dive the week before his incident to see if he could equalise or not and he was absolutely fine. He was leading a baited shark dive that Sunday morning with a maximum depth of 16.3 m. On looking at his dive profile, there was a lot of surge and he was up and down quickly with a difference of 2-3 m at a time. He sneezed underwater and then had a very bad coughing fit. He came back up from the dive feeling fine and they returned to the beach. The skipper stopped on the back line so that life jackets could be handed out and as Mark turned his head he practically fell over. He had lost all sense of balance and they had to carry him from the boat to the vehicle and then up to the centre. He had an inner ear bend which they think was from a combination of all of the above.

Mark went for a dive medical on 29 November 2012 with Dr Gary Morris where he was declared fit to dive. Very slowly at first, and as a casual diver with one of my professional staff members as a buddy, and eventually back into full teaching status.

DAN-SA, I cannot thank you enough for what you do for our industry and in particular what you did for Mark.

Pam Love

ADMINISTRATIVE SERVICE

Thank you very much for your quick response, as usual. I am very satisfied with the DAN-SA administration process and would like to congratulate you on this.

Johan de Wet

> "WE OWE A GREAT DEBT OF GRATITUDE TO DAN-SA FOR CO-ORDINATING ALL THE NECESSARY RESOURCES AND STAFF WHO TOOK SUCH GOOD CARE OF MARK. HIS MEDICAL BILLS WERE ALL PAID FOR.

DAN EVENTS FOR 2014

DAN DIVERS' DAYS

Join the DAN team at the DAN Divers' Day events in Cape Town, Durban and Johannesburg in 2014. These recreational diving medicine and safety workshops are open to anyone with an interest in diving and will cover diving medicine and safety issues. There is no charge to attend, but be sure to book your spot in advance by contacting the DAN office on 011 266 4900 or at danmedic@dansa.org

Cape Town DAN Divers' Day: 2 August at the Unique Hydra Factory
Durban DAN Divers' Day: 20 September at the St Augustine's Hospital
Johannesburg DAN Divers' Day: 15 November at the DAN Office in Midrand

RESEARCH DAY

Once again we invite all divers to participate in the DAN research event. We will also be introducing a range of new safety research projects such as the Dehydration Safety Drive and the Fitness to Dive Safety Drive. Any divers who experience ear problems before or after a dive are welcome to visit the DAN research station and get their ears inspected by a DAN doctor using a video otoscope.

Date: 15 November
Time: 9:00 – 14:30
Place: Miracle Waters, Brits

INCIDENT INSIGHT

Don't ignore your medical history

By Scott Smith

Image by Stephen Frink.

ALL DIVERS SHOULD CONSIDER THEIR MEDICAL HISTORIES CAREFULLY AND DISCUSS ANY POTENTIAL CONCERNS WITH A QUALIFIED PHYSICIAN.

THE DIVER

The diver was a healthy female in her 20s who was diving as part of her job. She was a scientific diver participating in training exercises with her team.

THE DIVES

Several divers were in the water practising survey techniques and learning to use new equipment in depths between 6 m and 9 m. Most of the dives lasted less than 20 minutes and the divers were in communication with the topside support staff at all times. After each training scenario, they would surface for a debriefing and learn about the next scenario. The group had some newer members, so divers switched buddies regularly to allow everyone to interact with each other. It was summer and temperatures were around 32°C.

Most of the divers were wearing dry suits, their normal diving attire, so the group took precautions to limit overheating during surface intervals. Conditions were calm and the water temperature was 29°C at the surface. Due to significant thermoclines, the temperature was 22°C at 4.5 m and 17°C at 9 m. All the divers carried lights and used full-face masks. As part of the training, each diver took a turn using a new surface-supplied air helmet to get used to working with an umbilical line and to learn to operate the helmet's emergency bailout system.

THE INCIDENT

All participants admitted to being hot and tired toward the end of the sessions. The diver who had the accident was the second-to-last member of the group to use the surface-supplied air system. She had some trouble adjusting to the umbilical line and seemed to get frustrated on several occasions when the line became entangled in features at the bottom. Halfway through her 10-minute dive, she complained to the topside tender about feeling strange and overheated. She called off the dive and asked the tender to begin taking up slack in the umbilical line and then started to ascend.

At 2.5 m, a safety diver who was watching her stated that the diver's eyes rolled back and her head fell forward. She stopped ascending and quickly sank to 6 m, where the umbilical line stopped her descent.

The safety diver initiated emergency procedures and the other divers in the water came to assist. During the ascent, the rescuers noted that the diver was breathing and described her as being stiff and sometimes twitching. On the surface, she was immediately towed ashore and her gear was removed. A certified diver medical technician (DMT) was on the scene and he quickly cut the diver out of her dry suit. Another member of the team contacted emergency medical services (EMS) and was told response time might be as long as 15 minutes due to the location of the training. When the paramedics arrived, the DMT provided them with his assessment, the diver's vital signs and the interventions made.

> SHE HAD SOME TROUBLE ADJUSTING TO THE UMBILICAL LINE AND SEEMED TO GET FRUSTRATED ON SEVERAL OCCASIONS WHEN THE LINE BECAME ENTANGLED.

ASSESSMENT AND EVACUATION

The DMT reported that the diver appeared to lose consciousness in the water during ascent and, based on the rescuer reports of twitching and muscular rigidity, there was concern of possible seizure activity as the diver was being brought to the surface. She was responsive to verbal stimuli by that time and would open her eyes for a few seconds when she was spoken to, but was unable to follow commands. Her vital signs (including blood glucose) were checked and found to be normal except for her slightly elevated blood pressure and heart rate.

The diver's mental status precluded detailed neurological evaluation, but potential concerns included an arterial gas embolism (AGE), hyperthermia and postictal state following a seizure. The gas supply was thought to be safe; none of the other divers who had used it that day reported any problems. Rather than route the patient to the local hospital, the emergency personnel decided to have her flown to a larger facility 72 km away, due to the severity of the symptoms. A helicopter had been placed on standby at the time of the initial call and it was ordered to launch within a few minutes of the paramedic's arrival at the scene of the accident.

During the flight, the diver was sleepy but able to answer some questions. The paramedics noted weakness on her left side and she experienced a seizure that lasted about 45 seconds. Due to the possibility of this being her second seizure, she was given medication (which made her very drowsy) to prevent additional seizures.

DIAGNOSIS AND TREATMENT

In the emergency department, the doctor diagnosed the diver with AGE. This diagnosis was based on the facts that the symptoms began during the ascent from a dive, the symptoms noted during the ascent may have been associated with impaired breathing (or even breath-holding), there was persistent unilateral (one-sided) paralysis and the diver had no known history of seizures. A computerised tomography (CT) scan of the diver's head showed no evidence of bleeding and the risk of stroke was minimal because of her health status and age.

She was transferred to the hyperbaric unit and treated in a chamber. Her drowsiness made it challenging for the staff to assess her response to treatment and they reported that during treatment she seemed to experience three periods of "spacing out" of which each lasted 15-30 seconds. After treatment, she was admitted to the hospital's neurological floor. She received an additional chamber treatment the following morning due to persistent neurological deficits on her left side.

THE HISTORY

By the next day, the patient's family had arrived. After discussing the incident with the family members, she admitted to the doctors that she had a history of complex partial epileptic seizures and that she had discontinued her medications so she could be part of the dive team. She had not had a seizure in years and had done many recreational dives without incident. Of the two seizures she had experienced in the past, both had occurred during periods of extreme stress.

Despite this discovery, the diagnosis was left as AGE due to the persistent weakness. However, the hyperbaric physicians and neurologists who treated the diver wondered if her symptoms were actually the result of a seizure complicated by a condition called Todd's paralysis (a type of paralysis that can follow seizures and usually only occurs on one side). Todd's paralysis resolves spontaneously within hours or a couple of days; the average time to resolution is about 15 hours.

Lending support to the suspicion of Todd's paralysis is the fact that hyperbaric treatment had no effect. The physicians stated they probably would still have done the initial chamber treatment even if they had known about the diver's medical history, but they probably would not have treated her a second time, because there was no improvement after the first treatment and there was a plausible alternative explanation for her state.

> FORTUNATELY, THE DIVER RECEIVED THE RIGHT TREATMENT EVEN THOUGH NO ONE WAS AWARE OF HER UNDERLYING CONDITION.

Fortunately for the diver, she received the right treatment even though no one was aware of her underlying condition. However, her case serves as compelling advice to make sure your dive medical officer (or dive buddy) is aware of any medical conditions that could affect your diagnosis or treatment if you are injured while diving. Several conditions, like hypoglycaemia, migraines and back problems may mimic diving-related conditions and may result in an expensive evacuation and hyperbaric treatments that are not indicated for the underlying condition. AD

A SAD, SAD STORY

ALPHA DIVE INSURANCE PROVIDES SUPERIOR INSURANCE SOLUTIONS WITH THE DIVING COMMUNITY IN MIND. READ ON TO FIND OUT WHY YOU SHOULD CONSIDER INSURING WITH ALPHA DIVE TODAY.

ALPHA DIVE
INTERNATIONAL DIVERS INSURANCE
FOR YOUR VEHICLE AND EQUIPMENT

MEET Sam Fins-Patrick. He is young, dynamic and besotted with scuba diving. Sam spent years training, spending many hours and Rands earning his qualification as an instructor. He ate toast for supper for many evenings, all in the name of saving money to purchase several sets of dive gear so he could open up his own dive school.

Today, he is super proud. He is standing in his driveway, looking at his 4 X 4 *bakkie* and trailer, emblazoned with "Scuba Sam's Dive School". This is it. He can literally touch his dream. What is even more exciting is that he is about to teach his first intake of students and he has spent the entire morning packing his new ride with all the brand new school gear. The smell of neoprene fills his nostrils as he takes a deep breath. That smell is not just the smell of wetsuits; it is the smell of success!

With his *padkos* packed and his chest filled with pride, Sam embarks on what should be the happiest day of his career; but unbeknown to him, the day is about to turn into an absolute nightmare.

You see, Sam hit a pothole. Not just any pothole, but one of those infamous it's-been-raining-for-two-weeks-in-South-Africa kinds of potholes. The deafening bang, the swerving of the *bakkie* and the trailer flailing about helplessly behind the out-of-control vehicle all feel like a bad dream. Sam is in some serious trouble! The *bakkie* finally comes to an abrupt halt, nose first in a ditch. The biggest problem is that his trailer was loaded with full cylinders and they are now lying strewn across the highway, with only a few still strapped in the trailer.

The first explosion felt like a kick in the stomach. He is scratched and bruised, but the pain from watching his dream go up in smoke is far more painful. One explosion, two explosions, flames, smoke, three explosions; it is like popcorn popping as all the cylinders take off. There is nothing to do but take cover and lay low – very low.

The rest of the weekend is spent trying to get through to his insurance company. The words, "you are number 317 in the queue, please be patient" haunt him! Do they not know that his dream is more than just a number? Do they not understand? Why is no one concerned?

Poor Sam! What he did not know was that he was not correctly insured. Standard domestic insurance does not cover you the minute you act in your professional capacity for reward as an instructor or even a dive master. Should an incident occur during this time, the claim will be repudiated.

For instructors like Sam, typical risks would be an incident with their vehicle with school gear in transit (in particular, cylinders) to a dive site. Insurers are not forthcoming when it comes to submitting business types of claims through your domestic policy.

Further areas of risk would be the storage of equipment, in particular enriched air nitrox and oxygen, on a domestic property. Domestic policies' wording excludes damage caused to the building and household content by hazardous material stored on a domestic property.

Another thing to take into consideration is public liability if your school or club is held legally liable by a third party rather than personal liability on a domestic policy.

> "STANDARD DOMESTIC INSURANCE DOES NOT COVER YOU THE MINUTE YOU ACT IN YOUR PROFESSIONAL CAPACITY.

If only Sam had made use of Alpha Dive Insurance. He would be shopping for new gear, a new trailer and a new 4 X 4, and he would not be the only person at his pity party. The Alpha Dive scheme is a commercial policy (for businesses) rather than a domestic policy (for personal cover) to ensure adequate cover.

Poor, poor Sam Fins-Patrick. AD

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Do you know that you're protected while training?

Entry-Level Student Dive Accident Cover
Emergency Hotline and Medical Information Line
Emergency Evacuation
Hospitalisation
Medical and Chamber Treatment

More than just Bubbles

By Dr Nicholas Bird & Dr Frans Cronjé

AS DIVERS, ARE WE TOO CONCERNED ABOUT DCS? THE GREATEST RISKS TO DIVERS ARE DISCUSSED IN THIS ARTICLE, INCLUDING FATALITIES STEMMED FROM HUMAN FACTORS.

DIVING grants us great freedom to explore. It offers the opportunity to experience what most people see only on film. As terrestrial creatures, we are ill adapted to the aquatic world but, nonetheless, eager to survey its wonders. For divers new to the sport as well as seasoned veterans, each dive is unique and requires diligent preparation prior to entering the water. Divers recognise that any excursion into or under the water carries with it some risk of injury. The question is – do we actually pay most of our attention to the greatest risks to our health and safety or not?

> IRONICALLY, HOWEVER, DCS IS ACTUALLY RELATIVELY RARE COMPARED TO SO MANY OTHER COMMON INJURIES AND AILMENTS THAT MAY OCCUR WHILE DIVING.

In numerous articles, seminars and presentations, DAN is a vocal advocate for physical and mental preparation prior to diving, including physical fitness, equipment maintenance and skills training. In practice, however, decompression sickness (DCS) frequently becomes the ultimate focal point. DCS is very well represented throughout DAN's publications and research and also forms an integral part of all introductory dive training programmes. Ironically, however, DCS is actually relatively rare compared to so many other common injuries and ailments that may occur while diving or while on a diving trip. Moreover, DCS is neither the most severe injury nor is it the most likely to be fatal. So, what is the greatest risk to divers?

WHAT HARMS DIVERS?

DAN has been gathering diving injury and fatality statistics for more than 30 years. In 2008, a team of researchers led by Dr Petar Denoble, senior director of DAN Research, published a paper on the causes underlying diving fatalities. While the ultimate endpoint is often classified as drowning, the triggering events that lead to these deaths provide insight into how such accidents may be avoided. For instance, health-related problems, such as heart disease, account for approximately 26% of dive fatalities. Other triggering events, like running out of gas, contribute 41%; entrapment contributes 20% and trouble with equipment contributes 15%. This illustrates the fact that the majority of dive fatalities stem from human factors [1]. This is a recurring theme throughout the published literature on accidents and mishaps in other fields such as medicine and aviation. It also points to the importance of procedures, consistent practices and a disciplined focus on accident avoidance.

> RUNNING OUT OF GAS, ENTRAPMENT AND EQUIPMENT PROBLEMS — THREE HUMAN-RELATED TRIGGERS — ACCOUNT FOR ABOUT 75% OF DIVING FATALITIES.

Human-related triggers account for the majority of diving fatalities.

Running out of gas, entrapment and equipment problems – three human-related triggers – account for about 75% of diving fatalities. The common pathway toward in-water incapacitation in most of these cases was asphyxia or rapid ascent associated with pulmonary barotrauma (lung-overexpansion injury) and a subsequent arterial gas embolism (AGE). In the unforgiving aquatic environment, incapacitation or unconsciousness unfortunately usually results in drowning.

It is also important to emphasise the significance of AGE in the fatality statistics and differentiate it from DCS. AGE is far more likely to lead to drowning, as symptoms often occur while the diver is still in the water, onset is sudden and it often results in loss of consciousness. DCS, on the other hand, is almost never fatal in recreational diving.

DCS IN PERSPECTIVE

When considering all the effort that goes into DCS prevention – including extensive dive table training, dive planning, dive table calculations, completing logbooks and the use of dive computers, divers tend to lose perspective of the fact that DCS is actually quite rare. DCS incidence rates are low in recreational diving (aggregated DCS incidence from all sources is two to four cases per 10 000 dives) [2]. In addition, DCS is rarely fatal and, at least among recreational divers, an uncommon cause of long-term disability. (Please note that this is by no means an endorsement of unsafe decompression practices or an encouragement to slacken preventive efforts.)

Even though severe symptoms, long-term disability and death are indeed rarely associated with DCS, this is the result of conservative training standards, adherence to established protocols and diligent monitoring of nitrogen exposure. However, the point is that divers should not be so preoccupied with DCS prevention that they ignore all the other aspects of their diving activities, no matter how mundane they seem. We must, for example, ensure adequate air supply and properly configured equipment. On a statistical basis, errors and omissions in these areas have much greater lethal potential than DCS.

SHIFTING THE FOCUS

Decompression-related problems represent only a fraction of the injuries and medical problems that travelling divers experience. Dive trips often involve other forms of recreational activities and thus additional sources of injury. Of the calls DAN receives from symptomatic individuals who receive evacuation or medical care co-ordination, about 70% have injuries that are unrelated to diving. This is a powerful statistic that points to other causative factors. Trauma tops the list as the single most common injury type. From broken legs to car accidents, DAN's evacuation services spend the most time on injuries acquired out of the water. So, whether cycling, driving, walking or riding a

scooter, the risk of injury while out of the water certainly warrants attention. If you are a diver who wears multiple computers to ensure adequate DCS prevention, do not put all your safety eggs in that basket and forget to watch your footing on boat ladders. Increase your caution while travelling in areas that have different traffic patterns than those with which you are familiar. Crossing a street with cars travelling on the opposite side of the road is a common scenario for pedestrian injuries in tourists. Injury prevention is even more important in remote locations where the local quality of medical services may be deficient and transportation and evacuation to higher levels of medical care may cause delays to receiving optimal care and this may contribute to additional complications.

> ACCIDENTS ARE, BY DEFINITION, UNPLANNED.

Accidents are, by definition, unplanned. Our best defence against them is vigilance and education which enhance our knowledge of possible hazards, guide our behaviours that reduce their likelihood and make us anticipate problems before they occur. First aid and rescue diver courses do not just teach people what to do when accidents happen, they also promote heightened awareness and a mindset of prevention.

Live safely, dive safely and may all your dives and travels be accident and injury free. AD

References

1. Denoble. PJ., Caruso, J.L., Dear, G.L., Pieper, C.F. & Vann, R.D. Common causes of open-circuit recreational diving fatalities. *UHM;* 2008; 35 (6).
2. Vann, R.D., Freiberger, J.J., Caruso, J.L., Denoble, P.J., Pollock, N.W., Uguccioni, D.M., Dovenbarger, J.A. & Nord, D.A. *Annual Diving Report*. Divers Alert Network: Durham, NC; 2006: p99.

It is important for divers to ensure equipment is properly configured before a dive to avoid accidents.

DAN Training & Education

Courses offered

DAN Training

Contact a DAN instructor in your region to take any of these courses. A full list of instructors is available from DAN-SA on 0860 242 242 or from the website.

DAN Training goes digital!
Some courses are now available digitally.

Entry-level courses

OXYGEN FIRST AID FOR SCUBA DIVING INJURIES

As a recreational diver, you can receive training to provide vital first aid that can make a difference to a scuba diver with decompression illness. The DAN Oxygen Provider Course provides entry-level training in the recognition and management of possible diving-related injuries using emergency oxygen first aid.

FIRST AID FOR HAZARDOUS MARINE LIFE INJURIES

Serious hazardous marine life injuries are rare. Most divers experience minor discomfort from unintentional encounters with fire coral, jellyfish and other marine creatures. This course teaches divers to minimise these injuries and reduce diver discomfort and pain.

AUTOMATED EXTERNAL DEFIBRILLATORS FOR SCUBA DIVING

More than 10% of all dive fatalities are actually caused by cardiovascular disease, according to DAN dive accident and fatality statistics. This course teaches divers and other interested parties to provide care for sudden cardiac arrest including the use of an automated external defibrillator (AED).

Intermediate courses

BASIC LIFE SUPPORT COURSE

The DAN Basic Life Support (BLS) Course will not only train divers and non-divers to resuscitate an injured person with a circulatory arrest, but can also prevent a person from getting in that condition. External bleeding, choking and shock can lead to severe circulatory and respiratory problems. The DAN BLS Course will prepare you to react in the correct way when accidents happen.

FIRST AID COURSE

The DAN First Aid Course represents training designed to educate people with a CPR/BLS certification in providing first aid to adult victims with non-immediately life-threatening injuries. Although the course was designed to be taught together with the DAN BLS Course, it can also be offered as an extra module to those who already have a DAN BLS or other BLS certification that respects European Resuscitation Council (ERC) guidelines. In a real accident situation, first aid skills are the next step after providing effective BLS.

ON-SITE NEUROLOGICAL ASSESSMENT FOR DIVERS

(Prerequisite: Oxygen First Aid for Scuba Diving Injuries)
Learn how to conduct a neurological assessment on a potentially injured diver in this course. The information gained in this assessment can help convince a diver of the need for oxygen first aid and help a diving physician determine the proper treatment.

ADVANCED OXYGEN FIRST AID FOR SCUBA DIVING INJURIES

(Prerequisite: Oxygen First Aid for Scuba Diving Injuries)
This advanced-level programme is designed to train existing DAN oxygen providers to use the MTV-100 or a bag valve mask while providing care for a non-breathing injured diver.

Advanced courses

DIVE MEDICINE FOR DIVERS

(Prerequisite: DEMP and NEURO)
When you want to know more than just basic first aid techniques, Dive Medicine for Divers is your next step. Ultimately, more knowledge and a better understanding of how our bodies react to the pressures and stresses of diving lead to safer dives, as we understand our limitations and the limitations of the situation.

Combination courses

DIVING EMERGENCY MANAGEMENT PROVIDER PROGRAMME

Learn the knowledge and skills from several courses in one single approach to diving emergency management.

Leadership programmes

INSTRUCTOR QUALIFICATION COURSE

To become a DAN instructor, you must complete the DAN Instructor Qualification Course (IQC). Instructor candidates will complete a core module that offers more information about DAN and explains how to teach DAN programmes. Candidates will then complete the course module for each DAN training programme they are interested in teaching.

INSTRUCTOR TRAINER WORKSHOP

This programme teaches scuba diving instructor trainers to teach the DAN Instructor Qualification Course and train DAN instructors. Only DAN staff members and examiners can offer this programme.

Chamber Profile

By Morné Christou

OVERVIEW:	DESTINATION:	CHAMBER TYPE:	TREATMENT TYPE:	DAN SUPPORT:
Dr Adel Taher & the Hyperbaric Medical Centre (HMC)	Red Sea, South Sinai, Sharm el-Sheikh, Egypt	Air filled dual lock	O_2, nitrox & heliox therapy	Chamber training & RCAPP

THE HYPERBARIC MEDICAL CENTRE SITUATED IN SHARM EL-SHEIKH, RUN BY DR ADEL TAHER, OFFERS FULL HYPERBARIC TREATMENT, MEDICAL SUPPORT AND AN ABSOLUTE DEDICATION TO THE WELL-BEING OF DIVERS IN THE EVENT OF DIVING ACCIDENTS IN THE AREA.

DAN-SA'S aim is to equip members with the most up-to-date information regarding diver health and diving safety. This includes being aware of recompression chambers and the treatment of decompression illness (DCI). We know that our members regard diving safety as a priority. Still, just in case you happen to find yourself at a recompression facility, we hope that you will have a better understanding of, and know what to expect from, the treatment and from the health care professionals taking care of you.

The Hyperbaric Medical Centre (HMC) in Sharm el-Sheikh is run by Dr Adel Taher and his assistants, Dr Ahmed and Dr Heikal. It offers comprehensive hyperbaric treatment and medical support in the event of a diving accident in the area. Dr Taher's renowned, long-established centre in Sharm el-Sheikh has been very successful in treating many victims of mild and serious pressure-related accidents and problems over the years; to be precise, since 10 March 1993. Dr Taher and his associates are also involved in sea rescue services and, should it prove necessary, they are also able to activate a fully comprehensive emergency programme in the event of any diving incident. This ensures the highest chance of successful rescue and treatment.

The most important aspect of the service offered by Dr Taher and the HMC is an absolute dedication to the well-being of all divers, be they in need of treatment or not. Dr Taher uses his international reputation and extensive experience, both in the field of diving and of hyperbaric medicine, to further the cause of diving medical science and to ensure the very best treatment for his patients. As a highly qualified and well-respected diver, with over 30 years' experience, he is more than aware of the risks and problems related to diving.

The HMC is part of the Ministry of Tourism and is therefore, by necessity, a business. However, a dedication and love for their work, coupled with a desire to provide the very best service are what, more than anything else, motivate Dr Taher and the HMC towards pursuing an international benchmark for excellence. It is refreshing to find a man who is responsible for such a valuable facility, where money takes a very definite second place to principles.

The Sharm el-Sheikh HMC has handled over 1 600 accidents since 1993. The centre has never closed its doors (they have no days off) and no patient was ever refused treatment. Since 2011, they have a new state-of-the-art

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recompression chamber capable of treating up to 12 persons seated, or two lying down and three to four seated. The centre has its own gas blending station to provide all the needed treatment gases. Having two working chambers allows for flexibility and opens the door for providing hyperbaric oxygen therapy for diseases other than diving accidents, like diabetic foot.

> DR TAHER'S RENOWNED, LONG-ESTABLISHED CENTRE IN SHARM EL-SHEIKH HAS BEEN VERY SUCCESSFUL IN TREATING MANY VICTIMS OF MILD AND SERIOUS PRESSURE-RELATED ACCIDENTS.

Naturally, no one wants to be involved in a diving incident and, thank goodness, they are relatively uncommon. Still, it is comforting to know that optimal treatment is so close at hand. So, to help expand and improve the hyperbaric service that Dr Taher and his team provide to divers who visit Sharm el-Sheik he invited DAN-SA to present a Chamber Attendant and Operator's course to a group of hand-picked dive professionals in the area. The course was presented during the evenings for a period of five days. Even though the students were exhausted after a long day out at sea, they arrived every evening eager to learn, more so as to one day play their part in assisting a fellow diver in need of chamber treatment. The Chamber Attendant and Operator's course covers many topics. What made the course at Dr Taher's facility particularly interesting, however, was the emphasis he put on the general operating duties of the chamber facility.

HOW IS DECOMPRESSION ILLNESS ACTUALLY TREATED?

Divers suffering from DCI are treated using recompression therapy. This means that they are placed into a pressure vessel or chamber that is subsequently pressurised. The objective is to offer them relief from the bubbles and the negative effects these have on the body. In practice, this is usually achieved at a pressure equivalent to 18 metres sea water (msw). Various treatment tables have been developed by scientists and diving doctors over the years. The most common tables were developed by the U.S. Navy, the U.S. Air force, the Royal Navy and private diving companies such as COMEX. In rare instances, 30 or even 50 msw may be used for recompression. However, this should only be undertaken by experienced, specialised and well-staffed facilities with a lot of technical support. Once in the chamber, the diver breathes pure oxygen by a special mask or sealed hood tent (much like a clear plastic helmet) for set periods of time separated by "air-breaks" of between five and 15 minutes. The treatment tables are designed for therapy, not for regular decompression. The usual table (also called U.S. Navy Treatment Table 6 or Royal Navy Table 62) is around five to eight hours in duration, depending on the severity of the DCI. There is also a shorter table of just over two hours (called U.S. Navy Treatment Table 5 or Royal Navy Table 61) which is used in very mild, uncertain or precautionary situations. Up to a depth of 20 m, pure oxygen may be breathed. Deeper tables, as may be used in commercial or technical diving accidents, require diluted oxygen-helium (heliox) or oxygen-nitrogen (enriched air nitrox [EAN]) mixtures or oxygen and nitrogen (known as nitrox).

> THE MOST IMPORTANT ASPECT OF THE SERVICE OFFERED BY DR TAHER AND THE HMC IS AN ABSOLUTE DEDICATION TO THE WELL-BEING OF ALL DIVERS.

HOW IS DECOMPRESSION ILLNESS DIAGNOSED?

Recompression treatment is usually prescribed by a doctor after a thorough assessment of the diver's condition. This assessment will usually include taking a detailed history of the diver and the dives made. This may even include looking at data from dive computers and logbooks. There is also a neurological assessment where the doctor will ask the diver to perform a series of simple tests to test memory, basic calculations, balance, co-ordination, muscle strength and tone as well as skin sensation. The tests will often include routine checks of vital signs (heart rate, blood pressure, breathing rate, temperature, blood glucose) and possibly an electrocardiogram (ECG) and X-ray if lung injury is suspected. There is still no specific laboratory test that can actually diagnose DCI, however. Doppler ultrasound or echocardiography devices may demonstrate the presence of bubbles, but detection of bubbles does not prove DCI as such; it merely demonstrates exposure to decompression stress. So, the doctor's task is to determine how likely a diver's condition is due to DCI as opposed to another medical cause. Once a likely diagnosis of DCI has been made by a doctor, recompression treatment commences. AD

HIV and the Diver

By Dr Imraan Khallil

ALTHOUGH HIV-POSITIVE DIVERS CAN ENJOY THE SPORT, THERE ARE POTENTIAL RISKS AND CONSIDERATIONS TO TAKE INTO ACCOUNT.

HUMAN immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) is a global pandemic with the highest incidence in Africa. As of 2012, approximately 35.3 million people have HIV worldwide with the number of new infections for that year being about 2.3 million. In South Africa, the estimated overall HIV prevalence rate is approximately 10%. The total number of people living with HIV has been estimated at approximately 5.26 million in 2013.

The disease is caused by HIV. There are two distinct types of the HIV disease – HIV-1 and HIV-2. Initially, the HIV-1 epidemic was most prevalent among homosexual populations and intravenous drug abusers. The HIV-2 epidemic originated and remains concentrated in West Africa, but has spread beyond its borders following the emigration of HIV-2 afflicted locals and tourists who have had sexual contact with infected West Africans.

TRANSMISSION

HIV is transmitted through unprotected sexual contact with an infected partner; exposure of broken skin or a wound to infected blood or body fluids; transfusion with HIV infected blood; injection with contaminated needles; and mother-to-child transmission during pregnancy, birth or breastfeeding.

Normal daily contact with an infected person is safe and communal handling of objects does not represent a risk. A risk of transmission is present through open wounds that bleed. However, when normal procedures are based on the assumption that all bodily fluids are potentially infectious, these appear to be adequate and appropriate to provide protection from other blood-borne viruses. Kissing or saliva contact does not cause infection, unless there is blood in the saliva. Contact with perspiration or urine is also not associated with transmission.

Transmission most commonly occurs through exchange of blood products or body fluids associated with the genital tracts. The virus does not survive long outside the body, unless it is suspended in body fluids. Transmission through exhaled air resuscitation, although theoretically possible, has never been documented. As such, it is highly unlikely in divers sharing a regulator when buddy breathing or from sharing other equipment such as helmets.

DISEASE PROCESS

Once the HIV virus enters the body, it invades the white blood cells (CD4 cells) and incorporates itself into the genetic material of these cells. The cell loses its protective function and is reprogrammed into an HIV factory.

There are three main stages of HIV infection: acute infection, clinical latency and AIDS. In the acute infection stage, the individual usually develops an influenza-like illness (40-90%) two to four weeks post exposure while others have no significant symptoms. During the initial few months following infection with the disease, proliferation of the HIV virus is explosive.

The diagnosis of HIV infection depends on the detection of antibodies produced by the body in response to HIV invasion. As such, there is an initial period of HIV–negativity that is called the window period. During this time, the victim is infected but the tests are negative. Seroconversion (i.e. the change from non-detectable to detectable antibody levels) occurs during the window period at three to eight weeks after the initial infection. Only after about six weeks will the person convert to HIV–positivity on testing a sample of blood, urine or saliva. At this point, the profound replication of the virus diminishes and it may appear dormant for many years.

The initial symptoms are followed by a stage called clinical latency. This stage can last from about three years to more than 20 years (average of eight years). While typically there are few or no symptoms at first, towards the end of this stage, many people experience fever, weight loss, gastrointestinal problems and muscle pains.

Finally, the immune system fails and full-blown AIDS appears. AIDS is defined by the development of opportunistic infections and/or certain secondary cancers known to be associated with HIV infection. Beyond the acute infection stage, HIV does not present as a disease itself; instead it allows other infections to manifest, such as tuberculosis or respiratory infections.

Even while healthy, anyone infected with HIV can transmit the virus to another person. The greatest risk for transmission is during the "invisible" window period of rapid initial virus replication and during the AIDS stage when the failing immune system and other opportunistic diseases increase the chances of coming into contact with infectious body fluids.

MANAGEMENT OF HIV/AIDS

Disease progression from HIV to AIDS may be delayed by prevention and early treatment of opportunistic infections, antiretroviral therapy and positive living. Currently there is no cure for AIDS nor is there a vaccine that will prevent HIV infection. The effectiveness and improved side-effect profile of antiviral drugs in use today allow most patients on modern HIV therapy to have a full, productive life to the benefit of society.

> THE CLINICAL LATENCY STAGE OF HIV IS NOT INCOMPATIBLE WITH DIVING.

CONSIDERATIONS IN DIVING

Although AIDS would be a contraindication, the clinical latency stage of HIV is not incompatible with diving. Known HIV seropositive divers, just like carriers of hepatitis B infection, should protect the safety of other divers by first realising the potential risks and opportunities for transmission that are associated with their condition and then deliberately avoid them. As such, there are some special considerations:

- Even in otherwise asymptomatic persons with HIV, there are often subtle changes in a variety of brain functions, e.g. behavioural and motor skills, eye movement, co-ordination and spatial orientation may be affected. These may be more noticeable in the underwater environment and could potentially threaten safety. Known HIV seropositive divers should be aware of the high incidence of subtle neurologic and psychiatric involvement.
- Blood-stained mucus (e.g. snot and spittle) that emerges from masks on surfacing is a potential (although as yet unproven) route of transmission of the virus. As such, buddy breathing techniques and use of rental regulators pose no verified risks. However, one potential area of concern is related to switching of masks after a scuba dive. It has been estimated about one-third of all scuba divers have small amounts of blood from sinus clearing that may find its way into the mask through exhalation or expectoration. This is a potential source of HIV transmission and should be considered. As a general precaution, HIV positive divers should avoid buddy breathing where two divers use the same regulator. The HIV positive diver should have an octopus regulator or alternate air source (i.e. pony or bailout bottle) and make sure their regulators are sufficiently disinfected after use.
- By rights, HIV infected individuals should inform their buddies of their health status. It is a moral obligation, because a rescuer may have to resuscitate a bleeding HIV victim. Non-contact, non-return mouth-to-mouth airways are available for emergency use. However, the problem with CPR is its urgency. Therefore, barrier devices, including airways, should be immediately on hand at all times. Suitable gloves, plastic aprons and goggles are also necessary to avoid inadvertent blood contact through existing skin injuries or via the eye, should the victim be coughing or spluttering blood.
- Some of the drugs that are used to treat HIV have side effects that may mimic symptoms of DCI – typically tingling in the extremities, aches in muscles and joint pains – which may cause diagnostic confusion if DCS is suspected. These symptoms can also occur as part of HIV/AIDS.
- There is also a question of an increased susceptibility to infections. Venomous marine creatures are no respecters of persons and a compromised immune system may lead to a long time of recovery or exacerbated illnesses.

Many potential problems do not seem to have materialised in individuals with HIV that are controlled by antiviral medication. An HIV positive status does not represent a contraindication to work as a diver, including as a saturation diver. There is no data suggesting that this imposes a risk to other diving personnel. Re-assessment of fitness must be carried out if secondary problems arise.

The Diving Medical Advisory Committee (DMAC) has published a guidance document (DMAC 18 Rev) which addresses the issue of HIV infection and AIDS in commercial diving. The document contains the following recommendations:

- Once full-blown AIDS is present, diving must be totally barred.
- Additional concerns suggest that hyperbaric oxygen may reduce the effectiveness of the blood-brain barrier (the brain's protective mechanism from certain damaging substances), thereby accelerating the onset of cerebral AIDS.
- Mandatory testing for HIV is not indicated for commercial divers or others in the industry.

In South Africa, the Employment Equity Act (Section 7) states that medical testing of an employee is prohibited unless legislation permits or requires the testing or testing is an inherent requirement of a job. AD

References

1. http://www.diversalertnetwork.org/medical/faq/HIVAIDS_and_Diving
2. The Diving Medical Advisory Committee – Human Immunodeficiency Virus (HIV) Infection and Acquired Immune Deficiency Syndrome (AIDS) in Commercial Diving, available at: www.dmac-diving.org/guidance/DMAC18.pdf
3. The Medical Examination and Assessment of Divers (MA1), available at: www.ndc.nl/downloadables/ma1.pdf
4. The Medical Examination of Divers – A guide for Physicians, available at: www.labour.gov.hk/eng/public/oh/Divers.pdf
5. HIV/AIDS and the Diver – Diving Medicine Online, available at: http://www.scuba-doc.com/AIDSSadv.htm
6. Diseases/ Viruses- Autoimmune. e-med private medical services, available at: http://www.e-med.co.uk/diving/dive_questions.php?cat=146
7. Statistics South Africa- Mid-year population estimates 2013, available at: http://www.developafrica.org/hiv-aids-Africa?gclid=Clr-jtvUmb4CFTMetAodnFAA5A
8. Kayle, A. Diving implications of HIV/AIDS. In Kayle, A. *Safe diving: A medical handbook for scuba divers.* 2nd edition. 2009. Cape Town: Struik Lifestyle; p138-140.
9. Edmonds, C., Lowry, C., Pennefather, J. & Walker, R. *Diving and Subaquatic Medicine.* 4th edition

PHYSICAL EXERCISE
BEFORE, DURING AND AFTER A DIVE

By Dr Lourens de Kock

RESEARCHERS HAVE RECENTLY UNCOVERED FACTS REGARDING THE RELATIONSHIP OF EXERCISE WITH DIVING. DR DE KOCK EXPLAINS THIS CONTROVERSIAL SUBJECT IN DETAIL.

AS a potential risk factor for decompression illness (DCI), physical exercise remains subject to controversy. Not only is the optimal interval between the exercise and diving uncertain, but the type and intensity of the exercise itself are also cause for concern. Former general recommendations have been based on expert opinion, some anecdotes and perceived biomechanical and biochemical processes. Moreover, with DCI itself being so unpredictable within the conservative exposures associated with recreational diving, the independent influence of exercise is difficult to determine. Is it exacerbating or mitigating? We still do not know for sure, but some evidence has emerged that is able to guide the way. Recently, researchers have uncovered some very interesting facts regarding the relationship of exercise with diving. This research may better equip today's recreational diver to plan their interval between the dive and the treadmill with greater confidence.

When it comes to exercise, there are essentially two potential interest groups. Firstly, there are the "fitness fanatics" who want to exercise whenever and wherever they can: before, during, after and in-between dives. Their interest lies either in actively lowering or at least not accidently provoking DCI. Secondly, there are those divers who want to stay in shape or perhaps combine their diving vacations with other sports or physical activities. Their interest is simply to avoid increasing the risk of developing DCI. With these two groups in mind, the following general recommendations have emerged from a variety of workshops, discussions and reviews of recent evidence and appear central in the ongoing debate [1-6]:

- General: Physical fitness is regarded as an essential requirement for the recreational diver to ensure the safety and enjoyment of the activity as well as to assist in protecting against DCI.
- Type of exercise: Moderate aerobic exercise that does not involve heavy straining of the muscles and joints is preferred; rapid movement (high cadence) of limbs should be avoided.
- Exercise before and after diving: In general, the consensus amongst researchers is that exercise should be avoided within four to six hours before and after diving. Previously, this was set at 24 hours which was impractical.
- Exercise during diving: The objective is to minimise gas uptake and optimise outgassing under conditions least likely to precipitate bubble formation. With this in mind, minimum exercise should be performed during the on-gassing period of a dive (that is during descent and bottom time). Mild, non-strenuous exercise (moving limbs and swimming easily) should be maintained during the off-gassing period of the dive (that is during ascent and at the safety stop). However, it is very important to take care once back on the surface to avoid dragging oneself up ladders and to minimise excessive strain on limbs and joints by removing heavy dive equipment whenever possible. Rather lighten the load by passing dive gear from the water to the attendant before making the exit. Then relax for as long as possible before dissembling, carrying and cleaning your equipment.
- Exercise between dives: Stay warm and maintain low-grade activity in between and after dives. This will facilitate ongoing gas elimination without provoking bubble-formation. Sleeping directly after a dive is not recommended as limb circulation may be impaired and if symptoms arise, they may not be recognised promptly.

In addition to these general principles, the outcome of several studies is providing some additional refinement. Between 2001 and 2004, a series of animal studies in Norway showed that rats exercising 24 hours prior to diving had fewer venous bubbles – using ultrasound [7, 8]. Although bubble grades do not correspond directly to the incidence of DCI, they are an accepted marker of decompression stress and can serve as a basis of comparison between more or less conservative dive profiles. Exercise is only part of the story, of course, but these discoveries have been important in identifying the effect of exercise on blood vessel function which also has several implications relevant to cardiovascular research.

In 2004, the same Norwegian group determined that their findings in rats also applied to humans [9]: The benefits of 40 minutes of intermittent, strenuous exercise on a treadmill, done 24 hours before an 18 m, 80 minute chamber dive resulted in a significant reduction of venous gas bubbles in the heart. With that, the race for the optimal interval between exercise and diving was on.

So, in 2005 a study of navy divers examined the effects of 45 minutes of exercise two hours before diving [10]. Using a slightly different combination of exercise and a 30 m dive for 30 minutes, these researchers also found a significant reduction in bubble grades. The researchers concluded that exercise as little as two hours before a dive might be expected to reduce the number of bubbles and, with it, hopefully reduce the incidence of DCI.

Then a group of French researchers truly pushed the limits of exercise before diving when they asked a study group of divers to exercise one hour

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Exercise should be avoided for at least four hours before and after a dive.

before a dive and then observed their bubble counts upon exiting the water [11]. Again, the researchers found a significant reduction in bubble grades and numbers.

In 2006, a group of divers performed 10 minutes of exercise after open ocean dives of 30 m for 30 minutes [12]. Doppler ultrasound commenced 20 minutes after surfacing, during cycling and immediately after termination of exercise. Somewhat surprisingly, this study found that even post-dive physical exercise significantly reduced bubble formation. The researchers mentioned in their conclusion that this result was obtained in very well-trained (physically fit) navy divers and that additional findings (i.e. further extensive research) would be needed before conclusions could be extrapolated to "normal" recreational divers. We echo their precautionary notes.

Although these research findings are encouraging, it will take larger scale studies on the wider diving populations before the recommendations can be applied as standard practice. Research subjects used in these trials were clearly not representative of the average recreational diver. Moreover, experimental conditions demanded on-site medical support which is not the case for most recreational dive sites. When it comes to diving, fortune tends to favour the conservative.

Then, having said all this, surely a dive trip is meant to be relaxing! So, by all means, maintain the rigorous exercise programme prior to the dive trip. But until the safety of ultra-short periods between exercise and diving has been confirmed, waiting at least four hours after a dive (based on the known peak appearance of venous gas bubbles after diving) would be a bare minimum.

To summarise, I give you the words of Zeljko Dujic from his article *Exercise, Endothelium and Diving Physiology* [13]: "Based on the abovementioned findings, it seems that high-intensity, pre-dive exercise and moderate exercise performed during decompression stops would appear to be a wise prescription for reducing the number of venous gas bubbles after air dives. However, before these procedures can be widely adopted as a predictable safeguard against DCS, we need further standardisation related to the exercise's duration and intensity."

So, get out your running shorts, fill up your water bottles and head out into the fresh air to ensure that you are perfectly pre-conditioned before your next dive trip! AD

References

1. http://diversalertnetwork.org/medical/faq/Timing_exercise_and_diving
2. http://www.awoosh.com/DocVikingo/Exercise_and_DCS
3. http://www.scubadiving.com/training/basic-skills/ask-dan
4. http://www.scuba-doc.com/tenfootstop/?p=183
5. http://www.undercurrent.org/UCnow/dive_magazine/2004/ExerciseBefore200403
6. http://www.yorkshire-divers.com/forums/dive-medicine-fitness/188768-hard-exercise
7. Wisloff, U., Richardson, R.S. & Brubakk, A.O. NOS inhibition increases bubble formation and reduces survival in sedentary but not exercised rats. *J Physiol.*; Jan 15 2003; 546 (Pt 2): p577-582.
8. Wisloff, U. & Brubakk, A.O. Aerobic endurance training reduces bubble formation and increases survival in rats exposed to hyperbaric pressure. *J Physiol.*; Dec 1 2001; 537 (Pt 2): p607-611.
9. Wisloff, U., Richardson, R.S. & Brubakk, A.O. Exercise and nitric oxide prevent bubble formation: a novel approach to the prevention of decompression sickness? *J Physiol.*; Mar 16 2004; 555 (Pt 3): p825-829.
10. Blatteau, J.E., Gempp, E., Galland, F.M., Pontier, J.M., Sainty, J.M. & Robinet, C. Aerobic exercise 2 hours before a dive to 30 msw decreases bubble formation after decompression. *Aviat Space Environ Med.*; Jul 2005; 76(7): p666-669.
11. Castagna, O., Brisswalter, J., Vallee, N. & Blatteau J.E. Endurance exercise immediately before sea diving reduces bubble formation in scuba divers. *Eur J Appl Physiol.*; Jun 2011; 111(6): p1 047-1 054.
12. Dujic, Z., Obad, A., Palada, I., Ivancev, V. & Valic, Z. Venous bubble count declines during strenuous exercise after an open sea dive to 30 m. *Aviat Space Environ Med.*; Jun 2006; 77(6): p592-596.
13. Dujic, Z. *Exercise, Endothelium and Diving Physiology.* Paper presented at: The Future of Diving: 100 Years of Haldane and Beyond 2009; WASHINGTON, D.C.

Historic Overview of Recreational Scuba Diving

PART 3: The History Of Modern Diving (1959 – Today)

By Dr Frans Cronjé

IN THIS FINAL PART OF A THREE-PART SERIES, DR CRONJÉ GIVES AN OVERVIEW OF HOW THE MODERN-DAY SCUBA ASSOCIATIONS STARTED, INCLUDING THE BIRTH OF DAN.

THE next area of development in recreational diving, after the 1900-to-1960 period, was organised scuba training. In 1959, the Young Men's Christian Association's (YMCA's) National Aquatic Council offered the first nationwide diver training and certification programme in the U.S. In the same year, Confédération Mondiale des Activités Subaquatiques (CMAS) was formed in Monaco. These two organisations led the growth spurt in recreational diving in the U.S. and Europe for many years. Twenty-one years later, in early 1980, YMCA Scuba was granted equivalency by CMAS for YMCA qualified scuba instructors and divers. This distinction positioned YMCA as part of the world's largest diving organisation composed of some 12 000 diving clubs, 65 national federations and 3.5 million divers.

During 1959, the British Sub Aqua Club (BSAC) became a founding member of CMAS. Today, BSAC has some 45 000 members which makes it the single largest diving club in the world. BSAC quickly became a significant force in sports diving. The BSAC was formed in London in the autumn of 1953. The club's founder, Oscar Gugen, was assisted by Peter Small, who died tragically a few years later when he was doing a 303 m dive with Hans Keller.

Also in 1959, the Boston-based Northeast Council of Dive Clubs hosted the First National Convention of Skin Divers. The group formed an umbrella organisation representing many diving clubs, councils and constituencies – the Underwater Society of America.

Then, in 1960, Chuck Blakeslee, Jim Auxier and Neal Hess decided to hold a major instructor certification course. Al Tillman, director of the Los Angeles County Underwater Programme, was invited to design and direct the course. The National Diving Patrol was renamed the National Association of Underwater Instructors (NAUI) and was incorporated as a non-profit educational organisation. Tillman became its first president and Hess became executive secretary. The course qualified 53 out of 76 candidates and became the first international instructor certification course in history; this marked a whole new era in sport diving.

The Sealab II underwater habitat.

In 1961, Maurice Fenzy patented an inflatable buoyancy device invented by the underwater research group of the French Navy. It rapidly became the first commercially successful buoyancy compensator. Within a few years, divers throughout Europe and a few well-travelled Americans were all wearing Fenzys. Dive travel got a boost when Richard Adcock launched the first dedicated live-aboard dive boat in Mexico in 1964. Live-aboards have since become one of the mainstays of recreational diving.

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From 1962 to 1965, several underwater habitat experiments provided valuable publicity to diving and offered the world a glimpse of underwater experimentation and research [1, 2]. Edwin A. Link became the "Man in the Sea" with an experimental 24-hour dive on helium-oxygen at 61 m. Jacques Cousteau conducted Conshelf I, with a habitat housing six men breathing oxygen-enriched air (nitrox) at 11 m for seven days. Conshelf II and III followed, as did Hydrolab.

Then, in 1964, the U.S. Navy launched Sealab I. In this first experiment, performed under the watchful eye of Captain George Bond, four divers stayed underwater for 11 days at an average depth of 58 m.

Sealab II followed in 1965 with team leader Scott Carpenter living and working in the habitat at a depth of 62 m. Scott amazed the world when he spoke with astronaut Gordon Cooper in a Gemini spacecraft orbiting 320 km above the surface of the earth.

In 1965, Al Tillman developed the UNEXSO Diving Resort at Freeport in the Bahamas. Created at the beginning of the jet age, it soon became a major diving destination for dive training and travel. UNEXSO became a prototype of a complete dedicated dive travel destination.

Also in 1965, *Thunderball,* starring Sean Connery, modernised and glamorised the public image of scuba diving with streams of diving extras. The special visual effects even won an Academy Award. As a result, diving retailers had to face expectant customers asking for equipment just like James Bond's equipment.

The Professional Association of Diving Instructors (PADI) was formed by John Cronin and Ralph Erickson in 1966. Erickson developed the idea of continuing education. John Cronin died in 2003, with Drew Richardson taking over as the new president of PADI.

In 1967, the Undersea Medical Society, which was later called the Undersea and Hyperbaric Medical Society (UHMS), was founded in Maryland. The UHMS and its members continue to advance knowledge of the medical aspects of diving.

With the increase in diving activity came an increase in diving injuries and fatalities. In an effort to collate these statistics, John McAniff created the National Underwater Accident Data Centre (NUADC) at the University of Rhode Island in 1968. The statistics and accident information gathered, analysed and reported by McAniff advanced industry awareness of many aspects of diving safety.

In July 1970, President Nixon proposed creating a National Oceanographic and Atmospheric Administration (NOAA) to serve a national need "for better protection of life and property from natural hazards... for a better understanding of the total environment... [and] for exploration and development leading to the intelligent use of our marine resources". On 3 October, the NOAA was established under the Department of Commerce. In addition to serving the country through timely and precise weather, water and climate forecasts; managing fisheries; building healthy coastlines and monitoring changes in the oceans; NOAA became one of the springboards for professional diving activities and the cradle of recreational nitrox and technical diving.

Dr Sylvia Earle forever changed the macho image of underwater exploration in 1970 when she led an all-female team of aquanauts in a successful and highly publicised mission in the Tektite habitat. The two-week saturation at 13 m provided researchers with a lot of valuable data [3].

In 1972, the U.S. Congress passed the Marine Protection, Research and Sanctuaries Act. The Act recognised that marine sanctuaries were "part of our (the U.S.'s) collective riches as a nation" and charged NOAA with managing the programme. Today, the system embraces 13 sites, many of which are havens for divers as well as fishes.

A profound setback to recreational diving occurred when Hollywood released *Jaws* in 1975. Stephen Spielberg's rendition of Peter Benchley's book ended 15 consecutive years of industry growth. Aftershocks echoed in 1977 with *The Deep* and in 1978 and 1983 with *Jaws 2* and *Jaws 3*. Fortunately, popular affection for the underwater world was rekindled in 1984 and 1985 when two movies, *Splash* and *Cocoon*, respectively portrayed the ocean as a revitalising, nurturing environment and featured beautiful underwater scenes.

> "TODAY, BSAC HAS SOME 45 000 MEMBERS WHICH MAKES IT THE SINGLE LARGEST DIVING CLUB IN THE WORLD. BSAC QUICKLY BECAME A SIGNIFICANT FORCE IN SPORTS DIVING.

Although already formed in 1963, the national trade association called the Diving Equipment Manufacturers Association (DEMA) hosted its first trade show in Miami in 1977. The show established itself as "neutral ground" where the entire industry could meet. DEMA has become a potent force for professionalism and unity within the recreational diving industry based on the mission of "promoting, fostering and advancing the common business interests of the members as manufacturers of diving equipment".

Co-inventors Craig Barshinger and Carl Huggins, together with ORCA Industries' founder, Jim Fulton, introduced the Edge® in 1983. This first commercially successful American electronic dive computer device automatically tracked dives and continuously calculated remaining no-decompression time and depth limits. It sparked a new era in dive instrumentation and the development of technical diving.

THE BIRTH OF DIVERS ALERT NETWORK

As the increase in recreational diving led to an inevitable escalation in diving-related injuries, the need arose for a dedicated system to council and care for recreational divers. In 1980, Colonel Jefferson (Jeff) Davis created Leofast, a hotline service at Brooks Air Force Base in San Antonio, Texas. This provided 24-hour assistance and advice to injured recreational divers and their health care providers.

However, it was not possible to sustain this service indefinitely within the U.S. military. Therefore, in 1981, this initiative, together with support from NOAA, the UHMS and the diving industry culminated in the creation of Divers Alert Network (DAN) at Duke University Medical Centre as a section 501(c) 3 not-for-profit organisation under the leadership of Dr Peter Bennett. Around the globe, similar initiatives developed and ultimately, these organisations gave up their own identities and converged to become regional DAN organisations and International DAN was formed in 1993. In January 1996, the author became the founding president of DAN Southern Africa (DAN-SA) and handed over the reins to Francois Burman, the current president, in 2011.

THE FUTURE

To this day, the various recreational dive training organisations continue to provide safe entry to the underwater world for the aquatically inclined. Though they may each have unique business and educational nuances, these organisations collectively share a common mission of providing a safe metamorphosis into *homo scubiens.* While the future of recreational diving is unknown, this last frontier on earth, the sea, is likely to remain a popular recreational attraction for the foreseeable future, just as it has always been. History has shown that recreational diving is an evolving entity and will continue to be so. Industry and popular norms will change and shape the process, while those in the diving medical profession will continue to be its conscience. We should therefore realise that our professional persuasions and convictions will be challenged. Only facts and evidence will allow us to respond with wisdom and scientific credibility. While it will be the responsibility of the various scientific, medical and safety organisations to be our collective voice, it will remain our responsibility, through clinical observation, critical appraisal and concerted research efforts to provide them with something to say. AD

References

1. Barth, R.A. *Sea dwellers.* 2000. Doyle Publishing Company: Houston, Texas.
2. Miller, J.W. & Koblick, I.G. *Living and working in the sea.* 1995. Five Corners Publications: Plymouth, Vermont.
3. Bachrach, A.J., Desiderati, B.M. & Matzen, M.M. eds. *A pictorial history of diving.* 1998. Best Publishing: San Pedro, California.

The Tektite II all-female team in the crew's quarters.

Medical queries and

NOTE: Many of the original questions and answers have been altered slightly to ensure confidentiality.

By the DAN medical staff

Q | When I am not wearing a hood, I have no problems equalising my ears. Although, when I wear a hood, I always have great difficulty. Why is there a difference?

A | When we pressurise the middle ear space using the Valsalva manoeuvre or another equalisation technique, the tympanic membrane (ear drum) bulges outward slightly. If the ear canal is uncovered and can transmit that pressure, the water in the ear canal moves easily in response. A hood that fits snugly against the outer ear can greatly restrict the movement of this water, hampering the diver's ability to equalise.

An easy remedy to this is to insert a finger under the hood near the ear, which will allow the water to move more easily. Another solution some divers choose to implement is to cut a hole from the inside of the hood, near the ear canal, through the inner lining and the neoprene but leaving the outer fabric or covering intact. This hole allows the water to move with little restriction.

Marty McCafferty, EMT-P, DMT

Q | In a few weeks, I will be doing my first dive trip on a live-aboard. Several friends of mine who are veterans of live-aboards suggested I use a sleep medication (zolpidem or zopiclone), since travel and the environment can disrupt normal sleep patterns. I would like to use them so as to not be sleep deprived, but how safe are they in a context of frequent diving?

A | Time-zone changes may affect circadian rhythms and employing measures to adjust will help sleep disturbances. Many divers find the active environment extremely conducive to sleep and are pleasantly surprised at their ability to sleep well at the end of a busy dive day.

Both medications have been shown to be less problematic for most individuals than other hypnotics or sedatives. However, they are not without risk. There is evidence both from clinical trials and field reports that misuse of these medications can impair one's ability to safely drive a car. The physical and cognitive skills required for diving are very similar to the demands of driving, so it is reasonable to draw a parallel between the two activities. To reduce the risk of impairment, it is essential to take either medication as directed. The medication should be taken just prior to retiring for a night of eight hours of uninterrupted sleep.

It is important to discuss the use of these medications with your doctor to determine if they are appropriate for you, especially if you are taking other medications or have medical conditions such as sleep apnoea. It is equally important to try the medication well in advance of your dive trip to assess its effects and any potential impairment in a safe and familiar environment.

Another important factor to consider is that one of the medications you mentioned requires less time than the other for the body to eliminate. This does not preclude the use of either. However, depending on your sensitivity, the shorter-acting medication may be a prudent choice. In addition, there is some clinical evidence that people 65 and older may take longer to eliminate the medication from the body. If you awake in the morning after using the medication fully alert and unimpaired, diving is possible. This will require a brutally honest evaluation by you and your dive buddy; most medications have rare side effects and it is important to determine whether your medication is one of the rare cases.

Marty McCafferty, EMT-P, DMT

Q | My friends and I take turns every weekend jumping wrecks. The person whose job it is that weekend to attach us to the wrecks does two dives (one to secure the boat and one to release it) on two wrecks, both around 30 m deep. Each of the four dives takes a little more than five minutes and all surface intervals are about one hour. The person who ties us to the wreck always sits out the other dives, fishing and tanning while the others dive. We use an ascent rate of about 18 m per minute. Should we be doing safety stops for the short dives when securing the boat?

A | Quick dives to tie in to a wreck will not deliver much inert gas to slow or even intermediate tissues. Fast tissues, however, can be significantly loaded, particularly with the depth and exercise intensity that can be substantial on these dives. Brief stops can add a safety factor in two ways: first, by slowing the ascent speed in anticipation of the stop and, second, with the additional stop time for equilibration.

DAN conducted an ascent-rate study a number of years ago that was ended early due to an overwhelming increase in risk associated with fast ascent rates. You may be surprised to learn that 18 m per minute was considered the fast rate. However, having said that, it is important to realise that a uniformly slow rate may be counterproductive, since this can prolong inert-gas loading in the deeper phase of the dive.

One strategy that considers the relative pressure change would be to maintain a standard ascent through something less than the first half of the pressure reduction (ascent) and then to progressively slow from there to the point of performing a shallow stop to benefit the fastest tissues (lungs, blood, then brain). For example, the depth with one-half the pressure of 30 m is 10 m. It could be a reasonable strategy to start slowing the ascent around 12 m and

answers

ascending progressively slower until you halt the ascent at around 4.5 m. There is no magic number for the best stop duration. One minute might be okay for a short, low-effort dive; two to three minutes (or more) might be reasonable if there was greater work involved. It is important to bear in mind that safety stops by design provide an extra cushion – conservatism – in the exposure. Missing them does not guarantee a bad outcome. At the same time, not having a problem following a missed stop does not mean that the stop has no value. The safety-orientated mindset is one that has you incorporating comfortable safety factors wherever feasible to increase the odds of a successful outcome.

Understanding the importance of relative pressure change is important in managing decompression stress. Thoughtful ascent from any dive, long or short, is inexpensive insurance. The fact that you are thinking about the question weighs heavily in your favour.

Neal W. Pollock, Ph.D.

Q | I am an avid scuba diver and spearfisher. I am now pregnant and, as I expected, my doctor told me I should not scuba dive. But I was surprised when he said I should not freedive either. What is the logic behind that or is he simply overcautious?

A | Ethical considerations have limited both the scope and number of studies on pregnancy and diving (both freediving and scuba diving). Most of the literature that is available is purely anecdotal or consists of data collected after delivery. In the book *Women and Pressure: Diving and Altitude* (Caroline E. Fife, M.D. and Marguerite St. Leger Dowse, eds., Best Publishing, 2010), Maida Beth Taylor, M.D., cites a retrospective questionnaire that showed higher rates of low birth weight, birth defects, neonatal respiratory difficulties and other problems associated with scuba diving during pregnancy. These data are limited but sufficient to lead medical professionals to recommend against scuba diving while pregnant or trying to conceive.

The data on freediving and pregnancy are even more limited. Most of the research on breath-hold diving and pregnancy comes from Ama divers in Japan and Korea. These female divers are revered for their diving prowess and the Ama tradition dates back thousands of years. Many of these divers continue to freedive throughout pregnancy, although they modify their profiles as gestation progresses. While Ama divers may continue to dive until the day of delivery, they typically stay close to shore in the later stages of pregnancy. Some Ama divers choose not to dive at all while pregnant.

Taylor states that there is a theoretical, and occasionally real, risk of decompression illness in freediving. However, this risk of decompression illness is usually associated with extreme freediving such as that practiced by Ama divers. Among Ama divers specifically, no adverse effects have been reported in infants. However, the closed nature of Asian traditional diving communities makes it difficult to garner detailed information and the divers may be reluctant to visit medical facilities.

Taylor concludes that it is reasonable for pregnant women to freedive, but that it should not be considered a good form of exercise for them. If freediving is a regular occupation, she judges it to be safe to continue provided that weight gain and other signs of a healthy pregnancy progress appropriately. If maternal parameters fall, something less strenuous is indicated. Ultimately, the decision is the woman's and should be made in consultation with her doctor. DAN medics are available for consultation as well.

Lana Sorrell, EMT, DMT

Lung Squeeze:

Coughing your lungs out

By Dr Rob Schneider

DR SCHNEIDER DIVES INTO THE PARTICULARS OF LUNG SQUEEZE – A LARGELY MISUNDERSTOOD AND UNKNOWN DIVING CONDITION AFFECTING BREATH-HOLD DIVERS.

"LUNG squeeze" is a condition that is practically unique to breath-hold diving. Scuba divers are not really aware of it and, sadly, most doctors have never heard of it, let alone learnt to treat it. There are many urban legends about this rather poorly defined and largely misunderstood phenomenon. So, let us dive into the topic and hopefully avoid getting a brain squeeze in the process!

DEFINITION

"Lung squeeze" is also known as chest squeeze or more formally as pulmonary barotrauma (PBT) of descent. PBT is thus damage or injury to the lungs as a result of the effects of increased environmental pressure on the closed gas spaces of the lungs during breath-hold diving.

The description and definition refers to what happens to the lungs because of increased pressure during descent. Some authorities include tracheal squeeze as part of the broader concept of PBT.

So, using this imperfect definition, let us consider what these effects actually are. How does increased environmental pressure affect the closed gas spaces of the lungs?

PHYSICS AND PHYSIOLOGY

In order to better understand PBT, it is necessary to revisit some basic physics and physiology.

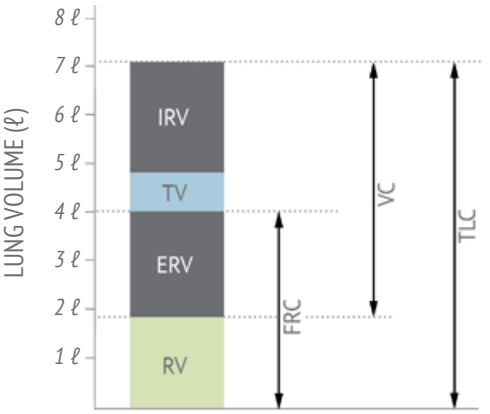
First, Boyle's law: "The volume of a given mass of gas is inversely proportional to its pressure if the temperature remains constant." By this gas law, it is understood that the volume of gas in a closed system or space will decrease as the ambient pressure increases and vice versa. In breath-hold diving, our lungs represent the closed gas containing space with the increased ambient pressure provided by the water's hydrostatic pressure during descent.

For every 10 metres of seawater (msw), an additional 1 atmosphere (ATA) of pressure is incurred. Take note that this inverse volume decrease as pressure increases follows an exponential curve, as shown in the table below.

Depth	ATM/BAR (atmospheres of pressure)	Lung volume	Volume ratio
0 m	1	8 ℓ	1
10 m	2	4 ℓ	1/2
20 m	3	2.66 ℓ	1/3
30 m	4	2 ℓ	1/4

Secondly, some basic understanding of lung volume is required. The total lung capacity (TLC) of a 1.7 m, 70 kg male is roughly 7 ℓ. As the lung volume is emptied down to the absolute minimum, the lowest volume is called the residual volume (RV). The other volumes are not of major significance to the topic and are added for reference purposes.

The figure below shows the lung volume and constituents of a breath-hold diver.



TLC = Total lung capacity
VC = Vital capacity
FRC = Functional reserve capacity
RV = Reserve volume
ERV = Expiratory reserve volume
TV = Tidal volume
IRV = Inspiratory reserve volume

Originally, the assumption was that RV represented the minimum volume that the lungs could achieve before mechanical damage would start to ensue. In other words, it should be safe to dive on breath-hold to a depth where the compression effect on the lungs does not exceed a volume reduction to less than RV. RV is usually 20-25% of the total lung volume after full inhalation. Thus, according to Boyle's law, RV would be reached at about 35-45 msw (i.e. 4.5-5.5 ATA) making this the breath-hold depth limit. Clearly, this is not the case, however, as freediving depth records now exceed 200 msw. This prompted the discovery of other physiological mechanisms that play a role. Besides actual partial collapse of the chest cavity itself, the most important additional compensatory mechanism is the central pooling of blood in the chest from the surrounding tissues. This allows for the accumulation of up to 1.5 ℓ of blood in the blood vessels of the chest.

Essentially, the central pooling of blood in the chest equalises the pressure gradient when the RV is reached and thereby decreases the effective RV and allows for deeper depths to be attained safely. This mechanism increases the pressure in the pulmonary vascular bed and subsequently in the pulmonary capillaries with rupture and haemorrhage both being a possible consequence of the pressure.

In practice, these mechanisms allow the lungs to be compressed down to about 5% of the TLC in highly-trained breath-hold champions. This begs the question of whether this would set the absolute limits for breath-hold diving? Even so, it is not uncommon for these athletes to cough up blood and the feats they achieve do not translate to everyone.

> MANAGEMENT OF PBT FOLLOWS BASIC EMERGENCY MEDICAL MANAGEMENT PRINCIPLES.

SYMPTOMS AND SIGNS

Although it may seem that PBT is limited to very deep dives, there are several reports of PBT occurring with shallow diving – typically repetitive dives with short surface intervals, even as shallow as 4 msw. It may be that more is going on than compression. It is well known that fluid can accumulate in the lungs simply as a function of being in water (as in so-called head-out immersion) or with surface swimming. Individual anatomical, physiological, pathological and day-to-day variations all play a role in the development of PBT.

Not all cases of PBT are recognised as they occur. Some features are transient. Others may be confused with common chest ailments like flu or pneumonia. When both manifest and are recognised, the following symptoms (i.e. complaints) and signs (i.e. actual demonstrable abnormalities) are associated with PBT.

Symptoms

- Chest pain
- Shortness of breath
- Sensation of fluid in lungs
- Coughing
- Fatigue
- Sensation of squeezing or constriction of chest during descent
- Dizziness
- Nausea
- Weakness
- Paraesthesia
- Faintness

Signs

- Hyperventilation
- Coughing up bright red blood or foamy blood
- Vomiting
- Respiratory distress
- Disorientation
- Loss of consciousness
- Neurological fallout
- Cardio-respiratory arrest
- Death

From the long list of manifestations it can be seen that PBT may range from mildly irritating to fatal. In terms of duration, it can be very short or last up to a few months. Re-occurrences are common and the question of permanent damage arises.

AVOIDANCE AND MITIGATION

Whether you are a competitive breath-hold diver or simply spend a lot of time in water, it is worth considering some of the following tips to try to minimise or avoid PBT:

- Maintain your fitness, especially respiratory fitness.
- Build up your carbon dioxide (CO_2) tolerance to reduce lung contractions. These contractions are involuntary gasps against a closed glottis or mouth in breath-hold divers as the physiological breakpoint is reached due to CO_2 levels stimulating breathing efforts.
- Warm up to reduce contractions at depth.
- Avoid stretching out at depth with arms or neck. No excessive or violent movements are required or desired.
- Improve and train your ribcage flexibility.
- Dive to depths you are comfortable with and avoid panicking.
- Turn before you experience contractions at depth.
- Build up slowly when starting to dive to depth.
- Avoid deep dives immediately after prolonged travel, especially if you have changed time zones or experienced jet lag. Recover completely first.
- Learn techniques to relax while diving, especially at depth, and concentrate on releasing tension from around the chest area specifically.
- Learn the Frenzel or mouth-fill technique for equalisation as it is gentler and uses less air.
- If you have a history of PBT, rest the day after a deep dive as there appears to be an increased risk of a PBT on the second day, even at shallower depths.
- If you start to experience symptoms similar to a previous PBT while diving, terminate the dive.
- Maintain regular depth training sessions during your off-season as well.
- Start exhaling just before the surface. Prior training in this regard is recommended.

MANAGEMENT OF PBT

Management of PBT follows basic emergency medical management principles, with the level of care being escalated or maintained depending on the initial clinical presentation and progression of the problem.

A sensible protocol includes the following:

- Stop diving and ensure the safety of the injured diver.
- Stop any physical activity. Let the dive buddy assist in buoyancy and towing of the injured diver to a location where exiting the water can be accomplished.
- Allow the injured diver to rest and ensure comfort.
- If available and possible, let the injured diver breathe 100% medical oxygen.
- Encourage oral fluid intake if the injured diver's airway is secure and the diver is fully conscious, but avoid alcohol.
- Access emergency medical services as quickly as possible depending on available facilities and expertise. The DAN hotline is a good choice for first contact as they can be of great assistance in accessing medical services and they "speak the language of divers".
- Seek medical consultation, preferably with a diving physician as soon as possible.
- Rest for at least two weeks before resuming diving and preferably after being cleared fit to dive by a diving physician.
- Precautionary planning is better than playing catch up.

CONCLUSION

PBT is a curious and much debated problem amongst breath-hold divers. There is still much to learn about this condition and there are various ways in which it can be avoided or mitigated. Perhaps it is indeed the absolute depth barrier to deep breath-hold diving. Who knows? Today's barriers are tomorrow's trophies. In the meantime, dive safely and do not forget to enjoy it. AD

References

1. Brubakk, A.O. & Neumann, T.S. *Bennett and Elliot's Physiology and Medicine of Diving.* 5th edition.
2. Edmonds, C., Lowry, C., Pennefather, J. & Walker, R. *Diving and Subaquatic Medicine.* 4th edition.
3. www.britishfreediving.org
4. www.freediving.co.za
5. www.freedive.net
6. www.skin-dive.com
7. www.deeperblue.com
8. www.freedivers.net
9. www.pureapnea.com

TO STOP OR NOT TO STOP AND WHY?

By Saul and Ethel Goldman

IN ORDER TO ASSESS THE NEED FOR SAFETY STOPS IN PREVENTING DECOMPRESSION ILLNESS, DIVERS NEED TO UNDERSTAND WHAT SAFETY STOPS ARE AND HOW THE RISK IS CALCULATED.

THIS is when it happens: you are coming up from a great dive approaching safety-stop depth when internal conflict begins. What you really want is to be back on the boat as quickly as you can (as in right now, if not sooner). Maybe it is the cold water, too much coffee before the dive, or those refried beans you had for breakfast. The boat's head, grungy though it may be, looks increasingly attractive. A prolonged safety stop will likely result in a grossed-up wetsuit to clean. The easiest thing for you is to not do the stop, just this once. But there is a reason for safety stops, isn't there? Should you take a chance and skip the stop? How lucky do you feel? How lucky do you need to be to skip it without problems? (This brings to mind an iconic movie scene where Harry Callahan, pointing a gun, which may or may not be empty, says "You have to ask yourself 'Do I feel lucky?' Well, do ya, punk?" In the movie scene, the "punk" has enough information to consider his odds and make a decision.)

Back to real life. Do you have enough information to make a sound decision on the safety stop? What would you need to know? At the very least, you would want some estimate of your risk of decompression sickness (DCS), or "the bends", if you completed your safety stop and some estimate of your risk if you went straight up instead. Only then could you compare them and make a reasoned choice.

Right away, we are running into problems. Dive computers in use today do not operate on principles of reasoned choices or levels of acceptable risk. They operate on a straight yes or no basis: Yes, you may continue this dive at the present depth or no, you may not continue this dive at the present depth. It is true that many current dive computers do allow you to initially select your preferred level of risk, but what you are choosing is a relative degree of risk (i.e. more risky or less risky). Nowhere is it specified what level of actual risk any of these different settings represent. Personally, I find such generic categories unhelpful. Compared to some people I know, I am a major risk-taker; compared to others, I am not only a stick-in-the-mud, I have sprouted roots. So how can I judge the risk I am taking in more absolute terms?

Back in the 1980s, a serious attempt was made by Dr Paul Weathersby, a U.S. Navy scientist, to develop a probabilistic model for predicting the likelihood of decompression sickness. It recognised the obvious fact that, like most natural processes, decompression stress increases progressively. No single point exists below which everyone is 100% safe, while above it everyone will get bent. In 1993, the U.S. Navy solicited members of the Dive Equipment Manufacturers Association (DEMA) for a co-operative programme that would get this probabilistic algorithm incorporated into an established dive computer. There was apparently some interest expressed, a lot of

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Studies have shown significant decreases in detectable venous bubbles with safety stops.

objections and, in the end, no equipment manufacturer was willing to sign on. Some of the objections had to do with the then-current microprocessors being unable to handle the computations required. (Another interesting objection will be dealt with below.) Now, almost 20 years and several generations of microprocessors later, there are still no probabilistic models in dive computers.

So we have run into a small roadblock in our decision process. Maybe it will help if we re-start by looking at safety stops themselves.

What effect do safety stops have on diving safety? First, a little background. Unlike the dive tables, or the algorithms that lie at the root of dive computers, the safety stop is basically an add-on. When dives were a little close to the limits for no-decompression diving, it made intuitive sense to do something that resembled a decompression stop, just as a precaution. The feeling developed that this was probably helpful; although, initially, there was no scientific evidence and no real theory that supported this.

The earliest evidence in support was provided by a small, Doppler-monitored study by Dr Andrew Pilmanis. This demonstrated significant decreases in detectable venous bubbles with safety stops, which might indicate that such stops are useful. Unfortunately, while bubbles detected by Doppler-monitoring do seem to have some correlation with DCS, it is not a very strong relationship. So we are still left with a common sense idea about safety stops, anecdotal evidence (observations by the dive community that stops are helpful) and a limited amount of scientific support.

Where do safety stops fit into the theory? Or, more practically, into the theory and algorithms that underlie current dive computers? All dive computers in use today, although different from one another in various ways, are structurally based on the Haldane model of decompression. The Haldane model would predict only minimal benefits to safety stops. So, what is going on here? Are safety stops just some sort of uninformed superstition or do we need to look deeper for answers?

Now would be a good time to revisit the meeting between the U.S. Navy and DEMA, and a very interesting objection made by the equipment manufacturers to the proposed probabilistic algorithm for dive computers. The manufacturers were not willing to make and sell a dive computer that would tell divers their risk of getting bent was in the (somewhat unsettling) neighbourhood of 2.5%. And who can blame them for that? For one thing, it could scare off potential divers and, for another, it does not seem to correspond to what divers actually experience. In theory, with a DCS risk of 2.5%, a diver with 200 logged dives might be bent about five times. As for dive guides with thousands of dives, they should be expected to be about as familiar with the inside of a recompression chamber as with their favourite bar.

Refusing the Navy's conservative (i.e. rather pessimistic) algorithm would seem almost a no-brainer for the manufacturers were it not for a few inconvenient details. One is that the Navy figures were based on solid experimental evidence. The other is that the manufacturers in fact use the same Navy dive tables (or similar PADI tables) in calibrating the Haldanean model that underlie their own algorithms. If the equipment manufacturers were to turn their own algorithms into probabilistic ones, their estimates of DCS risk would be roughly the same as those in the U.S. Navy's proposed algorithm. It is not that they disagreed with the estimated risk; they just did not want to declare it.

> BACK IN THE 1980S, A SERIOUS ATTEMPT WAS MADE BY DR PAUL WEATHERSBY TO DEVELOP A PROBABILISTIC MODEL FOR PREDICTING THE LIKELIHOOD OF DECOMPRESSION SICKNESS.

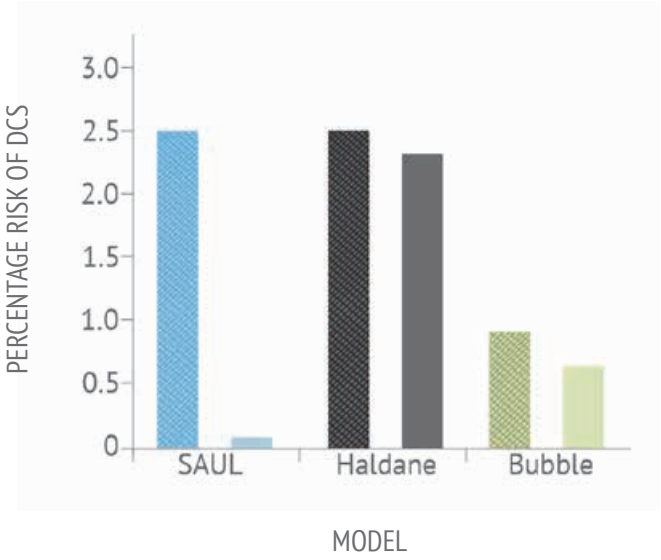
But we are still left with two very different risk estimates. On the one side is the experimental evidence of a 2.5% DCS risk. On the other side is the real-life experience of the diving community, where the actual rates of DCS appear to be only a fraction of the probabilities predicted by the experimental Navy DCS risk. Clearly, they cannot both be right. Or can they?

There are at least two key differences between the studies conducted by the U.S. Navy and what happens in the day-to-day diving world. In addition to the Navy dives being square profiles (maximum time at maximum depth), the divers in the study were brought to the surface with no safety stops – all the so-called no-decompression dives were performed with a direct ascent to the surface. On the other hand, under normal circumstances, safety stops are always recommended, even insisted on, in recreational diving. Of course, this can only amount to a difference if safety stops are in fact being used. Recent data provided by Project Dive Exploration (PDE) support our general observation that the vast majority of recreational diving really does include some version of a safety stop. Specifically, out of 102 642 dives on air, 95.7% of ascents from 6 metres sea water (msw) involved a safety stop, which is pretty good. But when the search was widened to include all ascents from 9 msw, 99.3% of ascents involved some form of safety stop. In effect, even though there was large variability in exactly how safety stops were performed, the overwhelming majority of recreational dives did include some sort of safety stop. So, there is indeed an actual difference between the U.S. Navy studies and the everyday diving world: direct ascents versus safety stops.

So, the question is: Can safety stops account for the apparent discrepancy between the U.S. Navy results and divers' experience when diving on a modern dive computer? Not according to decompression models based on the Haldanean structure, which means not according to the algorithm in your current dive computer. Even though most modern dive computers prescribe a safety stop, this is not the product of the underlying decompression algorithm. It is simply a safety measure that has been inserted because it appears to be helpful in reducing the risk of DCS in practice, not because of anything the model would predict.

This is where my contribution to the nebulous world of decompression modelling comes in. The model, called Safe Advanced Underwater algorithm (SAUL) (okay, so the acronym is not perfect and, sure, it is a bit self-referential) accounts for the safety stop effect as an integral part of a predictive model, rather than leaving this as a wild card.

Here is how it works. The SAUL model differs from models with a Haldanean compartmental structure (i.e. independent parallel compartments) in a key way. Because the compartments in SAUL are physically interconnected (as opposed to physically unconnected) when the math is worked out, the form of their off-gassing patterns during decompression differs fundamentally from that of their Haldanean counterparts (see the 2007 *J Appl Physiol* paper referred to below, particularly Eq (3) therein, and the surrounding text, for the math). With SAUL, the off-gassing rate at a stop is initially relatively rapid, it is intermediate at intermediate stop times and it is very slow at long stop times. Consequently, with SAUL (as opposed to an independent compartment model) the off-gassing is relatively extensive early on during the stop, i.e. during the first one to three minutes. Therefore, SAUL would predict that on surfacing, subsequent to a short safety stop, the diver would have a smaller burden of excess inert gas in his or her system than would be expected from the basis of a model with a Haldanean compartmental structure. Consequently, the DCS risk following a safety stop, as predicted by SAUL, would be less than that predicted by models with an independent parallel compartmental structure.



Effect of a stop on a very low-risk dive (approximately 18 msw for 40 minutes). The cross hatch colour is with no safety stops and the solid colour is with a safety stop at 5 msw for 3 minutes.

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The diagram on the opposite page shows how each of the three different algorithms would predict the risk of DCS for one typical recreational dive without a safety stop and for the same dive with a safety stop. The algorithms used are a typical Haldane model ("Haldane"), a bubble-based model currently in use by the U.S. Navy ("Bubble") and the author's model ("SAUL").

To what extent can we now answer our original question? How lucky do you need to be to skip a safety stop and avoid DCS? Obviously this would depend on the dive profile and the predictive model, so to allow comparison, let us compare the outcome of a typical 18 m dive for 40 minutes.

According to the Haldane model, your luck does not really change with the safety stop: your risk of DCS is pegged at 2.3% with a stop and 2.5% without one – not a huge difference. According to the Bubble model, your risk of DCS rises from 0.7% with a stop to 0.9% without one. Again, not a huge difference. With SAUL, skipping your stop increases the risk from about 0.1% to 2.5% or, to put it another way, your dive without a stop is 25 times as risky as that same dive with the stop.

So, what should you do? According to the Haldane or the Bubble model, omitting a safety stop does not make much of a difference in your risk of developing DCS. The SAUL model reflects the experience of divers around the world (including DAN's PDE dataset) who perform safety stops and offers probabilistic outcomes that are more consistent with the actual low incidence of DCS we observe.

With this article, I have tried to achieve two things. Firstly, I encourage you to invest in performing safety stops no matter what dive computer or algorithm you dive with. Safety stops slow down your ascent and allow you to practice buoyancy skills in addition to being a sensible precautionary measure against DCS. Secondly, I invite you to take a closer look at the SAUL model by reading some of the articles below or by visiting one of the author's websites. There is no SAUL model-based dive computer on the market at the moment, so I am not trying to sell you one. What I am trying to promote is scientific openness, honesty and plain language that respects all divers in discussing recent developments in decompression theory in the hope that we may pursue those aspects that are actually beneficial and avoid those that are not. AD

References

1. Butler, F.K. & Southerland, D. The U.S. Navy Decompression Computer. *Undersea Hyper Med.*; 2001; 28(4): p213-228.
2. Goldman, S. A new class of biophysical models for predicting the probability of decompression sickness in scuba diving. *J. Appl. Physiology*; 2007; Article 103: p484-493.
3. Goldman, S. Appendices and Additional Materials for *J. Appl. Physiology*; 2007; Article 103: p484-493.
4. Goldman, S. The stability of bubbles formed from supersaturated solutions, and homogeneous nucleation of gas bubbles from solution, both revisited. *J. Phys. Chem.*; 2008; B 112: p16 701-16 709.
5. Goldman, S. Generalizations of the Young-Laplace equation for the pressure of a mechanically stable gas bubble in a soft elastic material. *J. Chem. Phys.*; 2009; 131: p184 502.
6. Goldman, S. Free energy wells for small gas bubbles in soft deformable materials. *J. Chem. Phys.*; 2010; 132: p164 509.
7. Goldman, S & Goldman, E. Coming soon to a dive computer near you. *Alert Diver* (European Edition, IVth Quarter, 2010).
8. www.chemistry.uoguelph.ca/goldmanmoderndecompression.com

Safety stops are a sensible precautionary measure against DCS.

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NOISE-INDUCED HEARING LOSS affecting the diver

By Dr Jack Meintjes

LEARN ABOUT HOW THE PROVISIONS OF NOISE-INDUCED HEARING LOSS REGULATIONS, PUBLISHED UNDER THE OCCUPATIONAL HEALTH AND SAFETY ACT (SOUTH AFRICA), AFFECT THE DIVING INDUSTRY.

THE noise-induced hearing loss (NIHL) regulations apply in all workplaces where a person at work may be exposed to a noise level above 85 A-weighted decibels (dB[A]). Such a noise level is determined by evaluating the exposure over a period of eight hours. Therefore, if a person is exposed to high noise levels for short durations, the average exposure over eight hours may well be below the noise rating limit. The way in which such exposure is determined in practice is by means of a specific measurement by an approved inspection authority.

For details on approved inspection authorities who may perform noise measurements, visit http://www.labour.gov.za/DOL/downloads/documents/useful-documents/occupational-health-and-safety/aiapamphlet.pdf

ASSESSMENT OF EXPOSURE

The regulations require an employer to formally assess the workplace for potential exposure above the noise rating level of 85 dB(A) at least once every two years. Such an assessment should consider the potential sources of noise and the extent to which persons may be exposed. Other factors to include in the assessment would be the work processes and whether failure of noise control measures can be expected.

In terms of the diving environment, the following are common sources of loud noises:

- Compressor rooms are notorious for their high levels of noise and cylinder filling stations may likewise be noisy.
- Depending on the machinery used and the activities performed, workshops can be quite noisy.
- The air flow into hyperbaric chambers from high pressure gas banks have been measured as exceeding 100 dB(A).
- The peak noise levels that are measured in diver helmets (especially the free-flow type used for diving in contaminated waters) have been measured to exceed 110 dB(A).

- Commercial divers may be exposed to a range of noisy underwater tools where levels exceeding 170 dB have been measured.
- Boat engines may also cause noise exposure above the exposure limit.

The assessment of exposure should be reviewed more frequently than once every two years if it is expected that the latest assessment may no longer be valid. This may be as a result of changes in either the work methods or changes in the equipment.

Whenever the assessment by the employer determines that a person may be exposed above the noise rating limit, formal measurements and monitoring of noise exposure are required. The details of the noise monitoring required are described in the regulations, including references to the South African Bureau of Standards (SABS) documents that prescribe certain standards. The noise monitoring may only be performed by an approved inspection authority and this must also be performed every two years.

The records of assessments of potential exposure and of formal noise monitoring must be kept for a period of 40 years.

NOISE ZONES

All areas with noise levels above the noise rating limit must be clearly demarcated with signs indicating that the area is a noise zone. No person may be allowed to enter such an area without wearing appropriate hearing protection. In addition, attempts should be made to reduce the noise levels by means of engineering or administrative control measures (e.g. the rotation of workers).

MEDICAL SURVEILLANCE

Persons who are exposed to noise levels above 85 dB(A) are required to take part in a medical surveillance programme, which will screen them for possible effects of exposure to noise. This would include the performance of a number of different audiogrammes (at baseline, followed by regular periodical audiogrammes as prescribed and exit audiogrammes). Not just any medical person may perform the medical surveillance – the regulations specifically state that it must be performed by someone with a qualification in occupational health; an ear, nose and throat (ENT) specialist; or an audiometrist. The records of the medical surveillance must also be kept for a period of 40 years.

TRAINING

All persons who are required to work in a noise zone are required to receive training on aspects related to the noisy work. The contents of the training (as listed in the regulations) include the contents of the regulations; the sources of noise exposure; the health effects and safety risks associated with noise; precautions to be taken by the workers (including how to wear and maintain hearing protective devices and the limitations to their use); the need for medical surveillance; and how to report problems. Additional aspects that form part of the training would be related to a number of duties and responsibilities the regulations place on workers.

SOME PRACTICALITIES

Although noise exposure could be measured with relative ease both above and below water, the negative effects of underwater exposures are a bit more difficult to predict or model. Even exposures at levels exceeding 85 dB underwater may not always lead to hearing loss due to various dampening factors. This includes splinting of the tympanic membrane by water; the increased density of gas in the middle ear space (depending on the depth of the dive); and the gas mixture (i.e. gas mixtures other than air such as heliox or trimix used by recreational or commercial divers), all of which will have an effect on the auditory perception of the diver. These factors make it exceedingly difficult to model a noise dose-response curve in this environment. An additional complication is that occlusive earplugs are incompatible with diving, so that personal hearing protection strategies are not available to divers. This leaves engineering and administrative measures as the only practical options.

Notwithstanding the difficulty in modelling noise exposure of or providing personal hearing protection for divers, typical patterns of NIHL are frequently identified in divers (especially working divers). Accordingly, as we stated in the previous article in this series, some of them may qualify for compensation.

> “ALL DIVING OPERATORS SHOULD CONDUCT A NOISE RISK ASSESSMENT.

In conclusion, all diving operators and employers of divers should formally conduct a noise risk assessment as prescribed in the regulations and take further action (noise monitoring, medical surveillance, etc.) if noise exposure above the legislated limit is present. AD

References

1. The Noise Induced Hearing Loss Regulations, published under section 43 of the Occupational Health and Safety Act, 1993.
2. Goplen, F.K., Aasen, T., Grønning, M., Molvær, O.I. & Nordahl, S.H. Hearing loss in divers: a 6-year prospective study. *Eur Arch Otorhinolaryngol*; 2011 Jul; 268(7): p979-85.
3. Skogstad, M., Haldorsen, T., Arnesen, A.R. & Kjuus, H. Hearing thresholds among young professional divers: a 6-year longitudinal study. *Aviat Space Environ Med.*; 2005 Apr; 76(4): p366-9.
4. Skogstad, M., Eriksen, T. & Skare, Ø. A twelve-year longitudinal study of hearing thresholds among professional divers. *Undersea Hyperb Med.*; 2009 Jan-Feb; 36(1): p25-31.
5. Talmi, Y.P. Barotrauma-induced hearing loss. *Scand Audiol*; 1991; 20(1): 1-9.
6. Molvaer, O.I. & Lehmann, E.H. Hearing acuity in professional divers. *Undersea Biomed Res.*; 1985; 12(3): p333-349.
7. Molvaer, O.I. & Albrektsen, G. Hearing deterioration in professional divers: an epidemiologic study. *Undersea Biomed Res.*; 1990 May; 17(3): p231-46.
8. Curley, M.D. & Knafelc, M.E. Evaluation of noise within the MK 12 SSDS helmet and its effect on divers' hearing. *Undersea Biomed Res.*; 1987 May; 14(3): p187-204.
9. Summitt, J.K. & Reimers, S.D. Noise: A hazard to divers and hyperbaric chamber personnel. *Aerosp Med.*; 1971 Nov; 42(11): p1173-7.
10. Ross, J.A., Macdiarmid, J.I., Dick, F.D. & Watt, S.J. Hearing symptoms and audiometry in professional divers and offshore workers. *Occup Med (Lond).*; 2010 Jan; 60(1): p36-42.
11. Smith, P.F. Toward a standard for hearing conservation for underwater and hyperbaric environments. *J Aud Res.*; 1985 Oct; 25(4): p221-38.
12. Molvaer, O.I. & Gjestland, T. Hearing damage risk to divers operating noisy tools underwater. *Scand J Work Environ Health*; 1981 Dec; 7(4): p263-70.
13. Hughes, K.B. Sensorineural deafness due to compression chamber noise. *J Laryngol Otol.*; 1976 May 1; 90(8): p803-7.

A Day in the Life of a South African Navy Diver

By Dr Blanche Andrews

DR BLANCHE ANDREWS TALKS TO COMMANDER MICHAEL VREY, OFFICER IN CHARGE OF THE SOUTH AFRICAN NAVY DIVING SCHOOL, TO FIND OUT A BIT MORE ABOUT THE NAVY DIVING BRANCH.

Commander Vrey, as I understand it, you have completed all of the diving and explosive courses at the navy diving branch in addition to qualifying as a senior officer within the South African Navy (SAN). So, is it right to say that you are a fully-qualified naval clearance diver in addition to being the officer in charge of the SAN diving school? Please tell us more about yourself.

Yes, I am, just like you said. I joined the navy as a combat officer and commenced my training at the naval college in Gordon's Bay, but I really wanted to be a diver. The opportunity arose when I was a young ensign (junior officer). I commenced with my first navy diving course in 1997. Thereafter, I completed all of my combat functional courses and also completed all of the SAN diving courses. Currently, in the SAN, there is no different or alternative course for officers, so I completed all the required diving and explosive training at the diving branch as a regular dive recruit. No mercy! I have always enjoyed diving, though. I started from a very young age when diving recreationally for crayfish off the West Coast.

> "SINCE ITS INCEPTION IN 1996, DAN-SA HAS BEEN VERY SUPPORTIVE OF THE SAN.

What does qualifying as a naval clearance diver mean or involve in practice?

As I normally say to the newly-qualified clearance divers at their qualifying ceremony:

> "You are now among a few elite members within the SA Navy and South Africa. It is a great achievement for an individual to have successfully passed these gruelling courses. You are trained to be able to deal with any stressful situation that may occur in the water. This trait will also assist you in working well under stressful conditions in your daily work environment and making the right decisions in these stressful conditions. As a diver, you will be operationally deployed on various ships, both locally and internationally, and perform other operational diving tasks. No vessel can proceed on an operational deployment without a dive team on board."

It is a big deal and I like to tell them that!

DAN recently conducted a course at the SAN diving school. What was it about?

The course was on hyperbaric chamber maintenance. It was presented by DAN-SA's CEO, Francois Burman. Several naval life support technicians attended this learning opportunity. It was very informative to all the members present, as they work in this environment on a daily basis. The most value was gained in the broadening of our knowledge with regards to the regulations pertaining to the maintenance of pressure vessels. Since its inception in 1996, DAN-SA has been very supportive of the SAN, particularly the diving branch. Francois Burman actually completed his national service as an engineering officer in the navy, so the relationship goes deep and is of great mutual benefit. Similarly, Dr Jack Meintjes, DAN-SA's medical director, served at our diving school as a diving medical officer at the Institute for Maritime Medicine for many years, just like you, Blanche. So there is a lot of loyalty and collaboration in our history to draw from. AD

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DAN Recipe

Steak with Herb Butter and Vegetables

By Sel-Marie Pereira

A warm DAN chef's welcome to all our members. In this issue it is time to have a braai and it is so easy! As we all love a good braai, this is the ideal recipe that includes veggies and meat of your choice. Beef, veal and pork are packed with high-quality protein. The vegetables also contain all sorts of vitamins, depending on what you put in your parcel.

Did you know?
Beef, veal and pork are all a nutrient dense source of iron, zinc and minerals.

INGREDIENTS FOR HERBED BUTTER

2 tbsp and 250g unsalted butter, softened
2 tbsp minced garlic
1 tbsp minced fresh thyme leaves
1 tbsp minced fresh rosemary leaves
1 tbsp salt and 1 tbsp black pepper
Juice of 1 lemon

INGREDIENTS FOR VEGETABLES

You can use vegetables of your choice. (Remember that some vegetables, like pumpkin and potatoes, take longer to cook.)
Salt and pepper
Olive oil

METHOD

Herbed Butter

In a small pan, toast the garlic in butter over medium heat until it starts turning brown. Add the toasted garlic, chopped herbs, salt, pepper and lemon juice to the 250g butter. Mix well. Divide it in half and wrap each half in plastic wrap. Twist and tie each end of the plastic wrap to form two logs. Refrigerate until needed (for no longer than one month). After grilling your steak to your liking, place one or two quarter-inch thick disks of the butter on top of the steak.

Vegetables

Cut your choice of vegetables and throw them into foil. Sprinkle the vegetables with olive oil and season with salt and pepper. Fold the foil to make a parcel and seal it properly. This can go onto the braai with your steak.

DR OCTO SWORD FIGHTING

DAN Products

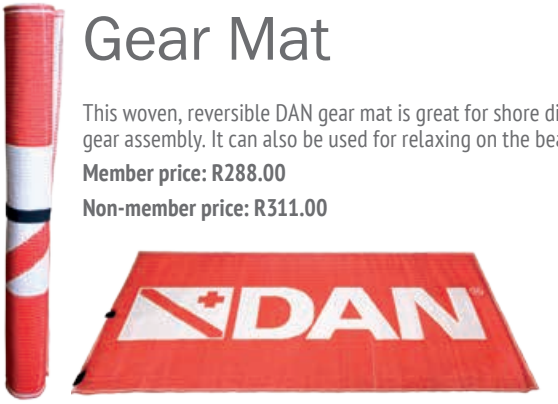
Limited Edition Dive System "iDive Pro" diving watch/computer (IDIVEDAN)

The iDive Pro was developed in conjunction with the DAN Europe Research team. This is truly a unique dive computer with many functions for the New-Age diver! For more details, visit the Dive System website at www.divesystem.com

Member price: R6 600.00

Non-member price: R7 130.00

Gear Mat



This woven, reversible DAN gear mat is great for shore dive gear assembly. It can also be used for relaxing on the beach.

Member price: R288.00

Non-member price: R311.00

Wrist Band

The new DAN silicone wrist band ensures that you always have the DAN emergency numbers handy. The money raised by the sale of these will go towards DAN Research.

Price: R10.00

DAN Men's Shirt

The black DAN men's shirt is perfect for a casual day and diving trips, and includes the DAN logo and grey trimmings.

XXXL and XXL:

Member price: R115.00

Non-member price: R124.00

XL and Large:

Member price: R106.00

Non-member price: R114.00

Medium:

Member price: R98.00

Non-member price: R106.00

Ladies' Tank Top

The black ladies' tank top, with the DAN logo at the back, is great for a day out at the beach.

Medium and Small:

Member price: R91.00

Non-member price: R98.00

ICE KEY

The ICE-KEY is a polyvinyl chloride (PVC) bracelet with an internal USB flash memory containing a software program (ICE_K_one) designed specifically to store personal and emergency medical information. The bracelet has a mechanical seal under pressure and it is hypoallergenic and impact, solvents and dust resistant. It is waterproof up to 100 m.

Member price: R274.00

Non-member price: R295.00

DAN Oxygen Unit

This standard DAN oxygen unit is specially developed to treat injured divers. The unit delivers 100% oxygen when using the demand valve, about 75% when using the non-rebreather mask and about 50% when using an oronasal resuscitation mask.

This unit can provide oxygen to two divers simultaneously when using the demand system only. It also has the option to connect an extra demand valve. The following items are included in the oxygen unit:

- Waterproof DAN oxygen unit case
- Oxygen-on-board sticker
- A 2.5 ℓ pin index medical oxygen cylinder (empty)
- DAN demand valve with white hose
- DAN oronasal resuscitation mask
- Tru-Fit mask
- Non-rebreather mask
- Pin index multifunction oxygen regulator (CE version)

Member price: R7 517.00

Non-member price: R8 118.00

Men's and Women's Fusion Jacket

The fusion jacket is perfect for a cool summer evening or to fight the winter cold. It is made of poly pongee with an inner microfibre fleece and has a durable full zip and zip pockets, stand up collar, inner fleece lining and a utility sleeve pocket.

Men's XXXL and XXL:

Member price: R615.00

Non-member price: R665.00

Men's XL and Large:

Member price: R563.00

Non-member price: R608.00

Women's

Member price: R484.00

Non-member price: R523.00

CO-Pro

The five separate test kits provide a quick and effective way to detect carbon monoxide (CO) in breathing air. If the air is contaminated with CO, the CO-Pro capsule within the balloon changes colour.

Price: R260.00 for five units

ALL ORDERS CAN BE PLACED AT YOUR NEAREST DIVE SCHOOL OR WITH DAN-SA ON 0860 242 242
ALL PRICES INCLUDE VAT AT 14%. E&OE.

DAN Industry Partner Directory

EASTERN CAPE

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GAUTENG

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Bubble Tech Scuba • 012 800 2811

Clear Vision Scuba • 016 981 6077

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Scuba 101 • 082 449 5392

Scuba CO • 011 958 0430

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2nd Breath Scuba Diving • 039 317 2326

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039 973 2233 • www.aliwalshoal.co.za

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Calypso Dive uShaka • 031 332 0905

Club Venture • 032 942 8014

Ocean Blue Scuba • 083 287 4037

TRITON DIVE CHARTERS
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KEY: DAN Business Member Platinum Status | DAN Business Member Gold Status | DAN Training Centre | DAN Diving Safety Partner

UMHLANGA SCUBA
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UNDERWATER WORLD
031 337 5586 • www.underwaterworld.co.za

MPUMALANGA

Buddy Scuba Diving Adventures • 013 656 9303

IANTD (SA)
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Nelspruit Scuba Diving Gear • 082 440 3089

PUMA SCUBA
013 741 1973 • www.pumascuba.com

Scuba Rebels • 013 235 4438

NORTH WEST

NAUTI-DUCK DIVERS
082 809 8353

Potch Scuba • 018 293 1930

WESTERN CAPE

ALPHA DIVE CENTRE
021 854 3151 • www.alphadivecentre.co.za

BELVILLE UNDERWATER DIVE CLUB
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Dive Action • 021 511 0800

Down South Scuba • 021 788 7616

Indigo Scuba Diving Centre • 083 268 1851

Learn to Dive Today • 021 670 5113

Maties Underwater Club • 046 122 9173

PISCES DIVERS
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Shark Alley Dive & Travel • 028 384 3846

UNDERWATER EXPLORERS
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INTERNATIONAL

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Blue World Explorer • 00 230 498 1356

Pro Dive Mauritius • 00 230 265 6213

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Divers Eco Operation • 035 562 3246

Jeff's Pro Dive Centre • 00 258 842 391100

LIBELULA LDA
00 258 823 066473 • www.divelibelula.com

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Pelago Adventura • 00 258 26 500 143

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082 376 9778 • www.parquedemalongane.com

Simply Scuba Dive Charters • 011 678 0972

TOFO SCUBA
011 608 2615 • www.tofoscuba.co.za

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RAS NUNGWI BEACH HOTEL
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DAN Diving Doctor Directory

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No. 1 Eighth Avenue
Summerstrand
Port Elizabeth
6001

A. Killian
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No. 1 Eighth Avenue
Summerstrand
Port Elizabeth
6001

FREE STATE

H.J.R. Colyn
057 353 3191
Mediclinic
106 Meulen Street
Welkom
9459

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0081

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011 315 5817
49 New Road
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1684

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012 362 8828
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Pretoria
0083

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8 Oak Street
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1501

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011 801 5600
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Christiaan de Wet Road
Honeydew
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Athlone Park
Amanzimtoti
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4001

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St Augustine's Hospital
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1200

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7 Myrtle Street
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021 938 9816
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Parow
7600

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044 691 2011
31 Schoeman Street
Mossel Bay
6500

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Annex No. 2
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021 910 0454
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8001

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6 Lemon Lane
Newlands
7700

W.H. Keuck
022 713 5636
20 Stephan Street
Vredenburg
7380

W.A.J. Meintjes
021 938 5051
SUN Baromedicine Facility
Francie van Zijl Avenue
Parow
7550

C.J. Roberts
021 938 9808
Baromedicine Facility
Faculty of Health Sciences
Tygerberg Medical Camp
Parow
7505

J.E. Rosenthal
021 710 9950
Tokai Medicross
Keyser Road
Tokai
7945

T. B. Welzel
021 462 5493
25 Deer Park Drive
Cape Town
8001

G.S. Wolfaardt
021 943 3500
Intercare Medical Centre
43 Old Oak Road
Bellville
7530

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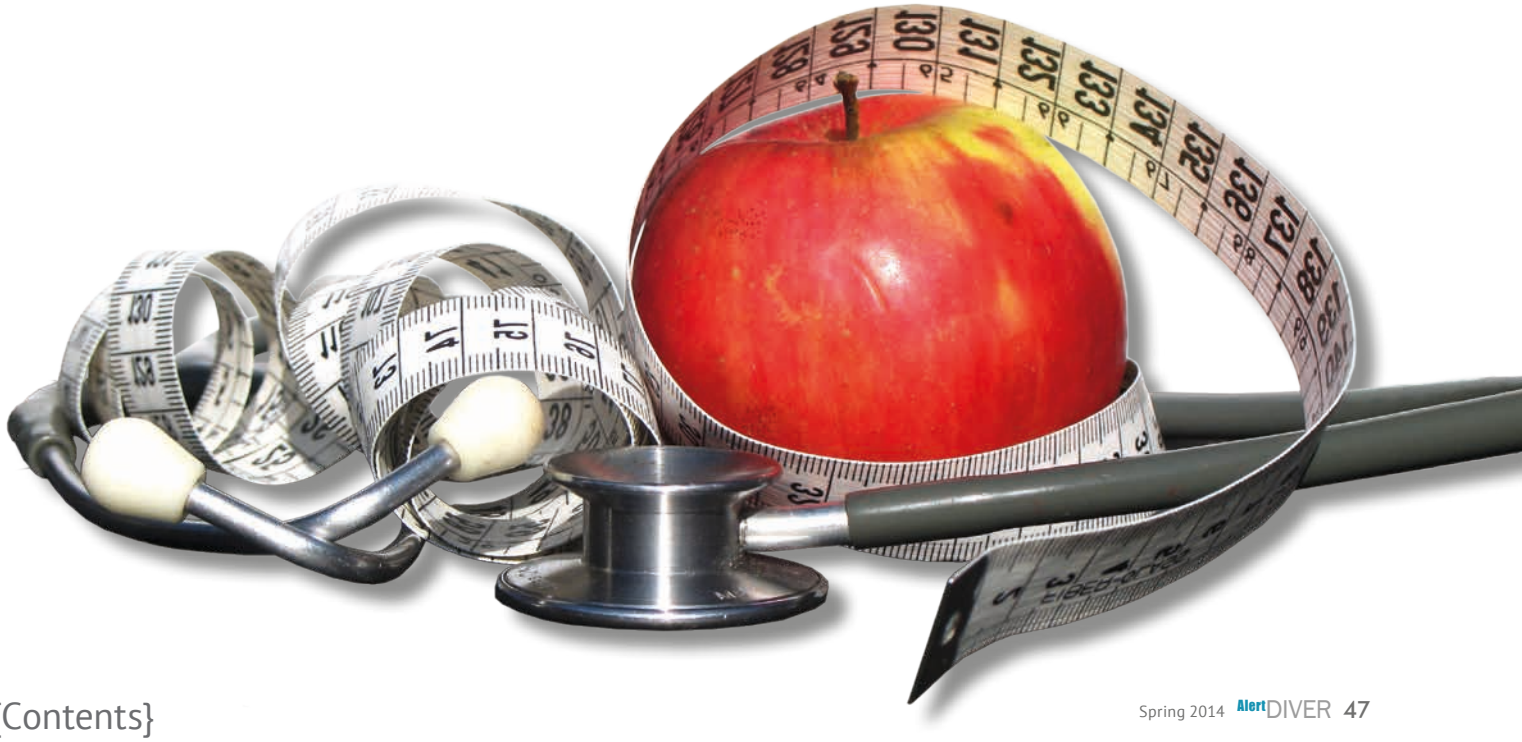

In a dive emergency

CALL DAN® SOUTHERN AFRICA

TOLL FREE

0800 020 111

from INSIDE South Africa

OR

+27 828 10 60 10

from OUTSIDE South Africa

MISSION

DAN Southern Africa is a public benefit organisation. Its primary mission is to provide emergency medical advice and assistance for underwater diving injuries, to work to prevent injuries and to promote diving safety. Secondly, DAN promotes and supports underwater diving research and education particularly as it relates to the improvement of diving safety, medical treatment and first aid. Thirdly, DAN strives to provide the most accurate, up-to-date and unbiased information on diving safety, diving physiology and diving medical issues of common concern to the diving public. DAN is your diving safety association.

VISION

Striving to make every dive accident- and injury-free. DAN's vision is to be the most recognised and trusted organisation worldwide in the fields of recreational diver safety and emergency services, health, research, and education by its members, instructors, sponsors, and recreational diving community at large.

DAN PUBLICATION PHILOSOPHY

Alert Diver Southern Africa is a forum for ideas and information relative to diving safety, education and practice. Any material relating to diving safety or diving medicine is considered for publication. Ideas, comments and support are encouraged and appreciated.

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Alert DIVER

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Caribbean Shark

DAN member Pedro Camanho submitted this edition's Parting Shot image. This is his story:

> The *Edward Williams* wreck is one of the best places in the Bahamas to dive with Caribbean reef sharks. Holding on to the hull of the wreck, rather than lying on the sand, minimises the amount of particles in suspension and creates great opportunities to photograph these magnificent creatures.

Parting Shot gives you a chance to share your interesting dive stories and images with us.

Have you encountered a rare or exciting activity underwater and captured it? Has an underwater event just added that something extra to your dive and you have a photo? If so, all you have to do is send through your high resolution image (300 DPI) along with your story (including a brief description of your creature, location of dive site and pertinent photo information) and contact details to partingshot@dansa.org and your submission could appear in the next edition of *Alert Diver!*

All images submitted for the Parting Shot become the property of DAN.


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