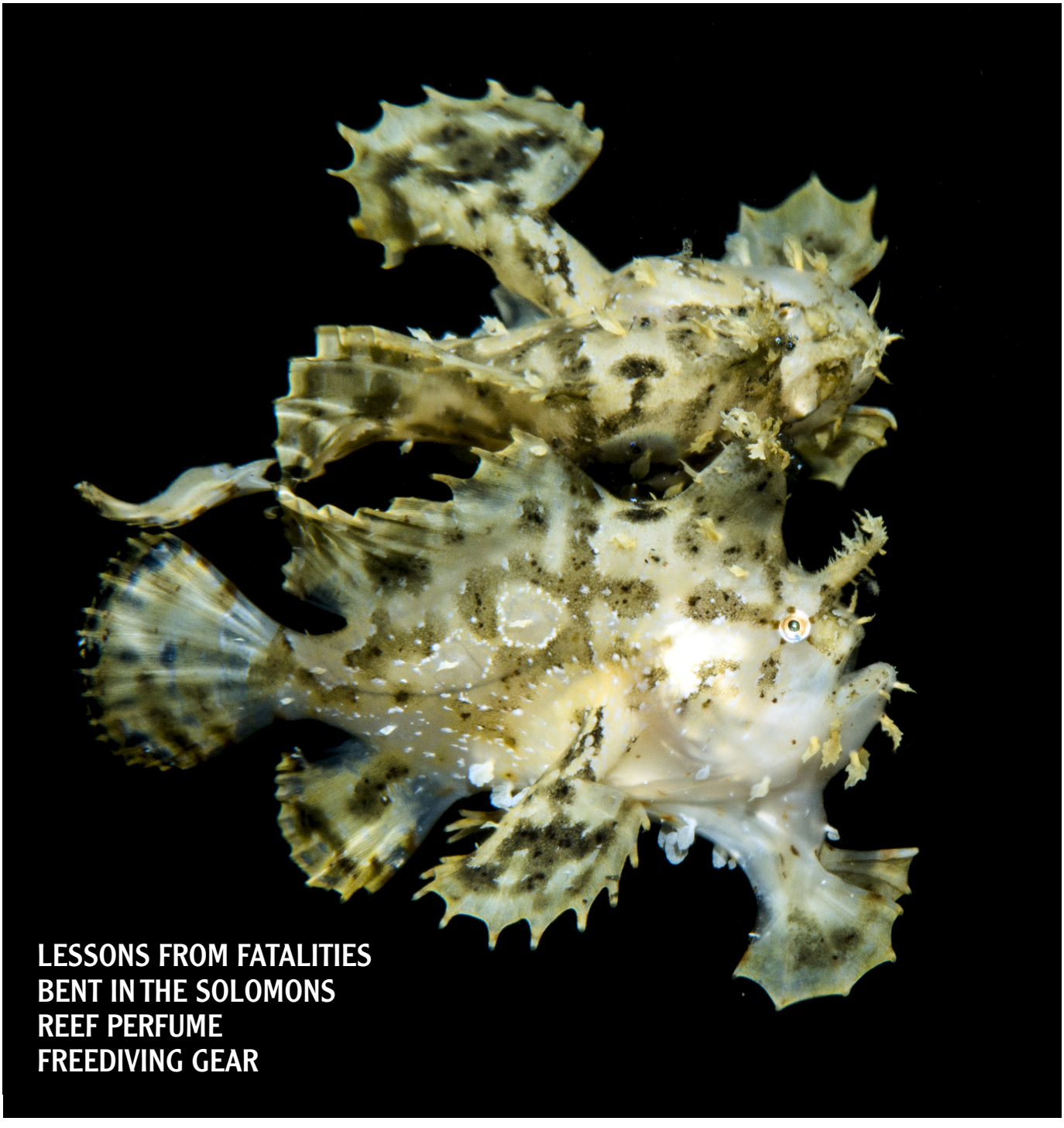
ALERT DIVER

The Magazine of Divers Alert Network Asia-Pacific

Published by READ MORE, DIVE MORE SCUBA DIVER AUSTRALASIA



LESSONS FROM FATALITIES
BENT IN THE SOLOMONS
REEF PERFUME
FREEDIVING GEAR

DAN ASIA • PACIFIC Divers Alert Network

DANAsiaPacific.org / Quarter 2, 2015

On the Cover

A frogfish in the waters of Anilao, Philippines
Image © Mike Bartick

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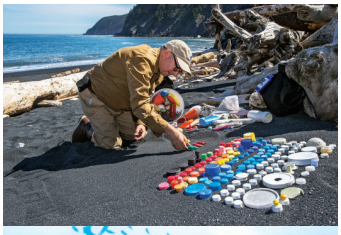

Alert Diver's Philosophy

Alert Diver is a forum for ideas and information relative to diving safety, education and practice. Any material relating to dive safety or dive medicine or accident management is considered for publication. Ideas, comments and support are encouraged and appreciated. The views expressed by contributors are not necessarily those advocated by DAN Asia-Pacific. DAN is a neutral public service organisation which attempts to interact with all diving-related organisations or persons with equal deference. *Alert Diver* is published for the use of the diving public and it is not a medical journal. The use and dosage of any medication by a diver should be under the supervision of his or her physician.

Alert Diver is published as a separate, independent magazine within *Scuba Diver AUSTRALASIA* (*SDAA*) magazine. DAN Asia-Pacific is not responsible for the content provided elsewhere within *SDAA*, and therefore this content should not be assumed to represent the views, policies or practices of DAN Asia-Pacific or *Alert Diver* magazine.

Email: *info@danap.org*
For more information on membership, insurances and training programmes, visit our website: *www.danap.org*

Are You Oxygen Prepared?

Diving locally with your club or buddy? Make sure you are oxygen prepared.

To determine the right DAN Oxygen Unit for your diving, consider:

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- ***If Boat Diving:*** *Time to shore plus the time to appropriate medical care.*

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- ***Your DAN Coverage is current.***
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- ***You have an Emergency Plan.***

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Let the DAN Team help you choose the right unit for your needs, email oxygen@danap.org with your location and basic information about your local diving.

DAN ASIA • PACIFIC

PERSPECTIVES

Getting the care you need, when you need it

Divers Alert Network (DAN) Asia-Pacific has more than 20 years of experience helping sick and injured divers. With our affiliated International DAN organisations across the globe we have assisted thousands of divers worldwide. From all that experience comes a level of expertise that divers rely upon and trust. That's why the 300,000-plus DAN members worldwide dive with peace of mind.

These divers we help value DAN as the experts in dive accident management. Here are some words from a few of our respected members:

"I've dived for 10 years and completed 680 dives, and I never thought I would have DCI, but I did. I hope you are covered by DAN, so you, too, will have someone to count on in the very possible event of a scuba diving incident. DAN was of great help from the moment they received the call about my condition; their professionalism and care was so efficient and touching."

-Seung Hee, Korea

"My wife and I are eternally grateful for the amazing support we received from DAN. I had no idea how stressful an incident would be on my partner and me. Next time you think that you don't need DAN coverage, think twice!"

-Dirk, Australia

There are many factors that distinguish our organisation from others and reaffirm DAN's level of expertise:

- DAN's sole focus is diving medicine and diving safety – that's all we do.
- When divers call one of our 24/7 hotlines they speak to medical staff with specialised knowledge of dive injuries, and who know how to handle diving emergencies correctly and immediately.
- DAN reinvests its funds into research and efforts to improve the health and safety of diving throughout the Asia-Pacific region.
- DAN Asia-Pacific is the only non-profit organisation dedicated to dive safety in the Asia-Pacific region.
- And, last but not least, when divers have DAN Membership with DAN insurance, our emergency medical staff can easily look them up, verify their coverage and begin needed care, right away – which is not always the case when divers have other insurance – an important point to remember when considering which insurance will serve you best and most quickly, in a real dive emergency.

To all our current members, thank you for your support. If you are not yet a DAN member, we look forward to welcoming you to DAN.

Safe Diving,
Chris Wachholz, CEO

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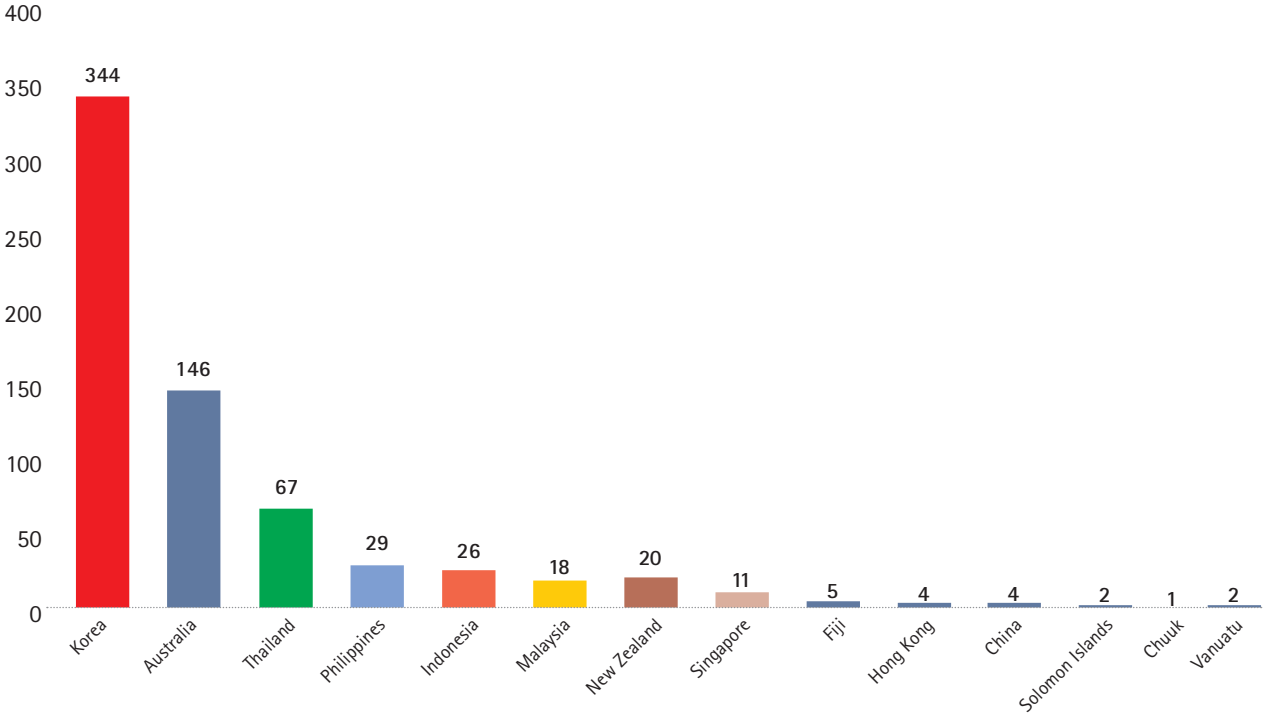
→ The DAN Asia-Pacific team

Decompression illness in the Asia-Pacific in 2013 as reported to DAN Asia-Pacific

By John Lippmann



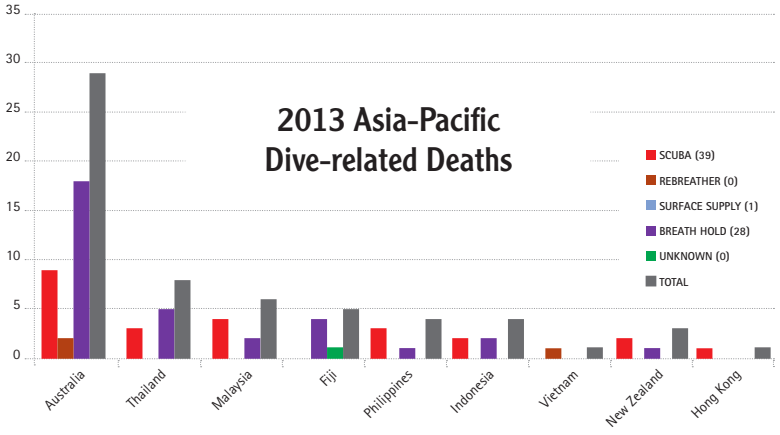
Decompression illness (DCI) is an ever-present risk in diving but fortunately is not a common event. However, each year a number of divers suffer from symptoms of DCI. Sometimes it is easy to understand why a diver developed symptoms by looking at his or her dive profile(s). However, in most cases, the divers had been diving within the limits of the computers, algorithms or tables and still got DCI. Sometimes this can be related back to the presence of a patent foramen ovale (PFO); other times to factors such as exertion, cold or dehydration; while on other occasions there is no obvious reason.

DAN Asia-Pacific has received reports of a total of 679 recreational divers being treated for DCI in the region in 2013. This is based on reports received from the major chambers. However, there are some small chambers in certain countries that treat divers from time to time but from which we receive no report.

The reality is that it is likely that quite a lot of divers who do suffer DCI do not present for recompression treatment. This is often because they do not recognise the symptoms or are in denial about them. It might also be that the symptoms have cleared with oxygen first aid, or with time.

In some countries, the dive community is better educated about DCI and chambers are very accessible. This leads to more divers presenting for treatment. Australia, for example, has a relatively high level of diving activity, from both locals and tourists diving on the Great Barrier Reef. There is a lot of readily available information about DCI recognition, and the dive industry is quite well educated about this. The chambers are many, accessible and cost-free to locals so the number of cases treated is relatively high, compared to places like Thailand, Indonesia and the Philippines, which also have high diving activity.

Once again the data from South Korea appear to be disproportionately high compared with the diving activity. This may indicate a safety issue for Korean divers, a low threshold for treatment in certain chambers, and/or possibly an issue with the reporting of the information.



30+ Years Helping Divers Like You, Worldwide 24/7

I've dived for 10 years and completed 700+ dives and I never thought I would have DCI, but I did. Thanks to DAN I was able to recover very well. I hope you are covered by DAN, so you too will have someone to count on in the very possible event of a scuba diving accident. DAN was of great help from the moment they received the call about my condition; their professionalism and care was so efficient and touching.

— Seung Hee, Korea

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INCIDENT PREVENTION + INCIDENT MANAGEMENT + INCIDENT PROTECTION

DAN Members enjoy benefits such as:

- 24/7 Medical Hotline
- Worldwide Emergency Evacuation Coverage
- 12-Months Peace of Mind
- Travel Assistance Benefits
- Access to Dive Injury (Treatment) Insurance Plans
- Subscription to DAN's quarterly *Alert Diver* magazine and complimentary access to *Scuba Diver Australasia* magazine
- Member-Only Portal Access

Dive Injury (Treatment) Insurance Plans
For comprehensive coverage add a Dive Injury (Treatment) Insurance Plan to your Membership to be covered for treatment expenses associated with a covered diving accident/illness.

Wherever You Are in The World DAN is There For You

" We recommend DAN coverage with confidence for our diving guests. Being in a remote location we need emergencies, however rare, to be handled by experts. DAN gives divers, and us, peace of mind knowing they will be in safe and expert hands if an emergency arises. Taking out DAN membership is quick & easy and offers great value for money for 12 months coverage."

— Lee Fewster, UEPI Island Resort

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INCIDENT PREVENTION + INCIDENT MANAGEMENT + INCIDENT PROTECTION

The Gyre Project

Creating art from a plastic ocean

By Kip Evans

In June 2013 a group of artists, scientists and educators embarked on an expedition in southwest Alaska to raise awareness of plastic pollution in the sea. In addition to cleaning up beaches and interacting with local wildlife, the participants created an art exhibit that is now on display at the Anchorage Museum in the U.S. state.

I had just begun to feel a little uncertain about the spot where I was standing, so I moved back. The grizzly bears had apparently decided to walk around us, but they stayed very close – no more than 15 feet away. The cubs were having trouble seeing us as they strolled by, so they stood on their hind feet to improve their view. My camera's motor drive whirred away, and one of the cubs began to climb up its mother. When it suddenly emerged on her back, we all just melted.

> ***"The ultimate goal is to reach new audiences, influence attitudes about consumption and waste, and ultimately to change behaviours that are fundamentally the cause of marine debris."***

It was June 2013, and I was documenting a unique expedition called Gyre, a weeklong cruise covering some 725 kilometres of Alaska's southwest peninsula. The expedition was sponsored by the Alaska Sea Life Center and the Anchorage Museum, and its purpose was to highlight the huge problem of plastic in our ocean and to help influence human behaviour through art. Other organisations involved with the expedition included the National Oceanic and Atmospheric Administration (NOAA), the Smithsonian Institution, Ocean Conservancy and National Geographic.

Alaska Sea Life Center project visionary Howard Ferren spent years planning the trip. "The ultimate goal is to reach new audiences, influence attitudes about consumption and waste, and ultimately to change behaviours that are fundamentally the cause of marine debris," Ferren said.

I was relishing the opportunity to explore this remote territory – not only with my camera but also with an incredible group of people. Gyre's participants included scientists, filmmakers, a teacher and artists, and all shared the same mission: to highlight the striking contrast between the rugged beauty of Alaska and the thousands of tons of trash that are spat out of the North Pacific Gyre onto Alaskan beaches each year.

From February through September, 2014, the Anchorage Museum is featuring an exhibit called "Gyre: The Plastic Ocean", which presents works of art made from garbage collected during the expedition. Artist Pam Longobardi collected scores of fishing floats, which are now part of her installation at the exhibit. Said Longobardi, "Plastics are the cultural archaeology of our time. They don't belong in the ocean, and the tremendous, conscious force of energy that is the ocean does everything it can to expel this material and vomit it back onto the beach to show us the wrong we have done."

Most of our days were spent on isolated beaches that can only be reached by floatplane or small boat. Some were expansive and contained thousands of massive logs. Others were tiny and contained no logs at all. We found debris ranging from huge fishing nets to plastic bottles from Japan. On one beach we found hundreds of college football flyswatters destined for fans across the U.S. On another we came across a massive ball of packing straps. In Alaskan waters, packing straps account for 50 percent of Steller sea lion entanglements. A strap slowly sawing its way into the neck is a horrific way to die.

↑↓ The rugged beauty of Alaska is a stark contrast to the thousands of tons of trash that wash up on its beaches, spewed out by the Pacific Gyre

After a week at sea we had visited nearly a dozen locations including Gore Point, Point Blank, Shuyak Island and Afognak. Along the way, Ocean Conservancy biologist Nick Mallos collected 831 brightly coloured bottle caps, more than half of which originated on the other side of the Pacific. According to Mallos, "Seabirds like albatrosses often mistake plastic bottle caps for

"Packing straps account for 50 percent of Stellar sea lion entanglements. A strap slowly sawing its way into the neck is a horrific way to die."

food. They take them back to their chicks, which ingest them and perish from gastrointestinal blockage and, ultimately, starvation."

During the final two days we visited an isolated area called Hallo Bay, which is part of Katmai National Park. Hallo Bay is a remote area, but it received an influx of debris from the 2011 Japanese tsunami. It's also famous for grizzly bears — park biologists estimate that some 2,200 live in Katmai.

Before we arrived, Katmai rangers had collected more than 1,800 kilograms of trash from the dunes and beach. Some of this garbage had been chewed on by bears. According to park superintendent Diane Chung, "Bears are very fascinated by the marine debris, especially plastic floats. Although we haven't documented any deaths, we are concerned about the bears being exposed not only to the plastics but also to the toxins such as lead that often coat these items."

Our visit to Hallo Bay was timed to remove this trash and take it back to Seward. It took our team nearly 13 hours to load everything with the park service, which left only one day to explore this beautiful area. Until then we had only seen bears from a distance, but Hallo Bay delivered the encounter with a mother and her curious cubs that none of us would ever forget.

↑ The project hauled out tons of the kind of plastic garbage that is responsible for killing vast numbers of marine creatures

Slowly the bears walked away and we were left in astonished silence. It was incredibly moving, and some people were even weeping. I had never planned on coming face to face with a grizzly during my trip to Alaska, but encounters like this one change people and remind why we protect wild places. They also motivate us to get involved — for the sake of the sea life, the bears and our own legacy on this planet. DAN ASIA · PACIFIC

↓ Meaningful encounters with creatures like these bears in Anchorage are an emotional reminder of the importance of changing our consumption of plastic

DAN Was There For Me ...

I was diving in the Maldives and had pain and tingling in one arm, an itching sensation on my back plus pins and needles in both feet. I called a DAN Hotline for help and was sent to the local chamber where I underwent two treatments that cost more than US$6,000. Fortunately, these expenses were fully covered by DAN.

- S. Lee, Taiwan

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Paralysis in the Solomon Islands

A wake-up call for one unlucky diver reveals the importance of oxygen therapy

Text by DAN Asia-Pacific member Rob Duckworth
Images by Stephen Frink

As someone who lives and works in the Solomon Islands I consider myself lucky that I am able to dive most weeks. The norm for me is conducting two dives every Saturday and Sunday. I am a 57-year-old male and consider myself relatively fit and healthy, and I have done around 550 dives to date with no prior encounters with decompression illness (DCI).

FAMILIAR DIVE, CONSERVATIVE PROFILE

One day, two friends and I were heading out for two shore dives at Mbonegi-1, which is a 25-minute drive west of Honiara. To date, I have dived this World War II Japanese shipwreck more than 50 times, so I know it well. The depth of this site ranges from seven metres at the bow to approximately 56 metres at the stern. We often dive to 40 to 48 metres on this wreck without any problems. The water temperature at 40 metres is between 28°C to 31°C, the visibility is typically excellent and the current minimal.

Our first dive was for 42 minutes to a depth of 40 metres. After a surface interval of 75 minutes, we completed a second dive to 42.4 metres for a total dive time of 50 minutes. Time spent at the maximum depth was only a few seconds on both dives as we cruised through a break in the cargo hold of the ship and then commenced our return to the surface.

Divers in remote areas such as the Solomon Islands should be especially conscientious about having an emergency plan and enough oxygen to get an injured diver to professional medical care

Both dives included a deep stop that I extended by one minute, a six-minute deco stop, which I extended to eight minutes and a three-minute safety stop, which ended up being about 10 minutes. This extended safety stop is common, as the majority of the reef near the shore is between three metres and five metres and full of marine life. On both dives, most of the time was spent between 12 and five metres. My computer is set conservatively at L2. All computer stops were adhered to.

RAPID PROGRESSION

On surfacing from the second and final dive of the day I felt fine. After about 12 minutes, I began to feel a tingling sensation in my groin and upper thighs. I was immediately suspicious it was DCI.

Right away, my dive buddy drove me to the dive operator in Honiara, where I could get access to oxygen. By the time we reached the shop I was completely paralysed from the waist down – I could not feel my legs or move my toes. At this stage I was concerned but still quite calm. I felt mild pain as the paralysis travelled down my legs. I was fairly confident that a combination of oxygen, DAN support and chamber treatment (which I felt sure I would need), would work.

I went straight onto 100-percent oxygen while the staff called the DAN/DES hotline. The oxygen was from a scuba tank and appropriate (oxygen-clean) dive regulator, and I put my mask on, blocking my nose to ensure I was breathing a high concentration of oxygen. After 10 minutes or so, feeling slowly began to return to my legs. I regained full use of my legs and was able to walk unsupported after about 20 minutes; I was ecstatic. I had hoped the surface oxygen would help, but I was quite amazed at how effective it was. The DES doctor recommended a five-hour, Table 6 hyperbaric treatment and contacted the chamber to advise them I was on my way. I continued breathing oxygen until I entered the chamber. Although the symptoms had gone, the doctor decided to run the Table 6 treatment as a precaution because it was a spinal bend.

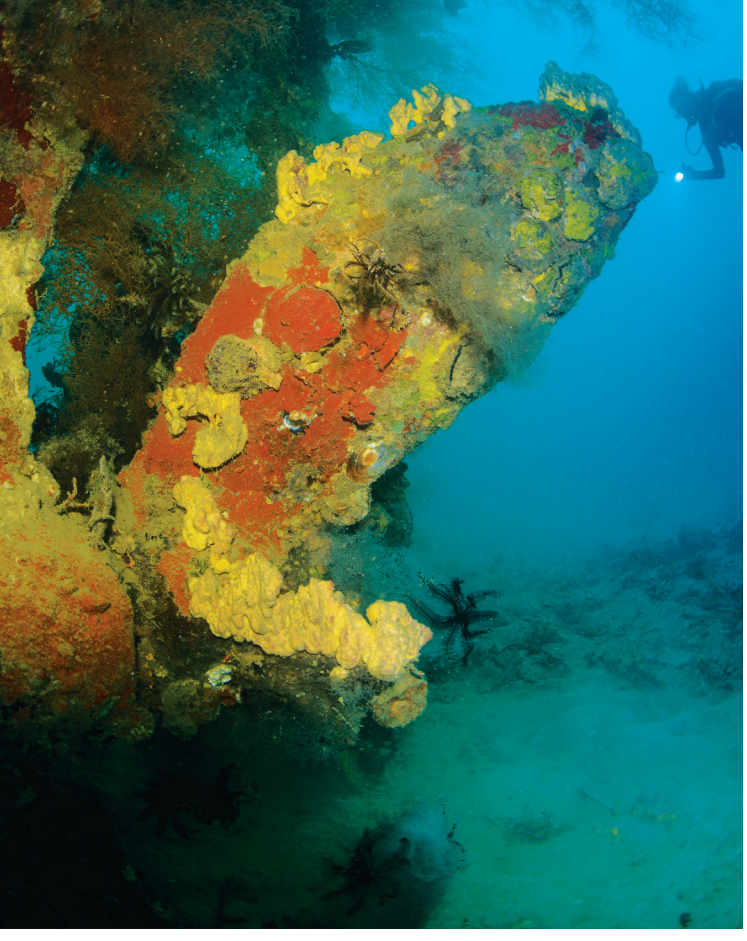
After the treatment, I felt completely recovered, with no residual symptoms. In conversation with the doctor I learned that a second treatment would not be required.

We present these cases to remind you that DAN is available 24/7 to answer questions, help with medical emergencies, arrange hyperbaric treatment and facilitate emergency evacuation through our 24-Hour Diving Emergency Hotlines.

IF YOU NEED HELP, CALL:
1800-088-200
(toll free within Australia – English only)

+61-8-8212-9242
(from outside Australia – English only)

An adequate, well maintained oxygen supply should be standard equipment on every dive



↑ The Solomon Islands are famous for their WWII wrecks

OXYGEN AND DAN MEMBERSHIP: ESSENTIAL EQUIPMENT

This incident gave me and my dive buddies a real wake-up call. We all dive this area on a regular basis and quite often to 40 metres. My experience goes to show that even when you follow your dive computer, and even when you use a conservative setting, you can still get hit with DCI. Prior to both dives I was fully hydrated and well rested, and I hadn't consumed any alcohol for more than seven days.

I was amazed at just how fast the onset of paralysis set in after I surfaced, and I was even more surprised by how fast it subsided with oxygen first aid.

The only modification I might make in retrospect would be to extend the surface interval a bit. Fortunately I have received the "all clear" from my doctor (who has training in dive medicine) and am diving again. Since returning to the water I have made two changes:

1. I now make sure that I take extended surface intervals between dives.
2. Knowing how effective oxygen first aid is, we now carry oxygen with us to avoid any delays in access should my buddies or I ever need it.

Having a DAN doctor on the other end of the line was very reassuring, especially when I was told I wouldn't need a second treatment. The doctor examined my profiles for the two days and suggested my "hit" was simply a matter of odds.

I was also pleasantly surprised when I received two follow-up calls from DAN just to see how I was – what a professional service.

In my opinion, anybody who dives and does not have DAN membership and insurance is foolish. Bad luck can happen to anybody, so it pays to be prepared. DAN ASIA · PACIFIC

"I was amazed at just how fast the onset of paralysis set in after I surfaced, and I was even more surprised by how fast it subsided with oxygen first aid."

COMMENT FROM DAN ASIA-PACIFIC'S JOHN LIPPMANN

This was a great outcome for Rob and so easily could have been far worse. I think he has gained some valuable insights, and his suggestions of how he can try to avoid a similar problem in the future seem sound to me.

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Australasian Scuba Diver
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Three Common Mistakes in Providing Oxygen First Aid

By John Lippmann with contributions from Stan Bugg
Images by Stephen Frink

DAN Asia-Pacific Members are by now familiar with our current safety campaign to reinforce the need for trained oxygen providers and suitable oxygen equipment at every dive site. For the management of decompression illness (DCI), oxygen is the first aid of choice, and the sooner it is provided, the better.

Along with DAN Asia-Pacific — which has trained more than 38,000 oxygen providers — diver certification agencies, first aid associations and lifesaving organisations offer oxygen first aid training. The level of training offered varies among agencies and individual trainers. As with most training, students must employ repetitive practice to first understand, then learn and finally embed the required skills so that they enter long-term memory and become automatic. Therefore, the more hands-on practice a training course provides, the more likely it is that the course will prove successful. It is important for oxygen providers to continue to refresh their skills as often as possible after their training course ends, if only by a brief "play" with the equipment.

After more than 30 years of teaching oxygen first aid and 22 years of fielding diving emergency calls, I've seen and heard about a broad range of errors made by oxygen providers; here I will highlight three of the most common.

ERROR 1: INADEQUATE EQUIPMENT

Every diver's oxygen unit should include:

- a suitable and well-functioning demand valve that can provide a high concentration of oxygen to a breathing diver;
- a non-rebreather mask fitted with three one-way valves for use with a breathing diver;
- a resuscitation mask for rescue breathing during CPR;
- a supply of oxygen sufficient to last until a doctor trained in dive medicine advises that oxygen first aid should stop or until an alternative oxygen supply is available.

Unfortunately, inadequate and poorly maintained equipment is common, especially in remote locations. I've seen many units in the field that are in poor condition or are missing components.

For example, I've seen absent and poorly functioning demand valves. If the breathing resistance of a demand valves is too high, it will

draw in (entrain) more air and dilute the inhaled oxygen concentration.

I've also seen units that contain non-rebreather masks that have been used (they should be disposed after use), are missing valves or were replaced by less suitable masks that provide lower oxygen concentrations.

Many units include relatively small oxygen cylinders that only last for a short time. Divers in remote places routinely require oxygen first aid for periods longer than four hours – and sometimes for more than 12 hours. They need cylinders that are large enough and adequately filled, and there often needs to be multiple cylinders to provide adequate duration and flexibility. I've come across quite a few situations in which cylinders were empty or near empty, rendering the equipment useless.

As a rule of thumb, assume that each injured diver needs at least 15 litres of oxygen per minute. On this basis, a 450-litre cylinder (size C) would last for only about 30 minutes. Don't forget that multiple divers can be injured simultaneously, and do the maths.

ERROR 2: POOR CHOICE OR USE OF DELIVERY DEVICE

When faced with an emergency, the oxygen provider must choose the most appropriate delivery device for the circumstances.

It is generally taught that a demand valve is the device of first choice for use with a breathing diver, usually conscious but not necessarily so. The bottom line is that they need to be breathing strongly and slowly enough to open the demand valve effectively. These are very easy to use, familiar to divers and often relatively economical on oxygen gas. The best demand valves available are the medical valves and an oronasal mask needs to be attached to these to provide an interface and seal between the valve and the diver's face.

While demand valves have the potential to deliver close to 100-percent oxygen to divers, the reality is that this efficiency relies on the mask seal, the demand valve's service status and, to some extent, the diver's position (which should be lying on the back rather than sitting, especially with the head down).

If the mask seal is poor, air will enter under the mask; therefore, the mask should be held or strapped firmly to the diver's face, at which point the rescuer should listen carefully to hear the demand valve opening and closing. If the demand valve isn't functioning properly, the diver will only be breathing air mixed with expired breath and will quickly start to feel worse.

Some operators deliver oxygen first aid using a diving demand valve attached to an oxygen cylinder, which is a viable option as long as the diver is conscious and the regulator is oxygen-clean. One common mistake oxygen providers make when administering oxygen is to forget to block off the diver's nose to prevent him from sucking in surrounding air. To block off the nose, providers can use a nose clip, pinch the nose with the fingers or block the nostrils by another suitable means. Some divers even choose to wear their dive mask.

Non-rebreather masks are useful and effective when fitted with all three one-way valves and reasonably well-moulded to the diver's face. The provider can get an acceptable seal by experimenting with the positioning of the mask and adjusting the nose clip. Still, an airtight seal is almost impossible to get. The oxygen flow rate should ideally be set at 15 litres per minute (lpm) initially, and the provider

> *"Efficiency relies on the mask seal, the demand valve's service status, and, to some extent, the diver's position"*

↑ If the seal is poor, the mask should be held or strapped firmly in place

← One common mistake providers make is forgetting to block off the diver's nose to prevent them from sucking in surrounding air

↑ A common mistake is that oxygen therapy is stopped too soon, when oxygen should be administered for a minimum of four hours before the siltation is reassessed

can adjust the flow rate to ensure that the reservoir bag never contains less than about one-third of its maximum volume. It is probably wise not to reduce the flow rate below about 10 lpm.

One common problem with this mask is that providers sometimes use lower flow rates to conserve oxygen if they haven't set themselves up with sufficient stores of oxygen in the first place. As mentioned before, one-way valves are often missing, which dilutes the inspired oxygen.

Some dive operations just provide oxygen to a breathing diver using the resuscitation mask. This is far from ideal as the oxygen concentration is usually relatively low. When necessary, the mask can be used to give oxygen-supplemented rescue breathing or can be attached to the demand valve.

ERROR 3: STARTING OXYGEN FIRST AID TOO LATE AND/OR FINISHING TOO EARLY

Although we are seeing progress in how quickly providers administer oxygen, we still see many situations in which extended delays endanger divers who may have DCI. Generally, these delays have to do with the diver and/or the dive operator failing to recognise that the diver requires oxygen.

The next step is to call a diving accident hotline to get proper advice. Let a dive doctor or medic decide whether continued oxygen is necessary. Hotline operators have considerable experience with DCI treatment and will know more than the dive operator or diver.

A common mistake made at this point, especially if a dive doctor is not in the loop, is that oxygen first aid is stopped too soon. Too often, divers are given oxygen for periods of say 15 minutes to two hours. Sometimes the symptoms improve or completely disappear during this time and this gives an often false impression of safety.

It usually takes more oxygen than expected to prevent symptoms returning. If a diver is remote, symptoms are relatively mild and proper medical examination is unavailable, DAN Asia-Pacific often suggests at least four hours of oxygen first aid before reassessing the situation. The reality is that, in many cases, recompression is still required, although timely application of oxygen may reduce the number of necessary treatments.

BEST PRACTICES: TRAINING AND EQUIPMENT

Providing basic oxygen first aid is not difficult. Providers occasionally make mistakes, but we try to learn from these in order to improve our practice. The following suggestions, gained from experience, may help to provide some guidance:

1) First and foremost, you should make sure that any oxygen first aid you provide is within your level of training. For example, don't use a bag-valve mask to try to resuscitate someone if you aren't adequately trained to do so, and your skills are not current.
2) Second, make sure that your equipment works, that you use the appropriate delivery device properly, that there is a sufficient oxygen supply and, importantly, that the environment is safe for using oxygen. The equipment and your hands must be free of oil and grease, there should be no naked flames or sparks, and the area should be well-ventilated.

Get out and get trained. Once you do, make sure that you practise your skills regularly and think about what you're doing. DAN ASIA · PACIFIC

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The design of the ADEX logo has been seeing changes every year. This is a reflection of the chosen marine species supported in various ways by ADEX each year. In 2016, we will honour the **seahorse** *Hippocampus kuda*, listed as "Vulnerable" based on a suspected population decline of at least 30%, caused by targeted catch, incidental capture and habitat degradation. Indirect evidence suggests that declines are continuing.

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While the original logo featured the silhouette of the manta ray, this year's ADEX logo depicts the dolphin, the marine organism that is celebrated in 2015.

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□ Blue Whale
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Why Divers Die

Lessons from DAN Asia-Pacific fatalities reports

By John Lippmann, Founder, Chairman and Director of Research
Images by Stephen Frink

Each year in Australia we see deaths associated with snorkelling and compressed-gas diving, many of which might be preventable. DAN Asia-Pacific collects information on diving and snorkelling fatalities that occur within our region, to help us develop accident-prevention strategies.

Using reports from accidents in 2009, which included 21 known fatalities, DAN Asia-Pacific developed a detailed account of each fatality along with an overview of what the incident helps us learn about dive safety.[1] Here we look at a few of these cases and a summary of the lessons learned from these tragic deaths.

DIVING ALONE … AND WITH EPILEPSY!

An apparently fit 47-year-old man had been diving for crayfish regularly for 20 years. He had a history of epilepsy for which he took medication, and he had been asymptomatic for many years. His doctor had no training in diving medicine and was unaware of the risks of diving with epilepsy.

The morning after the diver had gone diving alone from shore at a popular site, his body was found by a search team about 10 metres from shore. His tank still had plenty of air, but his mouthpiece had a 5mm cut on its underside, which could have been caused by the clenching of teeth during a seizure, though there was no clear evidence of this. Tests showed his regulator was functional and the remaining air was uncontaminated.

Officials reported the cause of death as drowning, but it is possible that the drowning resulted from an epileptic seizure.

LOST ON AN INTRO DIVE

For her introductory scuba dive, an apparently healthy 20-year-old woman received a pre-dive briefing in English, which was not her native language. Before the dive, an instructor taught the group basic skills while they were standing or swimming in water about a metre-and-a-half-deep near the shore of a small island. The sea was reportedly choppy, and waves disrupted the training from time to time. The water was murky, with visibility ranging from one to one-and-a-half metres, and there was a current.

When satisfied with their skills, the instructor led the group members into water about two-and-a-half meters deep, and the students "crawled along the bottom" in a line with the instructor just ahead, reportedly checking them regularly. The instructor could see the students' faces, although not their entire bodies. After a while the instructor noticed that the victim was missing and aborted the dive.

Before the group surfaced, witnesses saw the victim surface alone, call for help and then sink. Her body was found on the seabed about 40 minutes later. Her weight belt, including 9.5 kg in weights, was in place, her BCD was deflated, and her regulator mouthpiece was perforated, potentially enabling water to be inhaled. Police and paramedics attempted CPR without success.

The instructor was charged with manslaughter. Prosecutors argued that the victim was overweighted, that her regulator was poorly maintained and that the instructor made a serious error in taking a group of four totally inexperienced divers out in such poor visibility. However, the magistrate determined that the evidence was insufficient to support charges of unlawful killing and dismissed the case.

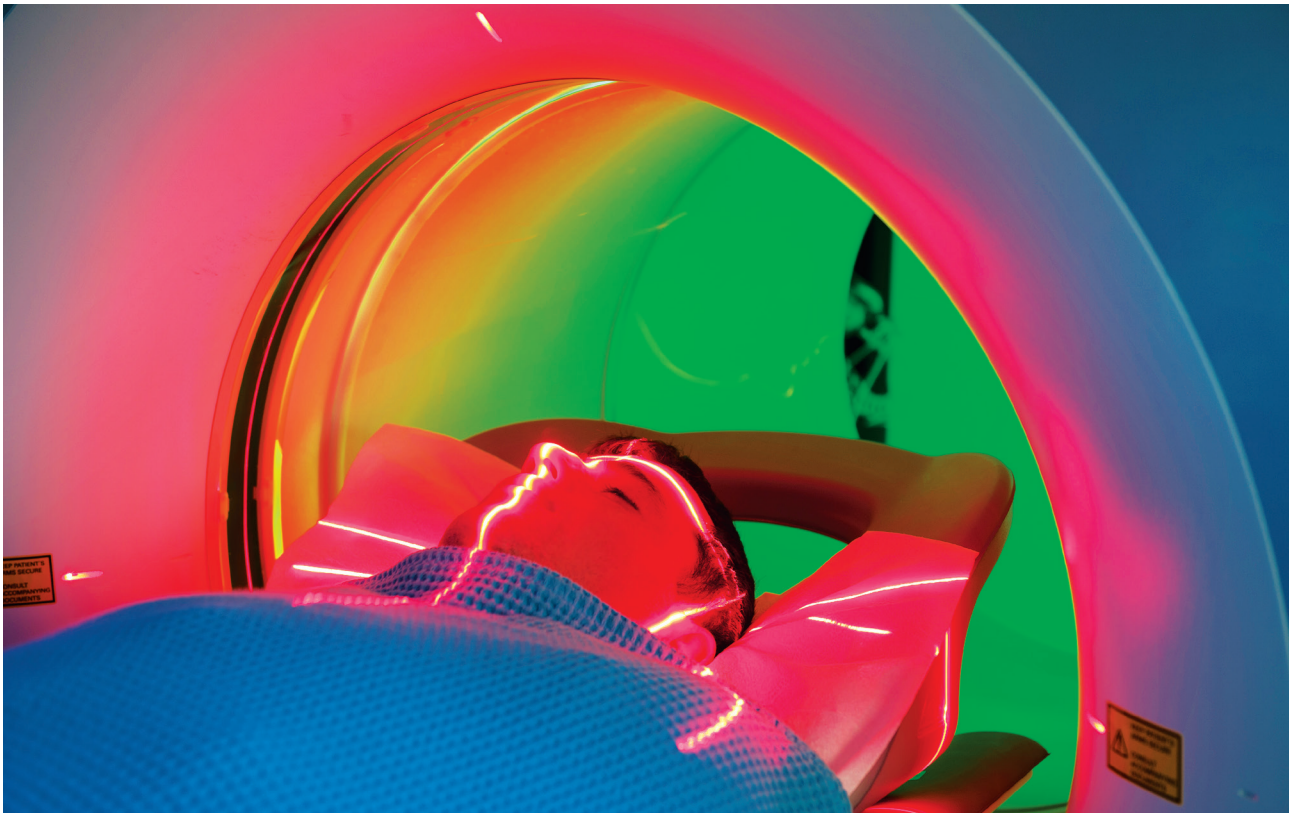
The cause of death was unreported but was likely drowning; although it is possible it was caused by a cerebral arterial gas embolism (CAGE).

** Images used are representative only and do not depict the divers in question*

↓ Epilepsy presents potentially serious problems for divers, and as such there are important restrictions on diving for people with a history of epilepsy

→ Correct weighting and good buoyancy is the cornerstone of dive safety


Cressi



↑ It is essential to understand any preexisting medical conditions that may cause complications underwater, prior to diving

➔ The importance of the buddy system should never be underestimated

HEART DISEASE

Despite a significant history of heart disease in his family, a 53-year-old male appeared to be very fit and healthy and was not known to be taking any medications. He had dived for 39 years, logging more than 2,000 dives, and had been an instructor for 20 years. He was on a day trip on a large charter boat and did not declare any medical conditions to the dive operator prior to diving.

During the dive, the diver and his inexperienced buddy navigated a wreck at a depth of around 25 metres.. The sea was calm, and there was a half-knot current running. After ascending the anchor line of another boat, the pair attempted to swim about 200 metres to their boat. The buddy was unable to swim against the current, so the diver towed him for several minutes until the buddy was able to make headway unaided. After they reached their boat's mermaid line and began to pull themselves along it, the diver became unconscious and began to float away.

"A recurring theme in dive fatality reports is the absence or breakdown of the buddy system."

Rescuers pulled the victim onto a tender and initiated CPR. This was continued with supplemental oxygen on the main vessel and later by a paramedic at a nearby resort without success.

Although this highly experienced diver appeared to be fit and healthy, his significant (presumably asymptomatic) cardiovascular disease combined with the exertion of towing his buddy against a current may have led to a heart rhythm disturbance (arrhythmia).

CONDITIONS AND INEXPERIENCE

A reasonably fit 33-year-old man had no known health conditions. He had been certified two months earlier and had only done three open-water dives when he went diving with friends from a rocky shore in a relatively calm bay. Although their entry point was sheltered and looked calm from their vantage point, there was a strong wind, a two-metre swell and strong current on the other side of the rocks.

The divers surfaced in rough conditions. Unable to access their planned exit point, they swam for 20 minutes toward the nearest rocks and exited the water with difficulty. Although the victim managed to climb onto the rocks, a breaking wave washed him back into the water. He swallowed some water and was coughing and struggling in the water and called for help. He put his regulator in his mouth before descending under the breaking waves without

his mask on. One diver jumped in to try to help but was smashed against the rocks by waves and retreated, losing his mask and fins in the process. Some of the others also lost equipment, and one broke a finger. The diver's body was later found close to where he was last seen. The cause of death was drowning.

LESSONS TO LEARN FROM THESE DEATHS

The following points summarise some of the most common problems seen here, and lessons that can be learned from these deaths:

- **Buddy system:** A recurring theme in dive fatality reports is the absence or breakdown of the buddy system. An unconscious, non-breathing diver needs to be rescued and resuscitated swiftly to have a chance of survival, so a vigilant buddy or close supervision is crucial.
- **Epilepsy:** Diving with a history of epilepsy can be very risky, even if divers are taking anti-epileptic medication and/or have not experience seizures for many years. Diving and snorkelling may expose divers to a variety of factors including stress, overexertion, sensory deprivation, high carbon dioxide levels, hyperventilation and hypothermia – all of which increase the chance of a seizure.
- **Buoyancy drill:** When divers are at risk of losing consciousness, they must gain positive buoyancy by inflating their BCD and/or ditching their weights. This is an important training drill that needs to be practised and periodically revisited. The need to locate a diver, especially underwater, delays the opportunity for relatively early resuscitation efforts, so it is far better for an unconscious diver to be at the surface.
- **Neutral buoyancy:** Divers should adjust their weights so that they are neutrally buoyant on the surface and at safety stops. Unfortunately, instructors often advise their students to stay negatively buoyant so they will not float to the surface without the instructors' knowledge. This means that, unless students or instructors use their BCD to properly adjust buoyancy, students may drag themselves along the bottom, possibly becoming fatigued and stirring up the sand, reducing visibility. Overweighting can also make it very difficult for divers to ascend and remain on the surface without inflating their BCD and/or ditching their weights, which can be dangerous, especially for inexperienced divers.
- **Adapting ratios to conditions:** Instructor-to-student ratios are set for ideal conditions and should be reduced accordingly in suboptimal conditions. In poor environmental conditions, instructors should consider rescheduling for both enjoyment and safety purposes.
- **Heart health:** Heart-related factors appear to have contributed to at least six, and possibly up to 12, of the 21 fatalities. The underwater environment puts a variety of stresses on the heart that place aging, obese and other divers at risk. Divers over 45 should discuss their heart health with a doctor trained in diving medicine.

Though there is always some risk associated with diving, many of the deaths in 2009 may have been prevented through proper medical screening, improved supervision, better equipment maintenance and design, and more thorough education about each dive and its associated risks. DAN ASIA-PACIFIC

Reference

1. *Lippmann J, Lawrence C, Wodak T, Fock A, Jamieson S. Provisional report on diving-related fatalities in Australian waters 2009. Diving & Hyperb Med. 2013; 43(4):194–217.*

We present these cases to remind you that DAN is available 24/7 to answer questions, help with medical emergencies, arrange hyperbaric treatment and facilitate emergency evacuation through our 24-Hour Diving Emergency Hotlines.

IF YOU NEED HELP, CALL:
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(toll free within Australia – English only)

+61-8-8212-9242
(from outside Australia – English only)

Scientific Diving and Safety

Responsible dive officers mean that diving for science has never been safer

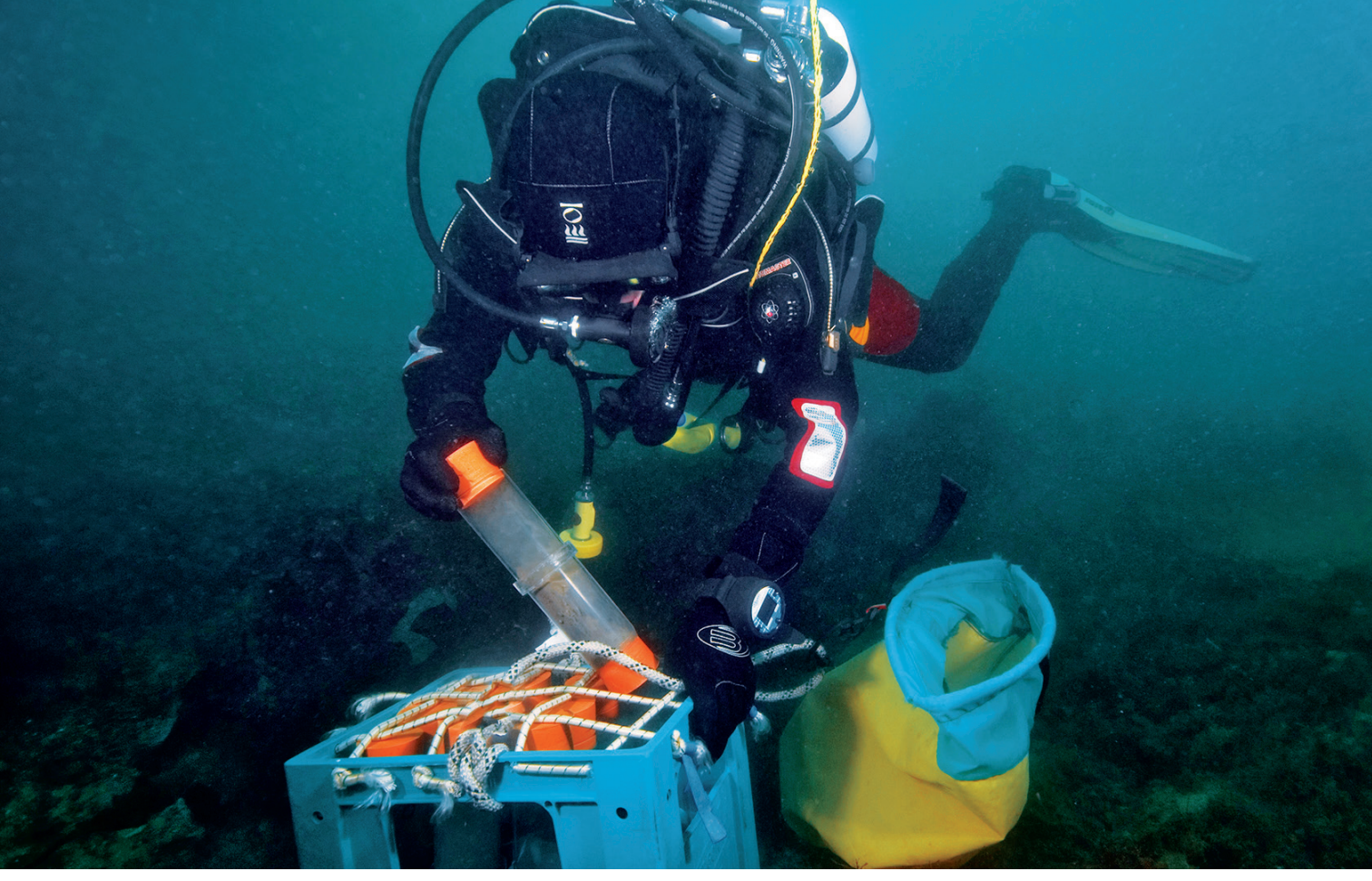
By Neal W. Pollock Ph.D.

Diving is unusual for the breadth of applications it can support. From entry-level recreational tours to hard-core recreational-technical excursions and from uncomplicated commercial projects to offshore saturation, the reasons people spend time underwater are innumerable and varied. Law enforcement, coast guard, and military services all have a toe or an entire leg in the diving realm. Photographers use diving for everything from point-and-shoot dalliances to commercial movie productions. And those movie productions may require diving not just by cinematographers, but also by the cast, construction workers and safety personnel. An even broader use of diving is to support science.

SCOPE

Scientific diving is diving conducted as part of scientific research or educational activity, generally under the auspices of a scientific diving programme. Scientific dives are conducted worldwide, using a variety of methods to address a wide range of goals. The fin-prints of scientific divers can be found from tropical to polar waters, and from well below sea level to altitudes approaching 6,000 metres. The biological sciences rely heavily on scientific diving, both for *in-situ* studies such as those popular in ecology and for sample collecting to support almost every conceivable sub-discipline. Chemistry, especially natural products chemistry, relies heavily on underwater collections to discover new

A researcher samples algal ecosystems under the fast ice in the high Arctic



↑ Hand coring by scientific divers has been shown to give highly accurate samples for a range of research disciplines

compounds. Moving further afield, archaeology has a strong presence underwater, both for shipwreck and submerged terrestrial site studies. Speleology and hydrology incorporate a great deal of diving for the study of caves and water. Many other scientific fields also have a presence.

Scientific diving is conducted both shallow and deep, under ice, and far back in caves, in pretty much any situation in which creative scientists can access water. What is interesting, given this remarkable range, is the strong record of scientific diving safety. A recent review of 10 years of scientific diving conducted by organisational members of the American Academy of Underwater Sciences (AAUS), a US-based association with membership primarily comprised of institutions with scientific diving programs, captured over one million dives with a very small number of accidents.

The sample included 33 cases of decompression illness (DCI) – the collective term for decompression sickness (DCS) and arterial gas embolism – for a DCI incidence rate of 0.324 per 10,000 person-dives. While the data for other forms of diving are incomplete, DCS estimates range from 0.9 to 35.3 per 10,000 person-dives. There are likely a number of reasons for the relatively good safety record of scientific diving. Most of the standards followed have evolved from years of thoughtful experience in a community, the choice of dive sites is usually retained by the scientist-diver, and it is relatively rare for dives to be necessary in conditions that offer a less-than-comfortable margin beyond acceptable. This reality is far different from that of some commercial and military operations. The supervision of scientific diving operations also provides a safety net not matched in most recreational diving activities.

LEADERSHIP

Many scientists come to diving primarily as a means to advance their science. Some continue to use it as simply another tool to facilitate their work. Others may more fully embrace the diving, and even gravitate to a greater focus on the diving and diving safety than the science. The latter group may provide the best pool of potential diving officers, the individuals

“What is interesting, given this remarkable range, is the strong record of scientific diving safety.”

“Diving officers, like other safety professionals, are in the position that if they do their jobs well, they help ensure that nothing, or rather nothing untoward, happens.”

responsible for the day-to-day administration of all divers and projects in the scientific diving programme. The experience of appreciating the scientific approach, knowing how scientists think, what they need to achieve their ends, and, often most importantly, how to reconcile the scientific motivation with training and safety needs, is a powerful capability. Should mission creep ever lead scientific divers toward questionable decisions, the diving officer (who often trains and certainly monitors and periodically evaluates the programme’s divers) stands by as a conscience to remind everyone of the priority of safety.

Diving officers generally work under the oversight of a diving control board (DCB), a panel normally made up of senior diving scientists and institutional representatives such as a medical officer. While the DCB can direct events, it is typically the diving officer who has the greatest impact on the character and operation of the programme. An individual with the right combination of expertise, leadership, teaching ability and motivation can navigate the challenges to ensure that divers are appropriately trained, making good decisions, submitting necessary documentation and retaining their currency – all to meet standards and avoid accidents. Diving officers, like other safety professionals, are in the position that if they do their jobs well, they help ensure that nothing, or rather nothing untoward, happens. All the critical assessment, planning, training, monitoring and anticipation establishes an umbrella of protection. A good diving programme will have a culture of thoughtfulness, low stress and safe operations with great institutional support. Each of these aspects is necessary for a programme to flourish over time.

EVALUATION

The evaluation of scientific diver competency can be an interesting challenge. Working scientists are busy, often disliking mandates to disrupt their activities for pool or classroom sessions. More importantly, such sessions are unlikely to represent the normal working conditions of the dive team. Artificial conditions are less effective at testing divers’ true capabilities, and the diving officer misses the opportunity to see the specifics of operations that are impossible to assess in summary documentation or highly constrained scenarios. The most effective strategy of a good diving

→ A student uses a suction sampler

➔ Standardised photoquadrat methods are used in the quantification of ecosystem change

officer, and probably the most enjoyable approach, is to join research teams in the field.

Field evaluations can be effective when offered as a convenience to the dive team. One method is for the diving officer to volunteer to assist with normal operations on the day for the small price of having the team participate in skill evaluations at the end. The diving officer assists with regular activities to keep the day productive while quietly evaluating normal operations of the team. This provides insights into crew performance and the needs of the scientific work. As an additional benefit, the time can also refresh some skills that the diving officer does not use on a daily basis, a useful element since the one providing oversight can sometimes be independent of the same protection. Running drills and emergency simulations at the end of the working day provides a better sense of performance with a normal degree of fatigue. Less-than-stellar performance under realistic conditions is more likely to capture the attention of a diver or dive team – it is more difficult to ignore problems evident in a normal day than a simulated one.

The completion of field evaluation days is often extremely satisfying. The cost, particularly for diving officers working in environmental health and safety offices with staff from multiple disciplines, is that it is hard for colleagues to resist a niggling (or greater) sense that these are wasted days. The best way to combat that is to have at least one other safety officer with some dive training to participate in one of the field evaluations. My favourite day of this type was when a fit – but minimally experienced with diving – safety officer who had agreed to be cross-trained declared in a staff meeting that the "wasted" day constituted the hardest work he had experienced in his career as a safety officer. It would, of course, have become much easier as he gained experience, but when part of the office time you have to justify is in the ocean, it is sometimes best to promote a few illusions.

A good way to investigate potential careers in diving health and safety is to join an existing scientific diving programme. While this may be easiest for students at institutions with programme, non-students may also be able to join, often initially as volunteer divers. This can be the gateway, providing experience and training and, if the fit is good, more opportunity. Those who enjoy the challenge of holding all of the pieces together to maintain a safe diving programme could find a very satisfying career path.

Sweet Siren Smells of Coral and Seawed

The olfactory allure of healthy marine ecosystems

By Naomi Lubick

↑ Healthy reefs give off scents that attract young fish, as well as coral (and other) larvae

Perfume is meant to allure – and healthy coral reefs and certain beneficial species of seaweed use sweet smells to entice young fish and baby corals. A healthy reef sends out attractive scents, broadcasting underwater like a siren to lure the young that will be the next generation of reef builders and dwellers. According to experiments by coral biologist Danielle Dixson of the Georgia Institute of Technology and her colleagues, biochemical signatures indicate whether a reef is healthy and would make a good place to settle down.

Dixson's team experimented with coral and seaweed species offshore in Fiji, near marine protected areas as well as areas open to fishing. The team gardened underwater plots in the area, pruning some to be skewed toward algal mats and nasty seaweed species, while enabling others to be more natural or even healthier. They tracked where coral and seaweed settled in the offshore plots and transects, and they counted the fish present in different areas. Fish appeared several times more often in healthier reef settings, and they avoided reefs smothered by noxious seaweed. The researchers also conducted a series of experiments in the lab to determine what would happen in simplified systems compared to their real-world experiments. They placed young fish and coral larvae into flumes spiked with good or bad scents. Invariably, both young fish and corals would head for the sweeter smells – even fighting currents to do so, the team recently reported in the journal *Science*.

"The thing that most shocked us was not that they could smell a good reef from a bad reef," said Dixson's co-author Mark Hay, a marine ecologist at Georgia Tech, "Nor that fish could swim away to wherever they wanted (usually to nearby marine protected areas, where the

> ***"The thing that most shocked us was not that they could smell a good reef from a bad reef... But coral larvae are tiny saclike creatures that can barely swim, and here they were heading towards the good smells... contending with waves crashing around them..."***

living is easy). But coral larvae are tiny saclike creatures that can barely swim, and here they were, heading toward the good smells in the flumes and most likely in the real world too, while contending with waves crashing around them, big enough that they were pushing us [humans] off the reef." Because the larvae can make a beeline to settle near sweeter-smelling healthy corals, they are much more in control of their survival than one might think, Hay said: "They glue themselves to the bottom, and that one choice that they make as a baby has so much impact on [their] future well-being."

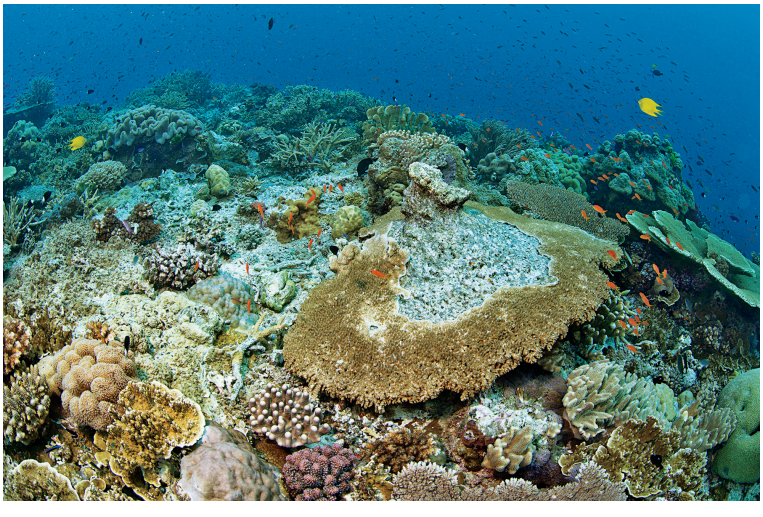
These behavioural insights also hint at one reason why reefs are in decline worldwide, according to Terry Hughes, director of the Australian Research Council Centre of Excellence for Coral Reef Studies at James Cook University, who commented on the research by email. "Often researchers ask the question 'What killed the corals?' when confronted with a decline in coral cover. This novel study shows convincingly that loss of corals, and [their] failure to recover, can also be linked to reproduction and settlement of larvae." Because both fish and corals avoid polluted, seaweed-smothered reefs, that could lead to their further decline. Could these sweet scents help protect coral reefs?

The new results may lead to a simple solution, said Robert Steneck, a marine ecologist at the University of Maine: "If you just protect parrotfish [and other fish species that eat noxious seaweed], they can create a much more attractive nursery habitat, for both fish and coral young. The study provides interesting feedback that we need if we are going to manage these reefs into the next century."

The next steps are to test that idea. Dixson and her team plan to train fishermen in Fiji to act like perfume purveyors: They could plant and tend to sweet-smelling coral and see if young fish and corals will come.

↑ Planting coral gardens full of healthy coral colonies that give off a pleasant "odour" could serve to attract reef-dwelling and reef-building species

↓ Failure for reefs to recover has been shown to be partly due to the ways in which polluted, algae-smothered reefs deter new recruits with scents that broadcast their demise



Freediving Gear

By Michael Sumlin

If it seems like you've been hearing more and more about freediving in recent years, it's probably not a coincidence: Freediving is the fastest-growing segment of the dive industry today. Robert King, vice president of AIDA International (Association Internationale pour le Développement de l'Apnée/International Association for Development of Apnea) estimates an annual growth rate of 20 percent. Notwithstanding this recent popularity, freediving is the oldest form of diving. The core gear hasn't undergone any major revisions lately – it still consists of a mask, a snorkel, fins, a wetsuit and a weight belt – but there have been subtle changes that have led to exponential evolutions in the sport. Most notable among these are the design and materials of the fins.

FINS

The most recognisable element of freediving gear is those crazy long fins. Long blades are very efficient with a slow, steady kick. The length adds to the flex and responsiveness of the blade, creating a perception of propulsion with less effort. Many freedivers believe long fins offer the best balance between low effort and high thrust. Less effort means conserving energy and oxygen and, thus, extending dive time. While long-blade fins could be used in scuba diving, they can be unwieldy and aren't designed to maximise torque, which can be a handy feature to scuba divers for starting, stopping and manoeuvring while wearing their much bulkier equipment. Long fins offer the greatest potential benefit to streamlined freedivers, who often seek to cover long vertical distances relatively quickly compared to gear-laden scuba divers.

Fin blades are made of plastic, fibreglass or carbon fibre. Plastic blades are easy on the wallet and extremely durable, but they are heavier than and typically not as responsive as the others. Fibreglass blades are more responsive and lighter,

The most obvious development in freediving equipment has been in the design and materials of freediving fins

and they are in the middle of the road in terms of price. Carbon-fibre blades are superior in performance and are the most lightweight of the three, but they are also the priciest.

There are also options for blade stiffness. In most cases these are classified as soft, medium and hard. The desired stiffness will be a product of individual fitness, body weight and the type of freediving that suits you. Most long blades on the market come with full foot pockets. A full-foot pocket that fits correctly will transfer energy better than an open-heel design. Some fins feature interchangeable foot pockets that allow you to replace a broken blade or match the best-fitting foot pocket with your favourite blade. Fin rails are another feature to be aware of – rails help keep the blade straight through your kick cycle, improving efficiency.

Some freedivers choose to channel their inner mermaid and use a monofin. As with bifins, monofins are available in a range of materials and degrees of stiffness. Manoeuvrability is greatly compromised with a monofin, however, making these best suited to either competitive diving or recreational depth diving.

MASKS AND SNORKELS

The masks and snorkels used in freediving are designed to maximise breath-hold performance. A low-volume mask is preferable for breath-hold diving because it takes less air to equalise at depth, which conserves oxygen. The lower profile also means improved hydrodynamics. Some divers prefer low-volume masks simply because having the glass closer to your eyes can make for great peripheral vision.

With regard to a snorkel, a basic "J" style with no purge valve tends to work best. They are simply less bulky, and more streamlined means more efficient. See a trend here? In freediving the snorkel is spat out before descent to prevent it from keeping the airway open in the event of a blackout.

OPEN-CELL WETSUITS

Most wetsuits are neoprene with a nylon or Lycra liner on the inside and outside. Open-cell suits, which are favoured by freedivers, don't have a liner on the inside, which increases flexibility. This enhanced flexibility allows divers to "breathe up" with less restriction on the diaphragm. Breathing up is the process of preparing yourself for a dive while breathing through your snorkel at the surface. Steady breathing from your diaphragm will help you relax and slow your heart rate before you take your peak inhalation and make the dive. Because they lack an inner lining, open-cell suits stick to you like glue and keep you warmer than fully-lined suits. Open-cell suits are more fragile, however, and require lubrication to put on. Don't be intimidated by the lube; it actually makes donning an open-cell suit even easier than putting on a conventional suit. Most open-cell suits are two pieces, including a top with an attached hood and a bottom. The hood enhances both warmth and hydrodynamics.

> *"Notwithstanding this recent popularity, freediving is the oldest form of diving."*

WEIGHT

The final piece of core freediving gear is the weight belt. Most freedive weight belts are made of rubber. The elasticity of the rubber allows the belt to stay snug at depth so it doesn't slide around as the wetsuit compresses. Simply snug up the belt low on your hips so it doesn't impede breathing up, and you're good to go. Freedivers generally prefer one-pound weights, which allow them to fine-tune the amount of weight worn. Overweighting is a serious problem and has caused many freediving fatalities. We know this because dive computers from deceased divers showed that in 90 percent of cases the diver blacked out on the surface and then sank to the bottom after exhaling during the blackout process. If weighted properly, a diver will maintain position on the surface even after exhalation. Many freedivers aim to be neutrally buoyant at 10 metres (33 feet). This allows the diver to make it to the surface in most blackout scenarios, and it makes for increased buoyancy at the end of the dive when oxygen supplies are low.

COMPUTER

A nice addition to your freediving gear is a dive computer that features an apnea (breath-hold) mode. The apnea mode will time your surface interval and, if used correctly, help ensure you allow enough time for your body to restore precious oxygen between dives. The majority of computers with apnea modes log dive time, depth, maximum depth and water temperature.

Freediving gear is simply core dive equipment designed to enhance your breath-hold diving capabilities. There is a lot of great freediving gear on the market, so find what fits you and just go and dive. Find a local freediving instructor, and learn how to be a better and safer diver. Get out there, and enjoy what Mother Nature has to offer. DAN ASIA · PACIFIC

Here's what you're missing in this issue of *Scuba Diver AUSTRALASIA*

Scuba Diver AUSTRALASIA is the official media partner of DAN Asia-Pacific.

Scuba Diver AUSTRALASIA is one of the most well respected dive magazines, full of mind-blowing images from the world's best photojournalists, the low-down on the newest dive equipment, the most exciting destinations, stories from the world of science and conservation, and much, much more!

FROM THE EDITOR

In SDAA's "Diving Green" issue, we bring you all things eco scuba. From how to travel, to where and how to dive, and the dive destinations that are making a difference. We also address the challenging question of what's stopping us from making the changes we need to make to protect our oceans. If you want to use your diving to save the seas, this one's for you.

Scuba Diver is more than SDAA, *Scuba Diver OCEAN PLANET* also comes out four times a year, bringing you dive travel, photography and lifestyle for all ocean lovers. With dive destinations from Asia, the Americas, Africa, Europe, and Oceania & Australasia in every issue, revealing info to enrich your surface intervals and underwater imaging tips from the pros, SDOP is the world's most comprehensive diving magazine.

Alice Grainger

Editor

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Find *Alert Diver* facing page 64, packed with essential information from the Divers Alert Network Asia-Pacific – the experts in dive safety, training and accident management

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OKINAWA
600kg of CO_2
Equivalent to the emissions from burning 300kg of natural gas

CAMBODIA
170kg of CO_2
The same as burning 40kg of oil

PHUKET
160kg of CO_2
The equivalent of burning 78kg of coal

SABAH
240kg of CO_2

PALAU
580kg of CO_2

KIRIBATI
1220kg

DIVING GREEN*

*STARTS WITH FLYING CARBON NEUTRAL

580kg of CO_2
The same amount as released by the fossil fuels that power an average house for 16.3 days

TASMANIA, AUSTRALIA
1020kg of CO_2
The same as the emissions from 42.5 propane gas cylinders

KAIKOURA, NEW ZEALAND
2600kg of CO_2
The same amount as emitted by a 13-watt light bulb continuously lit for 22.83 years

+ ALERT DIVER
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