



Text by Simon Pridmore

When it comes to responding to certain computer alarms, can one be too cautious? Being well informed about gas exposure limits and computer defaults can be an advantage. Simon Pridmore discusses a case in point, involving computer nitrox alarms on a routine wreck dive.

The other day, I joined a group for a dive on a small shipwreck, lying on a sandy plain just beyond a reef wall in the central Philippines. We were briefed that the site itself did not have much to recommend it. Recent coastal development had led to runoff and consequent coral destruction, and unsustainable fishing practices had taken care of most of the large schools of fish in the area.

However, from a marine life point of view, the wreck was an oasis in the desert, and that was why we were diving there. The interior was packed full of bait fish, and there were plenty of predators around—such as catfish, moray eels and



Can You Be **Too Cautious?** *— Responding to Dive Computer Nitrox Alarms*

PHOTO-ILLUSTRATION BY PETER SYMES

leaf scorpionfish—to take advantage of the prey. We were also advised to keep our eyes peeled for a photogenic red clown frogfish, and there would be cleaner wrasse offering their services to any passing animal with an itch, as well as a small school of blue-lined snapper

circling around us. So, we could expect lots of activity. It all sounded very good.

The dive

The dive guide did not lie. As we approached, even from a distance, one could see the wreck was jumping with

life, as opposed to the surrounding reef-escape, which was as dismal as we had been warned.

My buddy and I hung back a little from the group and watched the rest of our gang drift in to the site. Then, there was a beeping sound, swiftly followed by

more beeping. Suddenly, half the group started looking at their wrists rather than the wreck, there was a general onset of anxiety, and then they were gone, swimming quickly back to the reef wall, where they spent the rest of the dive searching in vain for something interesting to photo-





graph and ended up ascending early. After the dive, these divers surrounded the guide, complaining that the dive had been a waste of time. Meanwhile, the few of us that had stayed on the wreck were quite happy. There had been plenty of action there to keep us entertained.

Misplaced concern

I already had a good idea of why half

the group had chosen not to stay on the shipwreck and departed so quickly, but I had to ask.

"One point four," they replied. "My computer gave me a nitrox warning," "I don't want to die!" and "We were too deep!"

We were all using nitrox 32, and the wreck was lying at exactly 35m (115ft), sitting bolt upright on its hull, so its shallowest point was about 30m (100ft). As

the divers started swimming around it, they got close to a depth of 34m, their partial pressure of oxygen (PO₂) reached 1.4, their computers' nitrox alarm went off, and their immediate reaction was: "An alarm means danger. Let's get out of here!"

They were acting out of concern for their safety, even though their retreat would cause them to miss out on the best part of the dive. This, of course, is all very admirable in terms of diving priorities in general; although, in this case, you could argue that their concern was misplaced and the degree of caution they were exhibiting was unnecessary.

Facts and figures

The chart illustrating this article should be familiar to all nitrox divers. If it was not shown and explained to you when you took your nitrox course, your instructor did a shoddy job.

Scientists and navy divers were diving with nitrox for decades before sport divers started using it. The science behind nitrox, including this chart, came to us via a former United States National Oceanic and Atmospheric Administration (NOAA) diving officer named Dick Rutkowski. He started teaching nitrox diving to sport divers in 1985, after he retired from government service. Nitrox 32 was originally known as NOAA 1; nitrox 36 was NOAA 2.

The NOAA chart details the level of oxygen exposure at which a diver may be at risk of an oxygen toxicity convulsion. As you can see, the limits do not derive only from the PO₂ a diver is breathing; they derive also from the length of time the diver spends exposed to that PO₂. Therefore, spending 150 minutes at a PO₂ of 1.4 carries the same risk as spending 45 minutes at 1.6. But a PO₂ of 1.6 is the absolute maximum for sport divers because, beyond this level, the permitted exposure time drops quickly to only a few short minutes. NOAA deliberately set conservative limits. After all, it did not want to lose its scientists.

When Rutkowski and others started teaching sport divers how to use nitrox, some people in the established sport-diving hierarchy feared that this was a dangerous thing to do. They prophesied that it would lead to mayhem, with nitrox divers suffering oxygen convulsions and drowning all over the place. This did not happen.

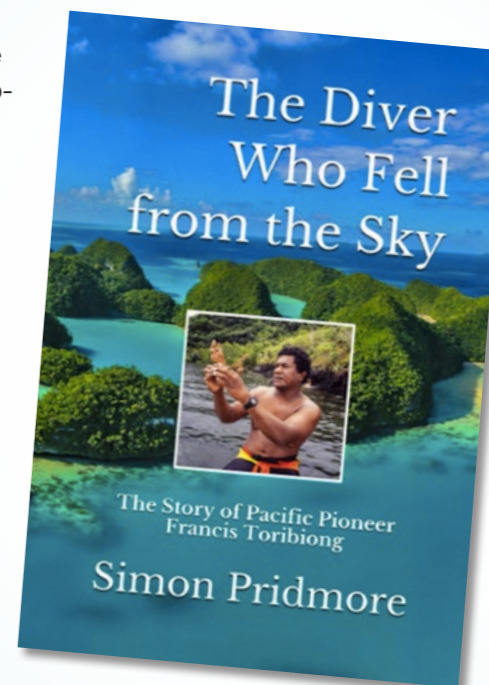
Today, millions of nitrox dives take place each year and it still does not hap-

NOAA Oxygen Exposure Limits		
PO ₂ (atm)	Maximum Single Exposure (minutes)	Maximum per 24 hr (minutes)
1.60	45	150
1.55	83	165
1.50	120	180
1.45	135	180
1.40	150	180
1.35	165	195
1.30	180	210
1.25	195	225
1.20	210	240
1.10	240	270
1.00	300	300
0.90	360	360
0.80	450	450
0.70	570	570
0.60	720	720

Chart showing NOAA oxygen exposure limits

A Pioneer Story by Simon Pridmore

When his country needed him most, Palauan Francis Toribiong came along and helped the Pacific island nation find its place in the world and become an independent, forward-looking 20th century state. And he achieved this, improbably, via the sport of scuba diving. This is the inspiring tale of an absolutely unique life, written by Simon Pridmore and illustrated with images of the beautiful islands of Palau, above and below the water.



Toribiong was born poor, had no academic leanings and no talent for diplomacy. Yet he was driven to succeed by a combination of duty, faith, a deep-seated determination to do the right thing and an absolute refusal ever to compromise his values. And, as well as all that, he was Palau's first ever parachutist—known by islanders as "the Palauan who fell from the sky." In giving

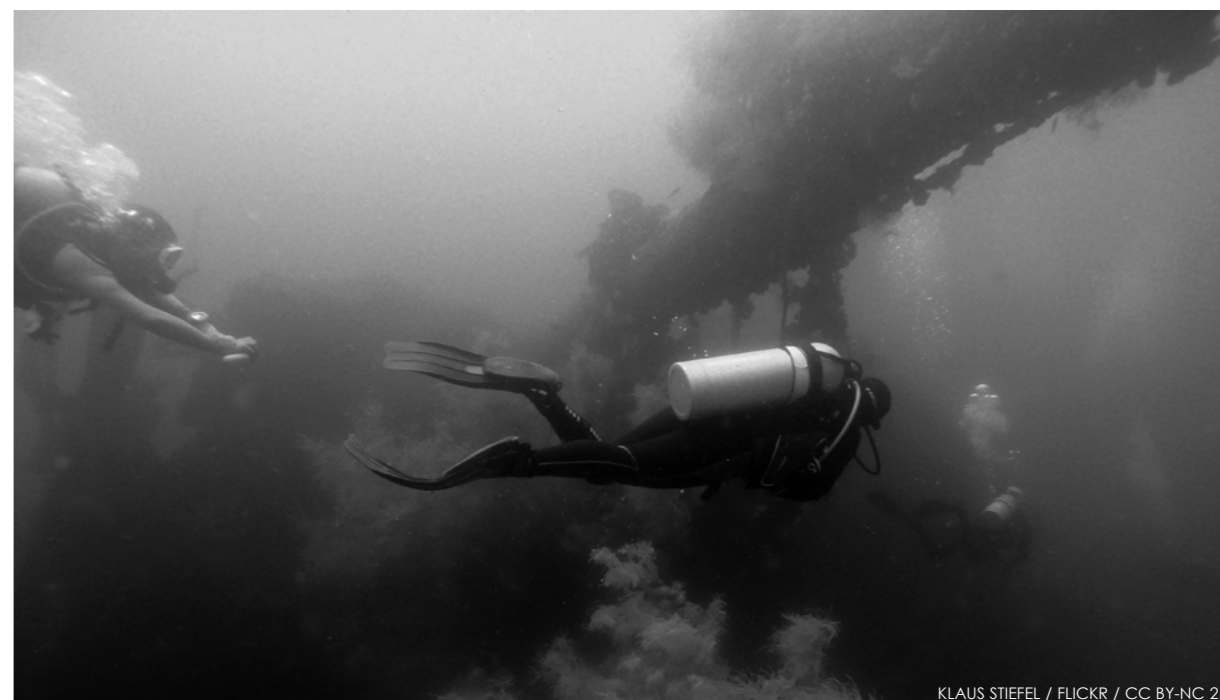
him this title, people were speaking both literally and figuratively.

Toribiong was so completely different from all of his contemporaries in terms of his demeanor, his ambitions and his vision, that it was as if he had come from outer space. Palau had never seen anybody quite like him and there was no historical precedent for what he did. He had no operations manual to consult and no examples to follow. He wrote his own life.

Toribiong was the first Palauan ever to seek and seize the international narrative. No Palauan, in any context or field, had previously thought to go

out into the world and say: "This is Palau—what we have is wonderful. Come and see!" This is his astonishing story.

Available in paperback or ebook on: **Amazon, Apple, GooglePlay and Kobo**



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pen. Experience has shown that sport divers diving on open circuit nitrox do not come to harm when diving within no-decompression limits and the NOAA oxygen exposure limits.

In any case, as one would expect, even in the beginning, the approach of the community of sport nitrox divers was conservative and instructors taught students not to plan their dive for a maximum depth where their breathing gas PO_2 would reach 1.6, but to allow for factors such as defective gauges, defective analysers and diver inattention, and to not exceed 1.5 or so.

However, the early establishment fears did not go away completely and, as nitrox became more commonly used,

the recommended maximum PO_2 level for sport diving dropped from 1.6 to 1.4.

Computer manufacturers started establishing 1.4 as the default PO_2 alarm level, and although the setting was user-changeable on many units, typically few divers ever bothered. This is still the case now and, in fact, some diver training agencies now teach 1.4 as the PO_2 level beyond which one shall not pass.

Moreover, the computer alarm is set to go off as soon as the computer calculates that the diver's gas and depth equate to a 1.4 PO_2 . The concept of a diver being able to remain safely at a certain PO_2 for a certain length of time seems to have been lost. The PO_2 level is now all that counts, not the duration or

the dose.

Hence, the misguided behaviour we observed among some of our fellow divers on the shipwreck dive.

Nitrox 32 was actually the perfect mix for that wreck dive. The water was warm. The visibility was excellent. There was no current and the divers had to expend only minimal effort on the dive, so there was no reason for any unusual level of concern. The maximum depth was 35m (115ft), giving the divers a maximum PO_2 of 1.44, even if they were lying flat on the sand. Also, with nitrox 32, their computers would give them a no-decompression time on and around the wreck of 20 to 25 minutes or so—far less than the 120-minute exposure limit that the NOAA

NEW 4 in 1!

Author Simon Pridmore has just released a new single volume e-book that brings together four books in his bestselling *Scuba* series:

- *Scuba Fundamental – Start Diving the Right Way*
- *Scuba Confidential – An Insider's Guide to Becoming a Better Diver*
- *Scuba Exceptional – Become the Best Diver You Can Be, and*
- *Scuba Professional – Insights into Sport Diver Training & Operations*

As Simon puts it, this is “a remastering and repackaging of the original albums rather than a greatest hits.” Nothing is missing. *Scuba Compendium* gives e-book readers the advantage of being able to access all the knowledge contained in the four books in one place, making this a unique and easily searchable work of reference for divers at every level.

Simon has always promoted the idea of safer diving through the acquisition of knowledge, which is why he has chosen to release this highly accessible version. If you have read his work before, you will know that he provides divers with extremely useful advice and information, much of it unavailable elsewhere; his



points often illustrated by real life experiences and cautionary tales. He examines familiar issues from new angles, looks at the wider picture and borrows techniques and procedures from other areas of human activity.

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chart allows for a dive at a PO_2 of 1.5.

Sadly, it was completely unnecessary for the beeping divers to abort. They missed a great dive. What a shame that their misplaced fears got in the way of having fun!

It is good to be a conservative diver, but it is important to be well informed, so you can distinguish between being sensibly careful and excessively cautious. ■

Simon Pridmore is the author of the international bestsellers Scuba Fundamental: Start Diving the Right Way, Scuba Confidential: An Insider's Guide to Becoming a

*Better Diver, Scuba Exceptional: Become the Best Diver You Can Be, and Scuba Professional: Insights into Sport Diver Training & Operations, which are now available in a compendium. He is also the co-author of the Diving & Snorkeling Guide to Bali and the Diving & Snorkeling Guide to Raja Ampat & Northeast Indonesia. His recent published books include The Diver Who Fell From The Sky, Dive into Taiwan, Scuba Physiological: Think You Know All About Scuba Medicine? Think Again! and the Dining with Divers series of cookbooks. For more information, please see his website at: **SimonPridmore.com**.*