Keeping Your Cool, Part I

Anxiety and panic in recreational scuba divers

The diving industry doesn't like to talk about the dangers of diving, but you and I know they exist. Those dangers are less likely to come from external events, such as running out of air, inability to negotiate currents, or bad visibility, than from our own internal events — how well we respond to these situations.

Panic is the diver's biggest enemy; it kills experienced divers as well as beginners. Yet it gets little attention in the literature. Recently, Dr. William P. Morgan, Professor and Director of the Sports Psychology Laboratory at the University of Wisconsin–Madison, produced a seminal paper on diver panic. His analysis is important to the safety of every diver. In this and subsequent months we will run a series digesting his work.

Ben Davison

Scuba diving is a high-risk sport. However, there is a tendency to underestimate the risks. According to one researcher, the "commercialization of the diving community has really de-emphasized the dangers."

The Death Rate

The mean number of annual diving fatalities between 1970 and 1993 has been estimated at 103.5, the median 106. This is only an estimate, because some fatalities go unreported as diving deaths.

It is difficult to determine the death rate per 100,000 divers because of varying estimates of the number of people who actually dive. John McAniff, the retired head of the University of Rhode Island's National Underwater Accident Data Center, estimates a maximum of 3.1 million divers in the U.S., a figure arrived at largely by counting certifications.

Some researchers believe that this figure is inflated by 20 percent or more because it is based on numbers from training agencies that include multiple certifications and also underestimates dropout rates. PADI disputes these contentions, and DAN points out that no one actually knows how many scuba divers are active in the U.S.

In the U.S., 600 to 900 divers are treated each year for DCI. Others experience DCI but do not seek treatment.

If we were to reduce the 3.1 million by roughly 20 percent, this leaves 2.5 million recreational divers. Using the median of 106 deaths per year, the relative risk is 4.24 deaths per 100,000 divers, considerably higher than the values of 2.0 to 3.0 that are commonly quoted.

This figure is crude; it does not consider the number or nature of the dives, nor the experience or conditioning of the diver. Treating a diver who performs one or two open-water dives per year in the same way statistically as one who performs several hundred dives per year does not comply with conventional epidemiological principles.

Although discussions of diving risk tend to focus on fatalities and DCI, other risk factors cannot be discounted. In the U.S., approximately 600 to 900 divers are treated annually for DCI (in 1993, 958 were treated) and the number seems to be increasing. No doubt more divers experience DCI but do not seek treatment. Furthermore, other diving accidents occur; propeller injuries, bone fractures, cardiopulmonary difficulties associated with near drowning are examples. These, too, are probably underreported.

Researchers are discovering other problems. Permanent neuropsychological changes (e.g., memory loss and depression) have been observed in professional divers who never experienced DCI.

In another study, investigators compared 52 amateur divers with long histories of scuba diving with 50 nondivers who swim or run. Brain lesions and degenerative changes of the cervical disks were more common in the divers: 27 of 52 divers had 86 lesions, while 10 of the 50 nondivers had 14 lesions. The researchers concluded that amateur divers are at risk of accumulating lesions in the central nervous system and in cartilage.

Indeed, scuba diving is not a low-risk sport; these factors must be considered to determine risk.

What Causes Deaths

In more than 60 percent of the cases, the cause of death is listed as drowning. But drowning itself is usually caused by a specific problem: lack of air, entanglement, embolism, narcosis, or panic. Of

these, panic gets inadequate attention. In fact, it is the precursor of many, if not most, deaths. Air embolism may result from rapid ascent due to panic.

When lack of air is "the reason" for drowning, pony bottles and buddy breathing are often available, but the diver panics and drowns. A diver who fails to escape from entanglement in a rope, a net, or kelp, may fail because he or she panics.

Many deaths remain unexplained because the equipment is found to be functional, air remains, or there are no signs of physical trauma or medical problems. Divers have removed their masks or regulators when exposed to stressors that provoke anxiety and panic. A similar response is found on land. Some anxious individuals exercising on a treadmill remove a breathing device or facemask if they have a sensation of suffocating.

Take the case of a 58-year-old male NUADC said died because of "entanglement in kelp." He had more than 1,000 psi of air remaining when found 24 hours later entangled in kelp at a depth of 15 feet, with his regulator removed. Did he panic and remove his regulator intentionally or by accident?

Or look at three independent incidents reported by divers responding to a survey of panic behavior. Each had become entangled and engaged in a frantic struggle to escape, depleting his air. Each eventually remembered the sheathed knife he wore on his leg and cut himself free. Had they become fatalities, their cause of death would have been listed as entanglement.

Here are three more deaths attributable to panic.

In May 1993, off West Palm Beach, Florida, a diver experienced difficulties at 70 feet. Eyewitnesses indicated that "for unknown reasons, he ripped his regulator out of his mouth and other divers in the group were unable to put it back."

A month later, in Redgranite, Wisconsin, a 20-year-old female instructor and a 34-year-old male student drowned during a training dive. They were found 10 feet apart at 65 feet, with their regulators removed. Both tanks contained air, the equipment appeared functional, and there were no injuries. Why would they remove their regulators even though they had air? Panic cannot be ruled out in these cases.

Has the commercialization of the diving community led to de-emphasis of the dangers of scuba diving?

In many fatalities, the dead diver is found without his mask. While it might be dislodged when the body is recovered, divers in the panic of running out of air are frequently seen by their colleagues to pull off their masks. Something similar apparently occurs ashore when fighters experiencing respiratory distress cut off their air supply by removing their face masks, often with fatal results.

Thus, the incidence of diving accidents and fatalities due to panic may be far greater than believed. Reports from the National Underwater Accident Center from 1976 through 1988 indicate that at least 19 percent and as many as 42 percent of the reported diving fatalities involve panic. One researcher has noted that "any sport diver instructor in the country will tell you that emotional instability or panic plays a big role in many if not most diving accidents."

In one study, 132 of 245 experienced men and women divers (54 percent) had felt panic while diving. But panic is not restricted to recreational divers. In a study of six commercial divers who died on the surface and 31 more mishaps taking place at depths as shallow as 40 feet, panic attacks or breaking down under stress were often implicated.

The role of panic does not receive adequate attention by the authors of scuba diving books, instructors, and the agencies. Whether this is intentional is unknown, but some speculate that the commercialization of the diving community has led to de-emphasis of the dangers of scuba diving.

Further Reading

*PADI's Encyclopedia of Recreational Diving deals with the chemistry and physics of d*iving, the physiology of diving, diving equipment, the aquatic realm, wreck diving, underwater photography, search and rescue, night diving, and deep diving. This book has been used by many PADI instructors and thousands of students. Yet there is a conspicuous absence of reference to panic and the problems that can result. Even the index, which reveals a comprehensive listing of scuba terms and phrases, does not include terms such as "anxiety," "panic," "stress," or "fatality." It is surprising that an encyclopedic volume of this nature ignores panic altogether. This is could be due to a concern about negatively affecting the reader.

The New Science of Skin and Scuba Diving is published by the Council for National Cooperation in Aquatics. Now in its sixth

edition, it has sold more than two million copies, influencing a generation of divers. While the problem of panic behavior is recognized in this book, its treatment is vague and superficial, and, as with PADI's encyclopedia, associated terms are not cited in the index.

Dennis Graver, in his introductory book *Scuba Diving*, states that panic is the diver's worst enemy, and has a section to sensitize the reader to the overall problem. Graver reports that divers breathe faster and shallower when they experience stress, and he recommends that the diver stop all activities and breathe deeply when this occurs.

While this might seem to be an effective strategy, there is no research to support the technique. In fact, some research suggests that respiration rate is not correlated with anxiety in scuba divers, and neither respiration nor anxiety is influenced by relaxation procedures. An exception is John Lippman's book for advanced divers, *The Essentials of Deeper Sport Diving*. He not only indexes anxiety, panic, and stress, but identifies potential preventive measures. He discusses Blue Orb Syndrome, in which experienced divers may panic in clear, deep water if they lose sight of familiar objects and experience sensory deprivation or a fear of isolation. Lippman says it can be overcome by focusing on familiar objects or people.

Dr. William P. Morgan's work was funded by the University of Wisconsin Sea Grant Institute and federal and state grants. We thank the Journal of Sports Medicine *for permission to excerpt. A full reprint, with footnotes, may be ordered from Dr. William P. Morgan, Sport Psychology Laboratory, Department of Kinesiology, University of Wisconsin–Madison, 2000 Observatory Drive, Madison, WI 53706 (608-262-7737, fax 608-262-1656, e-mail sportpsy@macc.wisc.edu).*

Next issue: Unconsciousness

Hoseless and Hopeless

Computers that don't compute

Dear Delmar: I am interested in an air-integrated, hoseless dive computer. I have seen a number of postings on the Internet concerning hoseless computers temporarily losing the signal between the wrist and tank units while underwater strobes are recycling. This problem has been mainly discussed with the Uwatec Air-X computer.

Bob Stinson

Dear Bob: I test-dived the USD-branded equivalent to the Air-X while on a trip to New Guinea early in 1995. It failed to initialize, despite dozens of tries, and was thus worthless on the entire trip. I also test-dived the Cochran Nemesis (reviewed in *In Depth*, January 1994). Both test units malfunctioned; one flooded, and the other cleared its residual nitrogen completely between dives.

Two weeks ago, I took yet another of the Uwatec hoseless clones (a Monitor 3) and one of the brand-new Pelagic hoseless units (Oceanic plans to sell them as the DataTrans, whereas USD's nearly identical version is called the Scan 5) on a one-week dive trip. Both were unsatisfactory. I dived each for several days, all the time resisting the temptation to take them off and drive back and forth over them with a van. When worn on a retractable reel clipped to my chest, the receivers continually disconnected themselves (lost signal) from their first-stage transmitters. About half the times I looked, I had deco information only, no air data. Both of them gave off infuriating audible and visual displays, either threatening me that they were either about to disconnect or telling me no information was available about air supply.

At present, when using air-integrated systems, I'm diving hose-type units (Suunto Eon or one of the three Pelagic clones made for USD, Dacor, and Oceanic). None of them has ever failed to work perfectly for me. Furthermore, I waited for years to get gauges off my wrist. Why would I want to put one back on? The hoseless wrist readout units I've tried were bulky and uncomfortable.

This technology doesn't look mature to me, but maybe I've got a bad attitude due to 100 percent failure rate of the five units I've lugged halfway around the world. I haven't yet tested a hoseless unit that I would buy — or even take for free.

Delmar Mesa