

South Pacific Underwater Medicine Society Incorporated

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OBJECTS OF THE SOCIETY

To promote and facilitate the study of all aspects of underwater and hyperbaric medicine.

To provide information on underwater and hyperbaric medicine.

To publish a journal.

To convene members of the Society annually at a scientific conference.

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Membership is open to medical practitioners and those engaged in research in underwater medicine and related subjects. Associate membership is open to all those, who are not medical practitioners, who are interested in the aims of the society.

The subscription for Full Members is \$A80.00 and for Associate Members is \$A40.00.

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All contributions should be typed, double-spaced, using both upper and lower case, on one side of the paper only, on A4 paper with 45 mm left hand margins. Headings should conform in format to those in the Journal. All pages should be numbered. No part of the text should be underlined. These requirements also apply to the abstract, references, and legends to figures. Measurements are to be in SI units (mm Hg are acceptable for blood pressure measurements) and normal ranges should be included. All tables should be typed, double spaced, and on separate sheets of paper. No vertical or horizontal rules are to be used. All figures must be professionally drawn. Freehand lettering is unacceptable. Photographs should be glossy black-and-white or colour slides suitable for converting into black and white illustrations. Colour reproduction is available only when it is essential for clinical purposes and may be at the authors' expense. Legends should be less than 40 words, and indicate magnification. **Two (2) copies of all text, tables and illustrations are required.**

Abbreviations do not mean the same to all readers. To avoid confusion they should only be used after they have appeared in brackets after the complete expression, e.g. decompression illness (DCI) can thereafter be referred to as DCI.

The preferred length for original articles is 2,500 words or less. Inclusion of more than 5 authors requires justification. Original articles should include a title page, giving the title of the paper and the first names and surnames of the authors, an abstract of no more than 200 words and be subdivided into Introduction, Methods, Results, Discussion and References. After the references the authors should provide their initials and surnames, their qualifications, and the positions held when doing the work being reported. One author should be identified as correspondent for the Editor and for readers of the Journal. The full current postal address of each author, with the telephone and facsimile numbers of the corresponding author, should be supplied with the contribution. No more than 20 references per major article will be accepted. Accuracy of the references is the responsibility of authors. Acknowledgments should be brief.

Abstracts are also required for all case reports and reviews. Letters to the Editor should not exceed 400 words (including references which should be limited to 5 per letter).

References

The Journal reference style is the "Vancouver" style, printed in the Medical Journal of Australia, February 15, 1988; 148: 189-194. In this references appear in the text as superscript numbers.^{1,2} The references are numbered in order of quoting. Index Medicus abbreviations for journal names are to be used. Examples of the format for quoting journals and books are given below.

- 1 Anderson T. RAN medical officers' training in underwater medicine. *SPUMS J* 1985; 15 (2): 19-22
- 2 Lippmann J and Bugg S. *The diving emergency handbook*. Melbourne: J.L.Publications, 1985

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Consent

Any report of experimental investigation on human subjects must contain evidence of informed consent by the subjects and of approval by the relevant institutional ethical committee.

Editing

All manuscripts will be subject to peer review, with feedback to the authors. Accepted contributions will be subject to editing.

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**DIVING MEDICAL CENTRE
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Three day (long weekend) courses are conducted to instruct medical practitioners in diving medicine, sufficient to meet the Queensland Government requirements for **recreational** scuba diver assessment.

The next courses will be at the Royal Perth Hospital, Perth, Western Australia, on 14th-16th April 1995 (Easter) and Bond University, Gold Coast, Queensland on 29th April-1st May 1995 (Labour Day Weekend Queensland) Royal North Shore Hospital, Sydney, New South Wales, on 30th September-2nd October 1995 (Labour Day Weekend N.S.W.) Hamilton Island, Queensland on 14th-16th October 1995 For further details contact Dr Bob Thomas Diving Medical Centre, 132 Yallambee Road, Jindalee, Queensland 4047. Telephone (07) 376 1056 / 1414

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PROJECT STICKYBEAK

This project is an ongoing investigation seeking to document all types and severities of diving- related accidents. Information, all of which is treated as being **CONFIDENTIAL** in regards to identifying details, is utilised in reports and case reports on non-fatal cases. Such reports can be freely used by any interested person or organisation to increase diving safety through better awareness of critical factors.

Information may be sent (in confidence) to:
Dr D. Walker
P.O. Box 120, Narrabeen, N.S.W. 2101.

DIVING INCIDENT MONITORING STUDY (DIMS)

DIMS is an ongoing study of diving incidents. An incident is any error or occurrence which could, or did, reduce the safety margin for a diver on a particular dive. Please report any incident occurring in your dive party, but do not identify anyone. Most incidents cause no harm but reporting them will give valuable information about which incidents are common and which tend to lead to diver damage. Using this information to alter diver behaviour will make diving safer.

To obtain Diving Incident Report forms write to DIMS, GPO Box 400, Adelaide, South Australia 5000.

The Editor's Offering

This issue of the Journal is largely devoted to legal matters. Given the attitudes expressed in liability releases originating in the United States every diver should be ready to really read the release before signing it, otherwise he or she may well be signing away all his rights to sue after the dive organiser has been negligent and caused the diver harm.

While one can sympathise with the attitude that without these all-embracing releases insurance would become too expensive for dive operations to be viable, one is forced to throw away what protection the law allows. Apparently such all-excluding releases may be valid in Australia. Unfortunately the paper from an Australian source on this matter was commissioned too late to make the deadline for this issue.

The problems of diving safety are compounded by the presence of the few bad apples, or cowboys, in the diving industry. Self regulation is an excellent idea, and it may work. But for it to work there has to be complete consensus in the industry, and this is hard to achieve. There is always someone under financial pressure who needs, or thinks he or she does, the money which following safe procedures would require. So unnecessary risks are taken. Such as recent episode in Queensland waters when the divers surfaced to find that their yacht had drifted away. There was a boat keeper, but she did not know how to start the engine so could not cope when the anchor failed to hold. Because anchors often drag, commonsense dictates that all crew members who might be left in charge of an anchored boat should be able to start the engine and take the boat back to its original position.

There is no single agreed "best" diving table. In a pluralistic world this is not surprising. Some recommend the DCIEM tables, but all tables are fallible and all divers' brains are less keen underwater than out of it. It could be that it is not the table that protects the recreational diver but the diver's cautious attitude. One can attribute safety to tables when there is a diving supervisor who controls the diver's depth and time. But recreational divers are vertical wanderers, and many of them seldom inspect their gauges. Very few use a Citizen Aqualand watch, or equivalent device, to warn them when they reach a chosen depth, and if the depth is wrong the table's protection has been perforce abandoned unless a new, and shorter time underwater is worked out and followed. Seven years ago few SPUMS members were willing to return their results to some simple questions involving table use, and many of those who did hand in their homework, all done out of the water, got the answers wrong. If an educated group, who ought to know the importance of adhering to tables while underwater, could not achieve the right answers with the tables in their hands on land, what hope has the average

diver of achieving the right answer to an unexpected depth excursion underwater?

As a non-lawyer whose working life has mainly been spent poisoning people in a controlled fashion (anaesthetising) the Editor has always tried to be safe at all times. But at times anaesthetist fail, often because someone was out of their knowledge "depth" but also when short cuts were taken or the anaesthetist tired out. The threat of legal action is ignored and usually nothing horrible happens. Luckily the anaesthetist was not negligent if less-than-best practice results in no damage.

A better way, than forcing the trainees and divers to abandon all possible claims against the instructor or dive boat, for the diving industry to go would be to increase the time underwater and the number of dives completed in the basic course. Also to abandon the misleadingly named "advanced" courses. Ten dives do not make an advanced diver, the diver is still a novice and will be for many more dives.

Robert Erwald's suggested release which puts the diving risks on the diver and the negligence risks on the provider of services seems a sensible way to go. John Lippmann and Tom Wodak suggest that divers should take more responsibility for their actions, but also that teaching organisations should make more effort to ensure that trainees leave the course with a realistic appreciation of their skills, and lack of them, and experience.

The purpose of loading this issue with legal opinions and sad stories of probably avoidable deaths is to make people aware of the risks of going diving and to stimulate discussion about where the responsibility for a diver's safety lies and how to improve safety. No one would dispute that during the first open water dive the responsibility lies with the instructor. By the end of the course the diver should, in theory, be safe to let loose in the ocean. This would imply that his or her safety is solely the diver's responsibility. But how much does a diver know of the risks and the problems, and solutions to them, of diving after 5 dives? AS 4005.1 accepts that the "trained" diver is only safe to dive in the area where he or she was trained and needs further instruction to be safe in other places and conditions. Bob Halstead is on record as considering that a new diver needs some 50 plus dives over his BC before he can be considered reasonably competent.

There is need for accurate risk data for legal actions, for both the plaintiff and the defendant, and Douglas Walker proposes Project Proteus to collect data from those who dive safely with conditions which are normally considered as contraindications to diving. This is a very worthwhile project and deserves support from all of us.

ORIGINAL PAPERS

AUSTRALIAN DIVING MEDICINE A RETROSPECTIVE 1965-95

Carl Edmonds.

Introduction

It was brought to my notice, rather cruelly I thought, that this year marks my thirtieth year of diving medicine. Although I started scuba diving in Hawaii in 1962, when the surf went down, I did not join the Underwater Research Group until 1965.

It seems a reasonable time to do a retrospective, to reminisce about the scene of thirty years ago. Although I reluctantly accept that some current diving medicos were not even born at that time, the fact is that they are still seeing clients who have been exposed to the diving hazards and medical naivety that were prevalent then.

I have selected a number of diving medical topics, which have changed over that time. Unfortunately, many others have not.

Shallow water blackout

One of the main reasons that I joined the Royal Australian Navy (RAN) was to determine the causes of unconsciousness and death in clearance divers, those professional and elite divers who used closed circuit re-breathing equipment. There was a very high incidence of "shallow water blackout" (SWB), a disorder first described by Barlow and McIntosh,¹ in the Royal Navy, during World War II. It was common in divers using oxygen (or mixed gas) re-breathing equipment at depths of less than 9 m (30 feet). There was little warning of the unconsciousness, and it was initially thought to be due to carbon dioxide (CO₂) toxicity.

With increasing improvements in CO₂ absorbent systems, together with the advanced technology being employed with closed circuit equipment, it was decided that CO₂ could no longer be the cause of this. Also, the CO₂ measurements, taken from the breathing bag, were mostly less than 1%.

SWB kept occurring so often that it was considered an inevitable occupational consequence of using re-breathing equipment. It was often not even reported officially. Sir Stanley Miles, who was a brilliant participator in diving medicine, and who therefore made the occasional mistake or two, decided that the cause must have been multifactorial, i.e., no one single cause could explain the plethora of cases.

In 1957 he introduced the concept of oxygen syncope,² as most of the cases occurred while breathing higher than normal oxygen, but not at a level great enough to induce convulsions. It was believed that the diver just lost consciousness, a syncope, from an unknown mechanism.

This was the situation in 1965, when two young RAN divers, using closed circuit equipment, disappeared near Jervis Bay.³ There were fanciful conjectures surrounding their disappearance, including being eaten by sharks, capture by a Russian submarine, desertion during active service, and even extra-terrestrial fantasies that were popular at the time. The subsequent retrieval of the bodies, underwater, introduced some realism.

We were left with the one explanation, which was really a non-explanation, of SWB. There were reservations held about the capability of the divers involved, the equipment used and the techniques employed. Divers were becoming demoralised and fatalistic about the increased hazards. The authorities blamed the divers (individual idiosyncrasy), not the equipment or the dive protocols. We had to find the explanation, and fast.

The experiments were the basis of a technique which has subsequently been used throughout Australia and internationally. We decided to re-enact the incident, replicating the presumed sequence of events, preferably terminating the experiment prior to a tragic consequence.

To do this we employed three different types of equipment.

- a A normal scuba system, with compressed air. This, according to popular belief, rarely if ever caused SWB.
- b Similar scuba equipment, but with compressed oxygen. If Miles was correct, then this should cause oxygen syncope or SWB first.
- c The same equipment (recharged) as was used by the deceased divers. We knew that this could cause SWB.

Closed circuit equipment had less oxygen in the counterlung (about 80%) than open circuit oxygen scuba (100%). We therefore hypothesised that the person on the 100% oxygen with scuba would be the first one to go, the diver with the closed circuit should be the second, and the scuba air diver should survive without problems.

A diver paramedic would use the scuba-air, I took the open circuit scuba oxygen and one of our best clearance divers would use the closed circuit equipment.

The result was not quite as expected. About half an hour into the dive, the clearance diver, on the re-breathing set, lost consciousness. We all came to the surface and that set was then transferred to another clearance diver, and we

all continued with the dive. The new diver lasted about 10 minutes. This was again repeated and the third clearance diver lasted about 5 minutes. There were no problems with either the scuba air or the scuba oxygen.

One explanation was that clearance divers were wimps, but no one was courageous enough to voice this possibility. Indeed, it was obvious from our experiments that it was the equipment itself, not the oxygen being breathed, nor the people using it, that caused the problems.

After that a whole series of experiments under different diving conditions were performed, with divers being dragged up out of the water as they lost consciousness and gas samples being taken from various parts of the equipment, *pari passu* with resuscitation. After a few months it was obvious that the main problem was still, as Barlow and McIntosh had said in the 1940s, the failure of the CO₂ absorption system to remove adequate CO₂, in a heavily exercising diver. This was as likely at 1 m depth as at 10 m.

The technique used to demonstrate this became known as an "accident (or incident) re-enactment" trial. As we became more proficient it was not necessary to proceed as far as unconsciousness, before the divers were surfaced and assisted.

The information that we obtained then allowed us to develop CO₂ absorption canisters which were more efficient, to such a degree that the clearance divers ended up having more faith in the School of Underwater Medicine (SUM) canisters, than in the commercial equipment. There were some quite spectacular breakthroughs in understanding canister performance. In 1969, despite its theoretical unacceptability, we designed a large pendulum canister which allowed us to double our time under water in safety. The last and most significant design development was produced by the SUM scientific officer, John Pennefather, during the early 1980s.

We also devised techniques to test equipment at its extreme ranges, i.e. very close to the surface and at maximum depth, at no exercise and at maximal exertion, at extreme temperatures, etc. These many tests were excellent in highlighting the failures and the limitations of equipment. The one way you cannot test equipment is to just put it on your back and "see how it goes". That will only test the mid range and result in an inappropriately positive report.

In the earlier 1970s the School of Underwater Medicine became quite famous for its ability to deduce the limitations in various pieces of equipment, including re-breathing sets, resuscitation equipment and dive computers. All the tests were based on the same principle, i.e. to "test the limits".

Why bring up this past? Well, a casual glance at many of the re-breathing sets now emerging suggests that the inadequacies of the equipment of yesteryear have been faithfully replicated in the 1995 advanced technology. Having a sophisticated oxygen sensor with an automatic computerised gas stabilising feedback system, does nothing to stop you dying from CO₂ toxicity.

Decompression sickness treatment

Treatment of decompression sickness involved the application of compressed air, at a minimum depth of 30 m (100 feet) and more frequently at 50 m (165 feet). The first case on which I was consulted, was another diving physician who had, that day, been in the chamber and treated a diver. The fact that the diver patient got moderately better and the medical attendant got seriously bent, did not inspire confidence in the treatment tables. Nor did a review of other cases. I presumed the air table failures were because we were getting divers many hours after the initial symptoms developed. This was not so in the US Navy, who were able to treat their divers immediately. We were dealing with civilians who often got bent long distances from the chamber. Often days would pass between injury and treatment.

MEDEVAC

The RAN and RAAF accepted responsibility for treatment of civilians in 1965, in lieu of any alternative. From 1967, to reduce the delay if the diver was significantly injured, we were as likely to take all the equipment (chambers, oxygen, appliances, etc.) to him, as we were to take him to the chamber. It all depended on which was the quickest way to treat the patient. We preferred RAAF Hercules aircraft, pressurised to 1 atmosphere, to transport us.

The development of the retrieval system, and a later extension of the Navy emergency telephone system for imparting advice and treatment to the diving community, was superseded in the 1980s by the Diver Emergency Service (DES) at the Royal Adelaide Hospital Hyperbaric Medicine Unit, with finance provided by the National Safety Council of Victoria (one of its more commendable achievements). When the NSC failed, financing became a problem and was for some years hand to mouth. DES has co-operated with the Divers Alert Network, which developed concurrently in the USA and which is spreading internationally.

Thus from the sick bay at RAN SUM, a very valuable diving medical cover has evolved. There is little resemblance between the 1965 and 1995 treatment facilities, certainly as regards hardware.

OXYGEN

In 1967 we started using oxygen before the actual

recompression, because of inevitable delays. Thus the diver would get oxygen in transit to the chamber, or he would be placed on oxygen while we brought the chamber to him. It is a moot point as to whether the French or the Australians initiated this oxygen regime as a first-aid measure before recompression. It also does not matter, as we were both very much impressed with its success.

OXYGEN TABLES

Fortunately, in 1965, Workman and Goodman⁴ produced their oxygen tables, allowing us to start treatment of almost all DCS at 60 foot. These tables really only became used, with any frequency, in about 1967. At that stage we were still treating very ill divers, very delayed and with variable success. Even the oxygen treatments did not seem to work in many cases, because of the excessive delays.

That was when we decided to experiment, using the criteria of success and failure. If a patient got worse during treatment, then it needed modifying. An obvious principle. We capitalised on the beneficial effects of pressure and oxygen without preconceived limitations. We took the (usually severely ill) diver to whatever depth produced a satisfactory response, and then decompressed with the maximum oxygen that would not produce convulsions.⁵ Dramatic treatment for a dramatic illness.

Those were called the "Australian Tables" and I would still revert to them for serious cases (not the woozy "I may not feel 110%" cases now cluttering up our chambers). We even employed heliox to replace the air breaks, with a prescience that was based on luck and irrelevant premises.

Independently, the French developed their Comex tables, which were a middle ground between the formal and very limited US Navy tables and the very flexible and so complex Australian ones.

UNDERWATER OXYGEN TREATMENTS

The history of underwater oxygen is in no doubt. This was developed in the late 1960's at the RAN, and by 1970 was employed through many parts of the Pacific, especially where chambers were not available. The rest of the world was horrified. The underwater oxygen regime is still employed by many of the divers in remote areas, such as in the Pacific islands, the abalone fields of southern Australia, and the pearl fields of the north. More recently the deep air dip, followed by the underwater oxygen regime, was developed in Hawaii.

This underwater oxygen treatment is now a part of most national diving manuals. It took 15 years to find its way into US Navy Diving Manual.

As always, the real origins of both the surface and underwater oxygen regimes were really based on work

done by others. The use of oxygen on the surface, to prevent decompression sickness deteriorating, was well described by Paul Bert⁶ last century. Thus, although the current French and Australians can argue about who should be credited, the real pioneers of this treatment pre-dated both, as with the underwater oxygen. Although they may not have used the techniques that we subsequently applied, the principles of oxygen treatment at shallow depths was well described by Behnke, Yarborough and Shaw,^{7,8} pre-World War II.

Hyperventilation, breath-hold diving, and drowning

In the early 1960s Craig⁹ produced his brilliant observations showing that hyperventilation produced a reduction of CO₂ levels, sufficient to extend breath-holding underwater, and resulting in hypoxia and unconsciousness, drowning and death. By 1965 the message and the magnitude of the problem was starting to seep through.

Unfortunately this was not well appreciated by our macho spear fishermen at the time, and there were many.

My predecessor at RAN SUM spent some time arguing with the then Australian breath-hold champion, in 1966, and I continued the arguments in favour of ditching this technique, in the early days of television. It was difficult to confront these brilliant extroverts, but fortunately for me, the champion managed to demonstrate his human fragility by hyperventilating before a breath-hold dive, off one of the oil rigs in the Bass Strait. The inevitable happened, and a very brain damaged ex-diver was sufficiently lacking in insight to front the national television audience. The arguments that had been placed by both Dr Geoff Bayliss in 1966, and me in 1967, were there for all to witness.

A tragic case, but one which was exploited shamelessly by yours truly, attempting to have hyperventilation blackballed in Australia, and gradually weaned out of the various spearfishing club techniques.

Salt water aspiration syndrome

In 1965 salt water aspiration syndrome just did not exist. The divers inhaled salt water because of the various provocative techniques (such as buddy breathing with an increasing number of divers, until one finally "breaks the circle" and tears off to the surface). Because the regulators were not terribly efficient (those used on compressors with a low-pressure air supply produced a fine sea water mist with each inspiration) and they produced a great deal of resistance. The practice of buddy breathing and towed searches, resulted in a great number of divers who presented some hours after the dive, with apparent

evidence of respiratory tract infections and fever. This was especially noted in the winter months. It was not until a group of stalwarts from the SUM decided to “doctor” the regulators in such a way as to guarantee aspiration, that the entity became well documented.

These cases were produced by having a diver immerse his head in a bucket of sea water, trying to breath from a regulator that had holes punctured in the diaphragm, against a progressively diminished air pressure. They demonstrated their discomfort by showing a drop in the arterial oxygen level on the ear oximeter. Only then was the soggy but stalwart diver allowed to lift his head out of the bucket, in order to perform repeated lung function tests that were needed to completely describe the disorder.

Until that time it was assumed that the post-dive illness was somehow precipitated by infections sustained during the dive, although it was hard to envisage how this could develop within a couple of hours of the dive. Nevertheless, there were many names given to the disorder, inferring a very rapid and significant infection and in North America it was often referred to as the “Key West Scuba Diver’s Disease”.

The excellent treatment (breathing 100% O₂) was discovered purely by accident, when the human “volunteers” were given this in order to more clearly elucidate the respiratory pathology, to differentiate diffusion from perfusion anomalies. Who said that we did not have the interests of the diver at heart. No reference need be made to the 10% oxygen inhalation.¹⁰

Marine animal injuries

It may come as a surprise to realise that the simple and common treatments of fish stings, in 1965, was the application of cold water or ice. Those who are now proposing this treatment for jellyfish stings, probably have no idea that it was used widely, 30 years ago, with as inadequate results as it has nowadays.

In the late 60s, the RAN dispatched me to do a survey of the current treatments of marine animal injuries through the various occupational fishing groups of Australia, with a tape recorder in one hand and a bottle of whisky in the other. I was amazed at how hospitable these pirates were. It resulted in the first really valuable clinical text¹¹ on treatment of these injuries. It sold well and is now printed in the USA.

The concept of hot water for fish stings evolved amongst the vulnerable prawners of Tea Gardens. It was described in the medical literature by the local general medical practitioner, Dr Hans Pacey.¹² They told me that when they got their cat fish stings they would use their remedy first, prior to his (local anaesthetic injection). Both

treatments worked fairly well. Hot water is the most effective, rapid and ubiquitous treatment that can be applied. Into the book it went.

In those days the jellyfish stings were treated with alcohol (methylated spirits externally, and a variety of others internally). Cleland and Southcott¹³ and Barnes¹⁴ were brilliant in their initial compilations of the clinical features of jelly fish stings, and they were followed by the very worthy work from Queensland. This included the observations of Hartwick,¹⁵ Williamson,¹⁶ and Fenner.¹⁷ They have certainly expanded our knowledge on the jellyfish stings and the treatment of the box jellyfish injuries with vinegar. Acott described many vertebrate envenomations.

Frankly, we are still not well equipped to treat jellyfish stings, but at least the box jellyfish antivenom is of value, and over the last 30 years this has been added to the stonefish and sea snake antivenoms, produced by Wiener¹⁸ and Sutherland¹⁹ at the CSL.

In fact, Australia has every reason to be proud of all our marine envenomation pioneers, but none deserves recognition as much as Straun Sutherland. In the last 30 years he has been a venomous treasure for Australia. The enthusiastic wielding of a Bowie knife, to tear the flesh below the ligature around the wounded limb, has now been appropriately supplanted by the much more civilised pressure bandage and immobilisation techniques for first aid treatment of blue ringed octopus, cone shell and sea snake bites.¹⁹ We have every reason to be thankful to Straun Sutherland for these innovations. Into the book it goes!

Research

In 1965 there was some valuable work performed at the RAN by Dr Geoff Bayliss, in consultation with Dr John Miller (the latter now runs a prestigious hyperbaric facility in Mobile, Alabama). Geoff had already commenced documenting diving deaths, observations on middle ear barotrauma and had planned animal experiments on air emboli.

Geoff’s original work on documentation of diving deaths in 1966 was resurrected by Douglas Walker in 1970. He expanded it to the most valuable and detailed compilations of this field, under the eponym of “Project Stickybeak”. Without Douglas working on this subject, now for some decades, the experts in this field would be nowhere near so well equipped with meticulous data.

The work on otology was well advanced by a group of us (naval and civilian) and led to the first ever text book on diving otology²⁰ (Otological Aspects of Diving, 1973). In that book the first major classification of hearing loss

and vertigo in diving was presented. Before that there was only two diving causes known for vertigo and one for hearing loss. In one fell swoop, Australia lead the diving world into otology, and it remained in the lead for many years.

Geoff's animal experimentation into air emboli went into limbo, but was brilliantly exhumed by Dr Des Gorman, who is now the leader in research activities in the Australasian region. With his meticulous approach, administrative skills and entrepreneurial personality, Des has erupted onto the international diving medicine forum. Look out world! I would consider that Des is the best thing to have happened in my years of diving medicine (not that I would ever admit this to his face, and even now proclaim it as a typographical error).

Thus Geoff has a lot to be proud of. His projects bore more fruit than he could ever have imagined.

Australia has always had the clinical material necessary for applied research. This is because of the large numbers of divers and the extensive diving that is performed all along our coastline. We have always had a health system which, although it might not have been of the Medicare type format, has required that all patients be adequately treated, irrespective of their means. This was how the RAN and RAAF came to treat so many civilians, simply because civilian facilities were not available at the time.

We needed the enthusiasm and support of the hierarchy. Initially, back in 1965, this was the RAN, its Medical Director-General, and the SUM. Now it involves a whole range of academic and hospital departments, led by the Royal Adelaide Hospital and aptly directed by Dr John Williamson, but chaperoned by Dr Des Gorman. The involvement of the National Safety Council was redeemed by the development of the Diver Emergency Service (DES) and now there is an Australian DAN, part of the international Divers Alert Network, working with DES.

Diving physicians (and diving medicine)

TRAINING

In 1965 there was one diving doctor in Australia. He was the guy who ran the SUM. He also dealt with: all diving accident treatments in and around Australia; all hyperbaric medicine treatments in Australia; most research and development; the acquisition and dissemination of all current knowledge on this subject (plus submarines).

All this was achieved by virtue of a posting order from the RAN. The officer also had to be reasonably competent at general medicine, resuscitation, treating venereal disease and as a back up clearance diver. All this without holidays.

By 1967 there were a few others, but these were essentially specialists and mainly Navy personnel. By 1970 the South Pacific Underwater Medicine Society (SPUMS) had formed, mainly as a vehicle for allowing the Navy diving physicians (Bob Thomas and me) a tax-free holiday in a prestigious tropical diving setting. It rapidly spread, as is the want of bureaucracy, to include many other groups that jumped on the bandwagon, but with a good result.

In 1971 I despatched the first Diving Medicine Newsletter to members of SPUMS, and this gradually flowered into the SPUMS Newsletter and, later, the SPUMS Journal, with full acknowledgment to Douglas Walker for most of its formative years and more recently to Dr John Knight.

The Navy then combined with SPUMS to produce the Diploma in Hyperbaric Medicine, strongly against my advice (proving yet again, that I am fallible). That was in 1974.

The overall skill of physicians advising on diving fitness and treating diving accidents, before 1965, was less than adequate. This has changed, initially at the instigation of Dr Rex Gray and with the development of the RAN SUM diving medicine courses in 1966, then the Diving Medical Centre (mainly Dr Bob Thomas) and other SPUMS approved courses. These now reach all parts of Australia, resulting in very highly qualified designated diving medical examiners. We have now have diving medical consultants, diving medical physicians, hyperbaric physicians, and diving medical examiners.

LITERATURE

Knowledge and training is always dependent on a good library. In 1965 there was only one clinical text on diving medicine.²¹ That was written by Sir Stanley Miles. It was a great little book, but with a mistake on every page. Nevertheless, without it we would have been lost. It contained valuable observations of a very good clinician.

On marine animal injuries there was a very small text by Bruce Halstead,²² and a very large three volume work by the same author,²³ both focusing heavily on identification and taxonomy, but scrimping considerably on treatment, with good reason.

A high powered text on compressed air diving and caisson work, by Bennett and Elliott, was first published in 1969.²⁴ It was a compilation of research papers of little value to the clinician, but fascinating to researchers

Australia has changed all that. We now have the best and most popular diving medical texts in the world.^{11,25-27} Most achieved international fame, and they have spawned a large number of clones (we do not refer to this as plagiarism, but as "flattering imitation") and

promoted the dispersal of knowledge. Some of these have been mentioned elsewhere in this article, but in the 1965-75 decade they included:-

1 **Dangerous Marine Animal Injuries of the Indo-Pacific** (A RAN publication). This later evolved into **Marine Animal Injuries to Man**, and now into **Dangerous Marine Creatures** (independently published in Australia and the USA). Although I was the scribe, the contributors were legion.

2 **Otological Aspects of Diving** (A combined Naval/Civilian publication).

3 **Diving and Subaquatic Medicine**. By far the most successful of the texts with which I have been associated. It was written by: An anaesthetist diver, Chris Lowry; A Naval scientist, John Pennefather; and me. It has been by far the most popular diving medical textbook, both in Australia and Internationally, since 1976. It has now gone into 3 editions and has, horrifyingly, emerged recently as a paperback.

Over the next two decades there was an avalanche of Australian diving medical texts. They include:

1 **The Divers Medical Companion**, a best selling (over 40,000 copies) simplified text for divers, written in 1978 by Dr Bob Thomas and Dr Bart McKenzie.

2 **Diving Medicine for Scuba Divers**, the text now most commonly used by recreational divers, for diagnosis and treatment of their ailments, written in 1992 by Dr Bob Thomas, Dr Bart McKenzie and myself. This has superseded their very successful "Divers Medical Companion" as the divers medical bible.

3 **The Sports Diving Medical**. A superb recent publication, used for the medical examination of recreational divers, written by Dr John Parker. This text has taken over the original "Sports Diving Medical", a landmark USA publication by the late Dr Jeff Davis.

4 **Australian Animal Toxins**, by Dr Straun Sutherland, 1983. A masterpiece.

5 **Oxygen First-aid for Divers**, by John Lippmann.

6 **Scuba Safety in Australia**, by Jeff Wilks, Dr John Knight and John Lippmann.

7 **The Divers Emergency Handbook**, by John Lippmann, now available internationally as the **DAN Emergency Handbook**.

8 Other books of a technical/medical nature with excellent physiological inputs, such as **Deeper into Diving**, and **The Essentials of Diving**, both by John Lippmann.

With this degree of educational material pouring out from Australia, there is no wonder that we have been accepted as leaders in the clinical diving medicine scene. We can not compete with the expensive, sophisticated technology of North America. We can and do compete successfully when it comes to assessing clinical cases and the treatment of patients.

FACILITIES.

The hyperbaric treatment chambers available in Australia have also expanded from one in 1967 to two in 1970, to about a dozen in 1995. And some of them are very good with enthusiastic clinicians, paramedics and technicians, with very sophisticated technology. The hyperbaric chambers now encircle Australia and are used frequently and judiciously. In each state there is a sophisticated and well-manned recompression facility that humbles our 6 man (sitting room only) chamber at HMAS RUSHCUTTER, circa 1965.

Finale

No, that was not all that happened in 30 years. There were many other experiments, a lot more teaching, many treatments, a few other publications and the occasional trip away diving. And there is a lot more to do. Over to you.

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NOVICE RECREATIONAL SCUBA DIVERS AND ASTHMA : TWO SMALL SURVEYS REPORTED

Rhys Cullen

Abstract

In two separate pilot studies, consecutive candidate open water divers were surveyed to estimate the incidence of asthma.

In the first of these, the diving medicals of 32 novices were examined. All had been passed as fit to dive. Two had current asthma, while two more had a history of asthma.

In the second survey, which was supported by a different Auckland dive club, fifty-two open water trainees completed a short questionnaire. Six of them answered yes to a question which asked if they had ever had, or now had, asthma or wheezing, or to use a puffer or inhaler. Eight were current smokers. One was both a smoker and asthmatic. All were medically certified as fit to dive.

The consistent finding of these surveys is that 12% of Auckland open water candidates have asthma or a history of asthma that they are willing to declare.

Two conclusions can be drawn from these results. Asthmatics are sufficiently common to make possible a prospective controlled cohort study of their outcomes as recreational divers, compared to both "normals" and smokers. Such a study is now underway in Auckland. Second, some scepticism needs to be attached to claims that asthma is an absolute contraindication to recreational diving, or that asthmatics are over-represented in diver deaths. The data just are not there to support definitive statements.

Introduction

There is, internationally, no consensus of medical opinion as to what criteria determine respiratory fitness for recreational diving.

The British Sub-Aqua Club recommends that asthmatics should not dive within 48 hours of wheezing. This is supported by a BMJ article¹ which attracted some contrary correspondence.^{2,3} The article is of limited merit. Its methodology consisted of collating completed questionnaires received from 104 divers with asthma. The questionnaire was included in the magazine *Diver*. This highly selected group of asthmatic divers provides anecdotal evidence that some divers who report themselves as having asthma also report a large number of trouble free dives. To conclude from this study, as the

authors do, that the British Sub-Aqua Club's recommendation is safe may only be as valid as concluding from a sample of living Russian roulette players that that activity is without risk.

A review article in the New England Journal of Medicine⁴ states "In principle, diving is absolutely contraindicated in persons subject to spontaneous pneumothorax, as well as in those with air-trapping pulmonary lesions or bronchial asthma". This view was immediately challenged in correspondence^{5, 6} on the (good) grounds that it was not supported by clinical data.

The recommendations in Australasia are conservative compared to those in the UK and USA. A discussion document of the Thoracic Society of Australia and New Zealand recommends that diving candidates with a history of asthma should be advised not to dive.⁷ Edmonds, Lowry and Pennefather in their book⁸ disqualify any candidate with a history of asthma or bronchodilator use in the previous five years. They support this on theoretical grounds with accompanying clinical anecdotes.

The attitude of Gorman et al in the course notes,⁹ used at the Royal Adelaide Hospital and the Royal New Zealand Navy Hospital, to teach diving and hyperbaric medicine to medical officers and diver medical technicians, is that fitness for recreational diving is a matter of risk assessment, and the role of the medical examiner is to know these risks and ensure the candidate diver fully understands them.

The theoretical risk posed to asthmatics is unquestioned by all these authors.

Asthma is an air trapping disease triggered by a number of factors that are part of the diving environment such as salt water, exercise, and cold or dry air. Air that cannot escape from a part of the lung is subject to Boyle's law on ascent, and that part of the lung expands to four times its initial volume in coming from 30 msw depth to the surface, and doubles its volume in the journey from 10 msw depth to the surface. The theoretical risk is that the trapped air may burst a piece of lung with consequent arterial gas embolus, pneumothorax or mediastinal emphysema.

A useful contribution to the debate would be a prospective, controlled, cohort study of asthmatic divers. However, before undertaking such a study it is necessary to demonstrate that asthmatic divers are sufficiently common to make the assembly of a cohort practical. This paper purports to be such a demonstration.

Methods

Over the winter of 1993, an Auckland dive school

obtained consent from 32 consecutive open water trainees, from five classes, for copies of their diving medicals to be provided to the researcher. These medicals are in two parts. In the medical history section divers tick if they have a history of various conditions. The examining doctor also records comments on his or her examination.

Over the winter of 1994, a different Auckland dive school had fifty two consecutive open water trainees complete a short questionnaire. It asked two questions:

- A Have you ever had or do you now have any of the following ? :
 - 1 asthma or wheezing
 - 2 use a puffer or any form of inhaler
- B Do you smoke cigarettes ? If yes, how many per day ? for how many years ?

The questions were designed in consultation with a chest physician.

Respondents were also asked their age and sex.

Results

Four of the thirty two trainees who provided access to their diving medicals had volunteered a history of asthma. The examining doctor had confirmed that two of them had current asthma. All four were certified as fit to dive.

Six of the fifty two trainees who completed the questionnaire answered yes to the question which asked if they had ever had, or now had, asthma or wheezing, or to use a puffer or inhaler. Eight were current smokers. One was both a smoker and asthmatic. All were medically certified as fit to dive.

Of the eighty four participants, 53 (63%) were male, and 31 were female. Ages were available for seventy-five of the respondents (Table 1).

TABLE 1

AGES OF 75 RECREATIONAL OPEN WATER SCUBA TRAINEES

Ages	Numbers
≤ 15	2
16-20	12
21-25	17
26-30	14
31-35	13
36-40	9
41-45	5
≥ 46	3

Discussion

Small surveys suffer from two weaknesses. They may not be representative of a larger population, and they estimate parameters with wider confidence intervals than larger studies.

One can have some confidence that around twelve percent of present Auckland open water trainees are asthmatic or have a history of asthma. The same figure has been obtained by two dissimilar methodologies. In the first, the information provided to, and by, a medical practitioner who in most cases presumably knows the candidate was relied on. In the other, information volunteered by the trainee was collected.

The aim of this study was to determine whether there are enough asthmatic open water trainees to make the gathering of a cohort for prospective study a feasible proposition. For this purpose a sample of eighty four is not small. It is, however, difficult to ascribe a rigorous confidence interval to the estimate as the "consecutive sampling" methodology is quite distinct from the simple random sample, and other standard techniques for which theory on the distribution of sample variance is established.

The results have been submitted for publication because they provide denominator information which has been missing from the debate about asthmatics and fitness for scuba diving. They may also encourage other researchers to seek out and study asthmatics who dive. These small surveys provide no information on the diving behaviour of asthmatics who complete open water training.

An immediate consequence of any future study confirming that around twelve percent of novice recreational divers have asthma or a history of asthma, while about half that proportion have current asthma, would be that asthma is not a contraindication to diving. There may be an increased relative risk (and there may not be) but in absolute terms the risk is small. It is easy to speculate that in a diving population of 150,000, if even one third of these are active, and 5% of those have asthma, there may be 10,000 to 50,000 dives a year made in New Zealand by asthmatics.

Finally, if 6% of divers are current asthmatics and if their diving behaviour can not be distinguished from non-asthmatic divers, then asthmatics are not over-represented in diving fatalities. The ANZ series of 100 dead divers¹⁰ identified nine as having pre-existing asthma. Treating this as a series of Bernoulli trials with the probability of success at any one trial being 0.06, there is a probability of about 15% of nine or more successes, i.e. $p=0.15$, which is not significant. A Bernoulli trial in this instance is exactly analogous to tossing a coin with the probability of a "head" (being asthmatic) equal to 0.06. The experiment consists

of 100 such tosses, where each toss corresponds to a diver death. Asthmatics are over represented in diver deaths if the probability of the observed number of asthmatics in a series of diver deaths is less than 0.05, given that asthmatics form 6% of the live diver population. The observed number was nine and the conclusion is that asthmatics are not over represented in the ANZ series if the proportion of asthmatics in the live diver population is 6%

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THE REGULATION OF RECREATIONAL SCUBA DIVING IN QUEENSLAND

Rob Davis

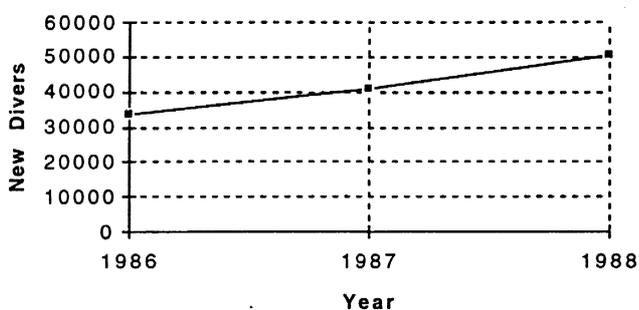
Introduction

Few activities can match scuba as an "out of this world" experience, and few countries can match Australia

for prime diving attractions. As a result, scuba has become a popular recreational pastime for thousands of Australians and a major tourist attraction for both local and international holiday-makers. Between 1986 and 1988 Australian scuba training agencies issued diver certification to 124,840 entry level divers.¹ During that period the growth of new diver certification averaged over 26% per annum from a 1986 baseline of 33,550 certifications. This growth is demonstrated graphically in Figure 1. These statistics understate the number of divers that ventured below Australian waters during that period as they do not include foreign certified tourists undertaking recreational dives, or already certified local divers. There is evidence that the annual number of overseas divers is high. For example, the 1991 International Visitors Survey confirmed that scuba diving was one of the most popular activities enjoyed by international visitors to Australia that year.² It has been conservatively estimated that in 1991 alone, there were 677,767 scuba dives conducted in Queensland waters.³ Other sources claim that in the year ended June 1990 as many as 884,000 recreational scuba dives were conducted in Queensland.⁴

FIG 1

**GROWTH IN NEW DIVER CERTIFICATION
BETWEEN 1986 AND 1988**



But the popularity of scuba diving belies the fact that it is a dangerous activity for inexperienced and unfit divers. Every year thousands of newly certified divers are let loose into Australian waters. Some of these progress to become experienced recreational or professional divers. But many, following an initial burst of enthusiasm for their new sport, become infrequent holiday divers with half-forgotten skills, poorly maintained equipment and declining physical fitness. Diver certification is no guarantee of diver safety or ongoing diver competency. Each year hundreds of divers are injured, and occasionally some are killed, by avoidable accidents. Many of these accidents are attributable to diver error resulting from lack of proper training, inexperience, and improper supervision.

The value of the sport as a source of tourist income is partially dependant on these dangers being adequately managed. Media reports of diving related injury and death

tarnish the image of the sport and effect the scuba diving industry economically. But these economic benefits are not the only justification for regulating diver safety. Clearly, scuba accidents impose a high social, emotional and financial burden to the injured, their families and the taxpayer. While these factors are strong arguments for greater regulation, there is concern in some sectors that over-zealous or inappropriate management of the sport may also reduce its value as a recreational pursuit while not significantly increasing its safety. The object of this paper is to examine the efficacy and extent of safety regulation of the Queensland scuba diving industry and the means by which this regulation operates.

Scuba safety record

In the period between 1955-89 there were 164 scuba related deaths in Australia.⁵ Between 1985-89, forty deaths were recorded in Australian waters from scuba incidents.⁵ Unfortunately, (and notwithstanding the efforts of data collecting projects such as DAN, DES, and Project Stickybeak and the Queensland Division of Workplace Health & Safety), there are large gaps in the available mortality/morbidity data on recreational diving. In consequence, the reported incidents of death and injury might significantly understate the actual level of injury that is sustained in this activity. Fortunately, the level of mortality has not increased proportionately to the phenomenal growth in the sport over the last three decades.⁵ This relative decrease in mortality is largely due to the increased emphasis placed on diver training during that period. But, as stated by Dr Douglas Walker, the instigator of Project Stickybeak; "...however rare a fatal diving incident may be, even a single death would be excessive if it is avoidable".⁵ As avoidable death and injury still continue to occur, continuing emphasis must be placed on improving scuba safety. What place does the regulation of scuba diving and diver training have to play in pursuing this goal?

Current Queensland regulations

When non-lawyers speak of regulation they usually use the word to mean government regulation. But government regulation, in the form of Acts of parliament and subordinate regulations are merely some of the means by which the activities of citizens are regulated. In this paper the term regulation is used in this wider sense.

The regulatory structures that govern the operation of the dive industry operate in layers. Each of these layers depend on incentives towards useful conduct for their operation. These incentives evolve from market forces, the threat of civil litigation, and criminal sanctions. Each of these types of regulation are discussed in greater detail on the following pages.

PRACTICES OF DIVER TRAINING AGENCIES.

The first layer is governed by the internal rules, policies and practices of the individual diver training agencies such as the National Association of Underwater Instructors (NAUI), the Professional Association of Diving Instructors (PADI), Scuba Schools International (SSI), and the National Association of Scuba Diving Schools (NASDS).

These associations self-regulate through prescribing the prerequisites for diver certification, training and advancement within each of the respective bodies. While these internal rules do not have the force of law within the industry, they nonetheless play a pivotal part in the safety of the industry as a whole. Further, the rules relating to safe diving practices do influence the courts in determining what a given dive instructor or dive master "knew or ought to have reasonably known" when deciding whether that person was guilty of negligence. A fuller discussion of the concept of negligence appears below.

STANDARDS ASSOCIATION OF AUSTRALIA.

The second layer consists of the "best practices" recommendations of the Standards Association of Australia, commonly known as Standards Australia. While these standards also do not have the force of law, they are given legal or quasi-legal status in one of two ways. First, they are regularly used by courts as a bench-mark when determining whether or not particular conduct amounts to negligence. Second, some statutes and regulations incorporate the recommendations of Standards Australia when specifying standards of conduct required by certain sectors of the community. For example, r259 of the *Workplace Health & Safety Regulations 1989 (Qld)* requires an employer to comply with AS 2299-*Underwater Air Breathing Operations*, and AS 2815-*Training & Certification of Occupational Divers*. In addition, r260 requires that scuba instructors conducting entry level certification ensure the student is certified fit to dive in accordance with the AS 4005.1-1992 *Training & Certification of Recreational Divers*. A failure to meet these standards can, in such cases, result in criminal sanctions or in civil action for breach of statutory duty. Further, the safety recommendations of health and safety legislation will usually be construed, in civil litigation, as imposing a minimum standard of care for the purposes of common law negligence actions.

REQUIREMENTS OF COMMON LAW

The third layer having a regulatory effect on the industry is the common law itself. Common law actions enable a person injured by another's conduct to claim damages against the wrongdoer. Usually these damages are compensatory in nature, but in rare cases the court may also impose an award for aggravated or exemplary damages that are designed more to punish the perpetrator

than compensate the victim. Irrespective of the nature of the damages awarded, these awards always serve double duty by simultaneously compensating the victim and punishing the wrongdoer. In this way, the spectre of the common law encourages useful and safe conduct within the community.

There are a number of common law theories of action that are relevant to the recreational dive industry. Perhaps the most common of these remedies are based breach of a duty of care owed in either tort or contract.

The tortious duty of care broadly extends to benefit all those who may foreseeably be injured by an individuals acts or omissions. Whilst the tortious duty extends to a wide group, the contractual duty is limited to the parties to the contract. The duties owed under both contract and tort may usually be modified by agreement between the parties, although statutory limits do exist on how far liability can be reduced in this manner.

The standard of care required in any case will vary dependant on the level of skill and experience possessed by the individual and the degree of danger inherent in the activity.

The minimum standard of care expected is to exercise the knowledge, skill and foresight of the ordinary person engaged in that occupation or role. This standard is an objective one, and it will be arrived at on the basis of industry accepted practices and standards. In many cases it can be difficult to discern just what the commonly accepted standard of practice may be. This is less of a problem in the diving industry than it is in many others as the courts will readily refer to the objective standards imposed by the internal rules and practices of the diver training organisations and the recommendations of the Australian Standards. These minimum standards of care will be increased where a party possesses special skill and knowledge over and beyond that expected of the ordinary diver. If a person possesses special skill and knowledge then they are obliged to use it. The more skill and knowledge that is possessed by an individual, the greater the level of care that will be expected from him or her.

A dive shop owner or dive charter operator will not escape liability by employing employees with inadequate skills or experience as the standard of care required also varies dependant upon the magnitude of risk inherent in the activity. Scuba diving is a dangerous activity and a high degree of care is expected by the courts. The magnitude of the risk is determined by the gravity of harm posed and the likelihood of that harm occurring. Whether or not a person has failed exercise reasonable care in a given case will often depend on the burden involved in eliminating or minimising the risk.

REQUIREMENTS OF STATUTES

The fourth layer of regulation comprises statutory based actions by victims for compensation. These are a hybrid form of action based in statute but giving rise to actions similar to those developed by the common law. There are three categories to be considered under this heading.

First, is the situation where legislation directly confers a right on an injured person to claim compensation. The federal *Trade Practices Act 1974*, the state *Fair Trading Acts* and *Sale of Goods Acts* all confer rights on individuals who are injured or otherwise suffer loss following the supply of goods and/or services. Their operation, whilst often fraught with technicality, creates a wide net of liability that catches most dive training and dive tour operations. While dive operators may minimise and even avoid liability under the *Sale of Goods Acts* through contractual exclusion clauses, they cannot escape the consumer protection provisions of the *Trade Practices Act*. This is because this Act specifically restricts the power to contract out of the liability it imposes.⁶ One consequence of this is that they cannot escape, by contractual exclusion, the obligation under s 74 of the Act that services be rendered with “due care and skill”. As this contractual warranty is contiguous with the common law duty of care, the inability to contract out of the *Trade Practices Act* also prevents any exclusion of the congruent common law duty. After all, if a person is party to the contract, the warranty to exercise due care cannot be excluded. If the person is not party to the contract, then *ipso facto*, he or she cannot be affected by any contractual exclusion contained in it.

Second, is the case where the legislation does not directly confer a right to sue but where it clearly imposes a duty of care on some persons for the benefit of others. Breach of the legislation will give rise to an action for damages for “breach of statutory duty”. There is an ongoing controversy as to the genealogy of the action for breach of “statutory duty”. Most decisions in the UK and Australia attribute its origin to a “presumed” intention on the part of the legislature to create a civil remedy for breach of a statutory provision.⁷ But in the USA it is considered to be nothing more than a court adopting the statute as setting the minimum standard of the tortious duty of care.⁸

Whatever its origin, the breach of a statutory duty of care gives rise to a right to damages at common law. Furthermore, the existence of a statutory standard elevates the liability from one of mere negligence to one approaching strict liability, or liability without fault. The logic behind this proposition is the maxim that everybody is presumed to know the law. If a person is presumed to know the law, then it can be no answer to say that the requirements of the statute were neither foreseen nor reasonably foreseeable.

One by-product of the controversy over the parentage of the statutory duty action is the question as to whether or not a person can contract out of a statutory obligation. The prevailing opinion in Australia and the UK is that a party cannot contractually exclude liability for breach of statutory duty. Although, curiously enough, liability can be reduced by contributory negligence and can be totally negated by voluntary assumption of risk. The two notions do not sit well together.

Third is where an Act confers authority to make subordinate legislation to establish codes of practice to be followed by a particular group or industry. This is a more recent approach and represents a hybrid between an action for breach of statutory duty and a statutory right of action conferred directly by the legislature.

Codes of Practice do not usually rely on in legislative sanctions for enforcement. For example, s 34(8) of the Queensland *Workplace Health & Safety Act 1989* states: “A person shall not be liable to any civil or criminal proceedings by reason only that the person has failed to observe any provision of an approved code of practice”

It follows that a breach of a provision in a Code of Practice cannot give rise to an action for breach of statutory duty. But the terms of a Code of Practice will influence common law courts when seeking to ascertain the minimum standard of care expected in a applicable industry. In this sense, Codes of Practice have regulatory effect in the same manner as do the Standards published by the Standards Australia. Of particular importance to the recreational diving industry in Queensland is the *Code of Practice for Recreational Diving* that came into effect on the 11th December 1992.⁹

REQUIREMENTS OF THE CRIMINAL LAW

The final layer comprises legislation enforceable by criminal sanctions such as imprisonment or fine. For example, Part II of the *Workplace Health & Safety Act 1989 (Qld)* imposes duties on employers at a “workplace” to ensure the health and safety of employees and others and imposes criminal sanctions for breach. The term “workplace” is defined to encompass “premises” where work is or is likely to be performed and the vicinity around the premises where plant or equipment is kept. The term “premises” is defined to include “any vehicle, vessel or aircraft”, “...any installation on land, on the bed of any waters or floating on any water”, and “...any structure or area, enclosed or otherwise, ...wherein or whereon any plant is, or is erected, kept, used, worked or in operation.” The term “plant” in turn is defined widely so that it would clearly cover any equipment supplied by a scuba operator to instructors, dive masters or customers at a workplace. (See section 6 of the *Workplace Health & Safety Act 1989*). A breach of the Act may simultaneously impose criminal liability, confer a right to sue for damages for breach of

statutory duty, or be relied on by common law courts as evidencing a breach of a tortious or contractual duty of care.

Section 9 of the act provides that an employer who fails to "... ensure the health and safety at work of all of his employees, ... commits an offence". Section 10 imposes duties on employers to ensure that "... persons not in his employment and members of the public" are "... not exposed to risks arising from the conduct of his undertaking". Section 11 requires persons who have control over premises or plant to ensure that the "... premises and means of access thereto or egress therefrom" are "safe and without risks".

Whilst the provisions of the Queensland *Code of Practice for Recreational Diving* cannot of themselves create civil or criminal liability, they can be applied parasitically to make a defendant criminally liable unless he or she satisfies the court that the Act had in fact been complied with. This in turn will give rise to an action for damages for breach of statutory duty as the provisions of s 34(8) referred to above will not apply in such a case. This is because it could not be said that liability was claimed "only" on grounds that a person had "failed to observe" a provision of the "Code".

Gaps In The Regulatory Cover.

While the existing levels of regulation may appear daunting, they do have deficiencies that make them less effective than first appears. Some of these problems are set out below.

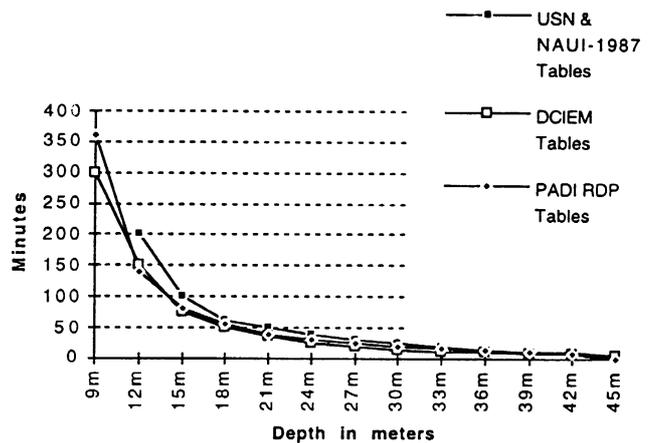
PROBLEMS WITH THE SELF-REGULATORY MODEL

The politics of self-interest is a major problem as each of the diver training organisations is a business enterprise that compete against the others for clientele. Then there is the competition between dive shops, often belonging to the same organisation, in an area. As a result, open co-operation in order to improve diver safety by adopting common "best practices" is limited to those instances where these agencies do not have a major clash of interest or philosophy. One example of this is found in the failure of the various dive organisations to agree on and endorse a common set of conservative no-decompression tables.

For example, until 1990 NAUI manufactured and marketed to its members dive tables utilising the US Navy Tables.¹⁰ Since 1990 NAUI has employed a modified version of the US Navy Tables. PADI recommends and markets tables developed by the Diving Science and Technology Corporation (DSAT), a PADI affiliated company. Each of NAUI, PADI and most other dive training agencies profit from the sale of their own tables to their divers. Naturally, they are reluctant to forego this

income in order to adopt a different set of dive tables. This is notwithstanding the availability, since 1983, of more conservative tables produced by the Canadian Defence and Civil Institute for Environmental Medicine (DCIEM).¹¹ Figure 2 is a comparison of these tables.

**FIG 2
DIVE TABLE COMPARISON**



Surprisingly, little litigation has resulted so far over the differing levels of safety represented by these various types of tables. One exception was *Andrewartha -v- Coolangatta Dive & Rawlins* that came before the Queensland District Court at Southport in 1994. In that case, in which I appeared as counsel for the plaintiff, a diver got bent on a dive planned and supervised under the NAUI 1990 tables. The diver claimed damages for negligence on the basis that the dive should have been planned and conducted in accordance with the more conservative DCIEM tables. The action against the dive master settled for \$80,000 plus costs and the claim against the dive charter company resulted in a no-contest verdict of approximately \$300,000 plus costs. Since the *Andrewartha Case*, which involved injury sustained in 1990, the federal *Trade Practices Act 1974* has been amended to impose on manufacturers and suppliers strict liability for dangerous and defective goods, (see Part VA). Merchandise such as dive tables and dive computers are clearly goods under the Act. In consequence, divers who suffer the bends through relying on less conservative tables will, in future, have a better target when seeking to recover compensation for their injury.

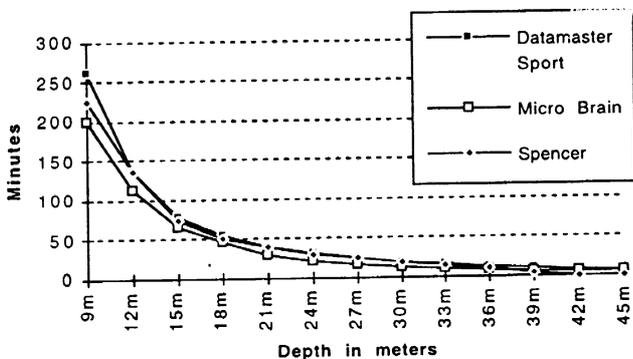
The inability of the diver training organisations to co-operate is reflected in all regulations that the interested organisations have had a part in formulating. For example, Australian Standards are formulated by a committee composed by representatives of the various state and federal regulatory bodies and the various industry bodies. As a result of the differences between the states and between the industry bodies, neither Standards Australian

nor the Queensland legislature endorse any particular set of dive tables as a minimum safety standard.

For example, Clause 3. 9 and Appendix B1 of AS2299-1990 require that occupational diving be conducted in accordance with decompression tables “approved by the relevant authorities”. The Standard then goes on to specify that the US Navy tables, the RN and the RAN tables, and the DCIEM tables are examples of tables that have such approval. Some of these tables, such as the US Navy tables, are less safe than others, such as the DCIEM tables. And there is also a great deal of variation in the safety of different dive computers (see Figure 3).

FIG 3

VARIATION IN DIVE COMPUTERS



This absence of a uniform standard for decompression tables is carried through to the Queensland *Workplace Health & Safety Regulations 1989*. These regulations incorporate AS 2299 and require divers to adopt a set of dive tables that is approved by the Australian Standard. Similarly, the *Workplace Health & Safety (Recreational Diving) Code of Practice 1992* also fails to establish a minimum safety standard for dive tables. The Code merely provides that recreational dives be “... planned consistently and conservatively” according to a set of “recognised” tables. But the Code then prescribes that the “... tables approved by a scuba training organisation” and any “... dive computer used in accordance with manufacturers instructions”, are recognised for the purposes of the Code, (see clause 2. 2(m) of the Code). But what is conservative under one set of tables may be less than conservative under another. But diver training organisations should draw little comfort from this legislative dithering. The level of care required by Standards and Codes of Practice are merely floors, not ceilings. An individual can still incur legal liability even if they have complied with the minimum standards required by legislation.

Those working within the industry are aware of and express concern over the lack of cooperation between the diver training agencies, industry representatives, and government agencies.¹² But the lack of cooperation is an

intractable problem that will not be solved merely by awareness. In the writer’s view, this is an area where self regulation and consultation has failed. The only suitable response to this failure is direct legislative intervention.

THE COMMON LAW

For defendants, the common law is not as scary as it seems. The common law is uniform and flexible, but it is also slow, expensive and unwieldy in action. It is not unusual for an injured party, depending on the court jurisdiction involved, to wait between 3 and 5 years for a trial. In the meantime, the victims of the accident are left injured, often unable to work, and at the mercy of a legal system that cannot properly satisfy their needs.^{13,14}

The injured plaintiff must sue if he or she wishes to be compensated for the injury. But when they resort to the legal system for assistance they encounter a number of barriers. Most injured plaintiffs are either out of work because of their injury, or were not in a good financial position to begin with. First they must find a lawyer willing to accept their case. This is difficult unless they have an excellent case and the lawyer is willing to spec his or her fees on the outcome. But even then, few lawyers will gladly fund expenses. Second is the threat posed by the English Cost Rule. That rule provides that the loser in court will have to pay the major part of the winner’s costs. These costs could amount to many thousands of dollars on top of the expenses they must pay out to prosecute their case. This rule is a daunting threat as a middle class plaintiff risks losing everything if the case is lost.

The result is that many plaintiffs with legitimate claims do not sue. And most of those with excellent cases settle out of court for a less compensation that they really deserve.¹⁴ These facts, and the ready availability of insurance, all operate to eliminate much of the incentive to improve safety within the diving industry. Nonetheless, some cases are brought and there is no doubt that they have an beneficial impact on the behaviour of the industry as a whole.

THE HUMAN FACTOR IN DIVER REGULATION.

The Queensland Workplace Health and Safety Legislation has received considerable criticism from many in the recreational diving industry. A recent survey of Queensland dive operators and dive instructors has gauged the extent of this concern.¹⁵ Of the respondents surveyed, 48% considered the legislation to be unnecessary and unrealistic; 19% considered it to be complex and bureaucratic; 24% reported encountering difficulties in dealing with diving inspectors; and 27% had experienced difficulty in implementing the requirements of the legislation.¹⁵ Indeed, the majority of the responses to the legislation were negative.

While the survey indicates great dissatisfaction with the legislation, this does not mean that the criticisms identified in the survey are all justified. There may be ulterior motives behind why many in the dive industry oppose greater regulation. Work within the diving industry does not pay well. But for the positive lifestyle factors associated with diving work, few would continue working for the money per se. Any regulation that impacts negatively on these lifestyle factors will make work in the diving industry less attractive. It is therefore to be expected that new legislation like, the *Workplace Health and Safety Act 1989* and the *Workplace Health and Safety Regulations 1989*, will receive a poor reception.

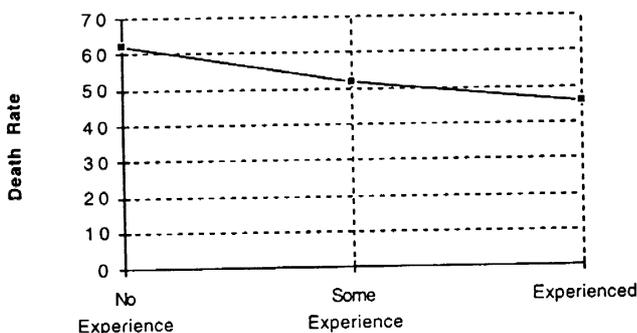
To what extent ought regulatory authorities take dive worker job satisfaction into account when designing regulations. On one view, the maintenance of the lifestyle rewards should not have priority over the safety of the diving public. But on another level, how great is regulatory compliance likely to be if those within the industry resent and oppose the very legislation they are required to implement? In all regulation, the weak point is always the human factor. At the end of the day it is people, and not legislation, that prevent accidents. Legislation merely provides another incentive for people to adopt safer practices. Only time will tell how effective the Queensland Workplace Health and Safety legislation is likely to be in achieving this goal.

LACK OF SKILL AND FITNESS REGULATION.

There is little doubt that most diving incidents are avoidable with greater skills and training. Figure 4, which is based on information from Project Stickybeak reported in *Scuba Safety in Australia*,¹ demonstrates a clear correlation between the level of diver experience and the rate of diver fatalities.

FIG 4

RELATIONSHIP BETWEEN DIVER EXPERIENCE AND DIVER DEATH RATES



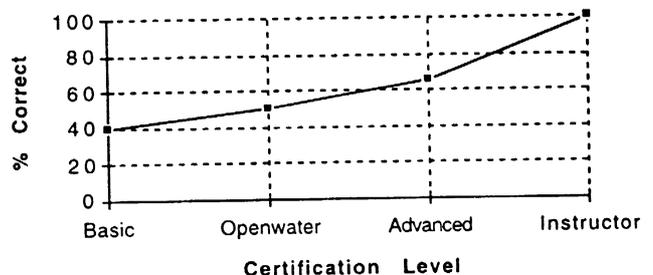
One cause of scuba injury and death is decompression sickness. Figure 5 identifies the main factors contributing to the incidence of this condition.¹⁶ Virtually all of these factors may be reduced by ensuring that minimum diving skills remain current.

This highlights the main weakness in the current regulatory regime. There is no legal requirement that a diver maintain a base level of diving skill by conducting a minimum number of dives per year. Clearly, divers do dive when their base skills are rusty. For example, one 1992 study found that 15% of divers diving from one dive charter boat had not dived at all in the preceding 12 months.¹⁷

Once a diver is certified he or she is entitled to dive. Few dive operators insist that dive clients produce log books to demonstrate the proficiency and currency of the client diver's skills. But there is little doubt that divers' skills do deteriorate over time. A survey of SPUMS members conducted in 1988 revealed an abysmal lack of knowledge in the use of decompression tables.¹⁸ This survey revealed a direct correlation between proficiency in table use and diving experience. The results of this survey are set out in Figure 6.

FIG 6

DIVER EXPERIENCE AND DIVE TABLE PROFICIENCY

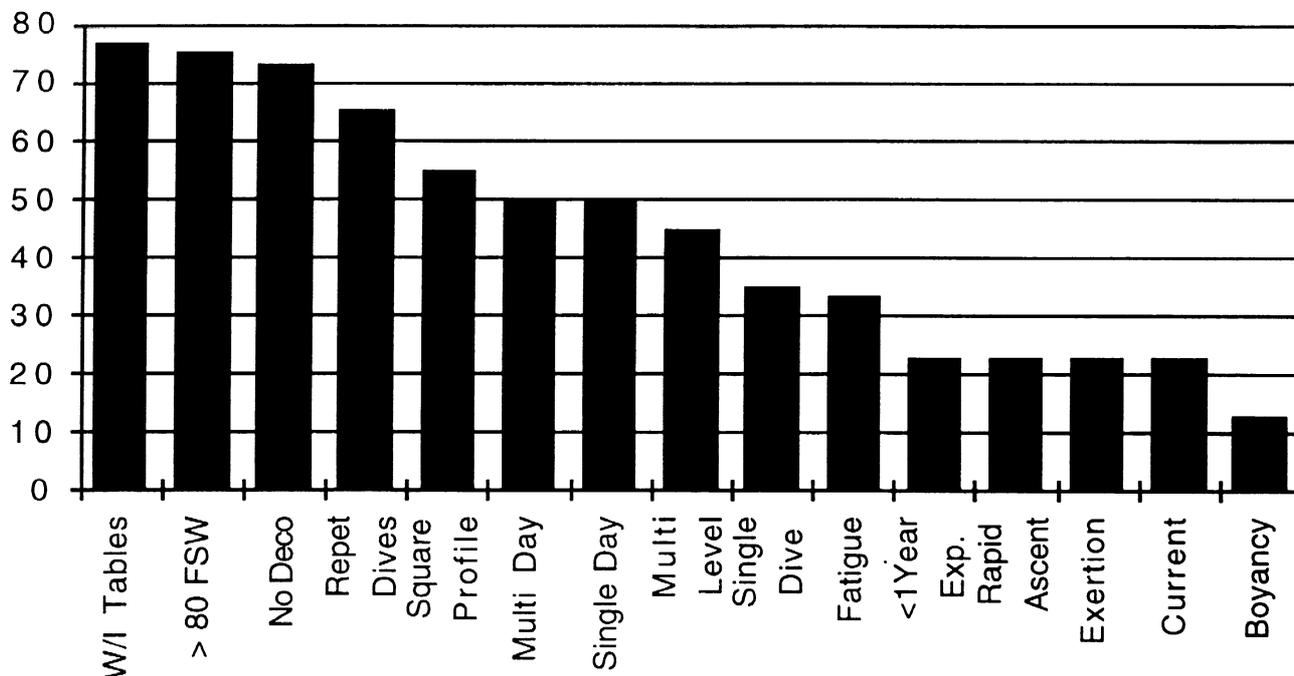


A further problem is the absence of any requirement that divers undergo regular diving medical assessments. While a diving medical is compulsory for initial certification, once divers are certified they need not again to demonstrate he or she remains medically fit for diving. Clearly, an individual's fitness to dive is not a constant. It changes with age, intervening injury, illness and the nature of the diving activities being undertaken.

Conclusion

There is no doubt that scuba diving has become safer over the last three decades. While reliable statistics do not exist, some studies have demonstrated that scuba diving is presently safer than many other sports.¹⁹ While these facts are cause for celebration they are not cause for

FIGURE 5
DECOMPRESSION SICKNESS PROFILE



complacency. Avoidable scuba accidents do continue to occur, and when they do occur, they result in an unacceptably high cost to life and health.

Most of the past improvements in scuba safety have resulted from better training and fitness on the part of those involved in the sport. But the impressive gains of the past are unlikely to be repeated in the future without greater co-operation between the diver training agencies and greater ongoing supervision over the currency of diver fitness and skills. These two factors are, in the writers opinion, the areas that show the most promise for further gains in dive safety.

It is essential that diver certification and medical fitness be subject to regular review. This may be achieved without direct legislative intervention only if all diver training agencies were to adopt minimum and uniform standards to regulate certification currency. In the writers view, it is also a priority that diver training agencies achieve similar uniformity on other currently non-uniform practices, such as decompression table use and dive computer use. The foregoing need not impose unnecessary red tape or financial burden. The requirement for ongoing certification review would likely increase the level of work available for the Queensland dive industry and this ought to cover the cost of implementing new rules.

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LEGAL RELEASES IN RECREATIONAL SCUBA DIVING

Bill Turbeville

Introduction

There are two opposing views of legal releases in scuba diving. They can be considered as a necessary shifting of risk or unconscionable shafting of the diving public. Those that require the diver to sign away all rights arising from the dive instructor's or operator's negligence produce the most emotion.

The Madison Decision

On July 29, 1986, Ken Sulejmanagic signed up for a scuba diving course at his local YMCA in Southern

California. During the initial enrolment procedure, Ken, who was nineteen years old at the time, was asked to sign a document entitled "NAUI Waiver, Release And Indemnity Agreement". The document Ken signed provided in relevant part as follows:

For and in consideration of permitting (1).....to enrol in and participate in diving activities and class instruction of skin and/or scuba diving given by (2).....the Undersigned waives and relinquishes any and all actions or causes of action for personal injury, property damage or wrongful death occurring to him/herself arising as a result of engaging or receiving instructions in said activity or any activities incidental thereto wherever or however the same may occur and for whatever periods that activities or instructions may continue, and the Undersigned does for him/herself, his/her heirs, executors, administrators and assigns hereby release, waive, discharge and relinquish any action or causes of action, aforesaid, which may hereafter arise for him/herself and for his/her estate and agrees that under no circumstances will he/she or his/her heirs, executors, administrators and assigns prosecute, present any claim for personal injury, property damage or wrongful death against.....or any of its officers, agents, servants or employees for any of said causes of action, whether the same shall arise by the negligence of any of said persons, or otherwise. IT IS THE INTENTION OF (1).....BY THIS INSTRUMENT, TO EXEMPT AND RELEASE (2).....FROM LIABILITY FOR PERSONAL INJURY, PROPERTY DAMAGE OR WRONGFUL DEATH CAUSED BY NEGLIGENCE.

Ken proceeded through his scuba diving course, apparently without mishap, and completed all requirements except for one open water dive which he had missed. On November 15, 1986, Ken went on a make-up dive with his instructor and a recently certified diver in the ocean off southern California. During the course of the dive, Ken ran low on air. Rather than terminating the dive at that point, Ken's instructor elected to accompany him to the surface and instruct him to swim to the dive buoy that had been anchored at the site prior to the commencement of the dive.

The instructor then returned to the bottom to continue his dive with the other diver, which lasted about another ten minutes. When the instructor and his buddy surfaced, Ken was no where to be seen. They were approached by another diver who asked if "they had been the ones yelling for help," which immediately led the instructor to believe that he had a significant problem on his hands. A search was made and Ken's body was located on the bottom. All resuscitative efforts failed and it was determined that Ken died from asphyxiation secondary to salt water drowning. Ken's parents promptly brought suit for the wrongful death of their son against the YMCA and Ken's instructor. Both defendants filed a motion for summary judgment basically stating that whether their actions

were proper or not, they could not be legally held liable for Ken's death because of the release he had signed as a condition to his enrolment in the course. The trial court denied the motion and the defendants appealed to the intermediate California appellate court.

Due to the nature of a motion for summary judgment, which essentially requires the court to give the party not moving for summary judgment every possible benefit of the doubt, the court took it as established that Ken's instructor was negligent for failing to follow the buddy system and that this negligence directly led to Ken's death. In a decision which was soundly based upon prior precedent, but which nevertheless opened a new era for recreational diving releases in the United States, the court held that "as long as the release constitutes a clear and unequivocal waiver with specific reference to defendants' negligence, it will be sufficient." 250 Cal. Rptr. at 304. Thus a nineteen year old diver on a certification dive, whose instructor was clearly negligent, could not pursue a wrongful death law suit brought on his behalf solely because he signed a brief piece of paper as part of his enrolment package. It is the purpose of this article to briefly analyse how that happened and whether such a decision is defensible in today's day and age.

Release issues

So how could the Madison court find for the negligent defendants? How could it, in light of the clear negligence of an instructor who disobeyed the foremost rule of scuba instruction of never abandoning a student, allow that instructor to walk away scot free leaving his parents and families with their anguish and nothing more? The answer is simple: because he signed a valid, binding contract.

Lest this be too glib of an answer, it must be realised that to come to this point, one has to consider nearly nine-hundred years of Anglo-American jurisprudence. The concept of a contract as it evolved over the centuries has come to mean one fundamental thing: if persons of sound mind with roughly equivalent bargaining positions decide to agree to something which is neither illegal nor contrary to the greater public interest, courts will strive to hold each party to that contract to their side of the bargain. And while, curiously enough, England has overridden this common law principle by an act of Parliament which forbids the enforcement of recreational releases of negligence, with only few exceptions the courts of the United States will uphold an unambiguous release. Freedom to contract has always been a fundamental principle of transactional law in English speaking countries. It has long been expressed that courts are loath to interfere in private transactions not affecting the public welfare, and it is upon this simple yet fundamental principle that recreational releases operate.

Yet recreational releases do face one elemental problem: courts across the country uniformly disfavour any type of contract which agrees to limit liability for wrong doing. The sort of viscerally negative reaction that most of us have to such an agreement (hence the commonly quoted but legally incorrect statement that "you cannot sign away your rights") is expressed by the law in the strict adherence to all the legal niceties of a proper contract when a liability release is to be enforced. While courts may struggle with the concept of a liability release, the greater interest, in least in the United States, has been to allow parties to contract as they see fit. As stated by one Oregon court:

Although agreements to limit liability are not favoured, neither are they automatically void. An agreement limiting liability is governed by principles of contract law and will be enforced in the absence of some consideration of public policy derived from the nature the subject of the agreement or a determination that the contract was adhesiory.

K-Lines v Roberts Motor Co., 273 Or. 242, 248-254, 541 P.2d 1378 (1975).

Or, as an earlier court from the same state declared, "there is nothing inherently bad about a contract provision which exempts one of the parties from liability. The parties are free to contract as they please unless to permit them to do so would contravene the public interest." Irish and Swartz Stores v First National Bank, 220 Or. 362, 375, 349 P.2d 814 (1960).

So what about the "public interest" in Ken Sulejmanagic's death? Is there not a public interest in preventing dive instructors from avoiding the consequences of their own negligence? Perhaps there is. But that is not the type of public interest the courts in the United States are focusing on. Nor is it the type of interest which is sufficient to overcome what the courts perceive to be the even greater public interest in freedom of contract.

The types of "public interest" which courts view as sufficient to overcome the tenet of freedom of contract were well outlined in a 1963 opinion of the California Supreme Court.

- 1 It concerns a business of a type generally thought suitable for public regulation.
- 2 The party seeking exculpation is engaged in performing a service of great importance to the public, which is often a matter of practical necessity for some members of the public.
- 3 The party holds himself out as willing to perform his service for any member of the public who seeks it, or at least for any member coming within certain established standards.
- 4 As a result of the essential nature of the service in the economic setting of the transaction, the party seeking exculpation possesses a decisive advantage of bargaining strength against any member of the

public who seeks its services.

- 5 In exercising a superior bargaining power, the party confronts the public with a standardised adhesion contract of exculpation, and makes no provision whereby a purchaser may pay additional reasonable fees and obtain protection against negligence.

Tunkl v Regents of the University of California, 60 Cal. 2d 92, 101, 32 Cal. Rptr. 33, 383 P.2d 442 (1963).

Applying these criteria to a recreational dive operation, or for that matter, any recreational activity at all, the courts of the United States have generally found that the concept of freedom of contract overrides whatever public interest may be involved in such a contract. At least in this county, recreational scuba diving is not considered to be the type of business “generally thought suitable for public regulation.” Indeed, the Occupational Safety and Health Administration specifically exempted both scientific and recreational scuba diving from its regulatory ambit when it decided to govern the commercial diving industry back in the late 1970s. This also holds true for such recreational activities as sky diving, (Hulsey v Elsinore Parachute Center, 168 Cal. at App.3d 333, 214 Cal. Rptr. 194 (1985)), mountain climbing (Blide v Rainier Mountaineering, Inc.), 30 Wash. App. 571, 636 P.2d 492 (1982)), snow skiing (Milligan v Big Valley Corp. 754 P.2d 1063 (Wyo. 1988)), and auto racing (Theis v J & J Racing Promotions, 571 So.2d 92 (Fla. 2d DCA 1990)).

Recreational scuba diving has never been found to be “a matter of practical necessity for some members of the public”, and is thus unlike travel on common carriers such as airlines, trains, or other forms of public transport. In fact, Federal law in the United States forbids such common carriers from requiring passengers to sign an exculpatory contract for this very reason. So too for the other established criteria for an essential public interest; the recreational diving industry is simply not seen as important enough to overcome the centuries old policy of allowing adults of sound mind to agree to do essentially, or at least legally, what they will. The Madison court discussed these very criteria when analysing the claim of Ken’s parents:

Here, Ken certainly had the option of not taking the class. There is no practical necessity that he do so. In view of the dangerous nature of this particular activity defendants could reasonably require the execution of the release as a condition of enrolment. Ken entered into a private and voluntary transaction in which, in exchange for enrolment in a class which he desired to take, he freely agreed to waive any claim against the defendants for a negligent act by them. This case involves no more a question of public interest than does motocross racing or motorcycle dirt bike riding. 250 Cal. Rptr. at 305 (citations omitted).

Perhaps the key statement here refers to the “dangerous nature” of scuba diving. Because of that, according to the court, the dive instructor and YMCA

could “reasonably require the execution of the release as a condition of enrolment.” And that is the essential point on which all these releases are based. Diving is a sport that has certain inherent risks. Among these risks are that your instructor might be negligent. As a result of this negligence, you might embolise, drown, become paralysed due to decompression sickness, be run over by a boat or any other of a myriad maladies associated with scuba diving.

While some are obvious (drowning) and others are not quite so apparent (decompression illness), the fact is the general public understands that any activity that is suppose to take place in a hostile environment (30 m below the ocean for scuba diving or 3,000 m in the air for skydiving) can be relatively dangerous. And while the Divers Alert Network has indicated that the morbidity rate for scuba diving is on par with that for bowling, the mortality rate is obviously far higher as is the rate of serious non-fatal accidents. Combined with the hyperlitigious nature of present American society, the simple economic fact is that without widely available and enforceable recreational releases, recreational scuba diving as it is presently known would simply cease to function in this country, not necessarily because so many more lawsuits would be filed, or that any more law suits would be successful for the plaintiffs, but because it would be simply impossible to obtain liability insurance for those activities. It is the cost of insurance which drives this whole issue. Indeed, it is a condition precedent to every presently available insurance policy for professional liability in the recreational diving field that a valid release and waiver be obtained prior to allowing a student to enrol.

So back to the original question: Is it just? Is it just that Ken’s parents not be allowed to bring a lawsuit against an obviously negligent instructor? The answer, of course, depends upon your perspective. From the greater perspective of freedom of contract, certainly. Ken got exactly what he bargained for. He was allowed to take a diving course in return for absolving his instructor and the YMCA from any negligence they may be responsible for during the course. No doubt that from the perspective of Ken’s parents, the result was horribly unjust. Yet, it must be remembered that the only remedy allowable in American courts in such a civil case is monetary damages, and no amount of money would bring Ken back.

Perhaps the most philosophically satisfying argument against the use of releases is that they may deter dive operators from consistently using their best efforts to make the sport as safe as possible. After all, if an instructor or dive operator knows that his actions are insulated by a release as well as a million dollar policy of insurance, why should they take the extra effort and expense to make what they may already believe to be a very safe sport even safer?

The problem with this approach is twofold. First, and most importantly, there is simply no empirical evidence whatsoever to support it. While I know of no studies that have been conducted on point, the experience of our firm, which has analysed over 1,500 diving claims in the past seven years, is that if anything, dive instruction and supervision of recreational divers has consistently improved over the years. Indeed, we have documented a rather dramatic decrease in actionable claims brought over that period of time. Secondly, as every operator and recreational certification agency is all too aware, the greater the number of claims, the higher the insurance premium for the activity. Hence, because even a properly executed release does not prevent a lawsuit from being served, nor from expensive litigation from being commenced, the insurance carriers themselves would soon crack down on unsafe practices should the claims history for the activity increase due to the casual negligence of their insureds. In a less litigious society such safeguards may not be needed. But in the present American legal climate, a valid release against negligence is necessary if for no other reason than that for every case as tragic and as culpable as that of Ken Sulejmanagic, there are many more that involve no negligence on the part of the diving instructor or operator whatsoever. And if there were some mechanism to prevent lawsuits in situations where no real fault is at issue, then releases against negligence would probably not be needed. The industry could certainly afford the relatively few legitimate adverse verdicts brought against it each year if that were the only cost involved. But with the cost of defending even a perfectly innocent defendant against a claim of negligence in a complex diving situation commonly approaching \$US300,000 and more, the simple cost of defence would be enough to drive many operators out of business, once again through the dramatically increased cost of liability insurance.

Elements of a valid release

It is not as though the consuming public has no options in selecting a dive instructor or operator. The fact is that with simply a little motivation and homework, most persons can easily find out who the reputable operators are in their community or at their resort destination. While even those reputable operators will most likely use a release, no release will be enforced that is not presented in the appropriate manner. That is, the person signing the release must be given an opportunity to read, understand, and ask questions regarding the release. They must also be given a "cooling off" period. Courts in the United States have expressly declined to uphold releases given to divers on board a vessel once the vessel has left the dock. At that point, according to most courts, the prospective consumer of a diving service is no longer in a position of roughly equal bargaining power with a dive operator. They are now effectively "held hostage" until the trip is over. And even though they don't have to get into the water, by that

time they are pretty much committed to the dive and may not be held to be capable of exercising true independent judgment.

Most importantly, the release must be clear, unambiguous, and unequivocal in its release of "negligence". If that specific word is not used, most courts will not enforce the release. While some states such as Florida presume gross negligence if ever the word negligence is used, many states do not. Thus if a dive instructor or operator is guilty of particularity egregious conduct, in most jurisdictions even a valid release against negligence will be insufficient to avoid an adverse verdict. Of course, no release will be upheld anywhere in the English speaking world for an intentional act designed to cause harm to another (with the possible exception of boxing!). So intentional torts are essentially out. But absent that sort of egregious conduct, parties in the recreation activities environment may contract as they pretty much please.

Conclusion

So are releases a necessary shifting of burden or an unnecessary shafting of would-be participants in this voluntary, recreational sport? While the ultimate answer depends upon the perspective which one brings to the question, in the United States, at least, the consensus appears to be that in return for allowing the virtual explosion of personal injury and wrongful death lawsuits that have been filed in this country over the past twenty years or so, if recreational activities with an inherent degree of risks are to be pursued at all, the right of the parties involved in those activities to freely contract between themselves. While there may occasionally be a decision that offends our sense of propriety in light of our knowledge of the standard of care we would all bring to the sport, the fact appears to be that without the ability to enter into such contracts, many of us would never have had the opportunity to engage in scuba diving to begin with. And it is upon that point that I would argue that valid, binding recreational releases are a necessary "evil" if the sport of scuba diving is to continue as we know it.

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Other views about releases and the diver's responsibility appear on pages 52-58

THE WORLD AS IT IS

ASTHMATIC AMATEUR DIVERS IN THE UK

P J S Farrell

Introduction

The theoretical reasons why asthmatics should not scuba dive are well known. In the UK the British Sub-Aqua Club (BS-AC) has always allowed certain asthmatics to dive. The subjective opinion has been that we do not see asthmatics at the treatment centres in the UK, hence our practices work. In 1994 I investigated the reality of the situation. Are asthmatics over represented in our accident statistics?

Methods

To determine the prevalence of asthmatics in the UK diving population, I randomly selected twenty five BS-AC medical referees who determined the total number of divers in their diving clubs and the number of asthmatics. The data was pooled to provide the prevalence figures.

Members of the British Hyperbaric Association and Royal Navy were asked to provide the number of cases of decompression illness (DCI), which includes both decompression sickness and gas embolism, treated in the period 1989 to the end of 1993 and the number of asthmatics seen.

Results

Of the twenty five BS-AC medical referees, nineteen replied. They recorded 813 active divers of whom 31 were asthmatics giving a prevalence of 3.96%

The chambers reported 402 cases of treated decompression illness in the period 1989 to 1993 of which 9 were asthmatics. Statistically X^2 with Yates correction was 3.607 $P > 0.5$, i.e. asthmatics showed no increase in DCI over the general population

Discussion

Our UK prevalence, that 4% of the amateur diving population is asthmatic, is interestingly similar to Bove et al¹ where 2.6% of his sample dived despite being asthmatic, in a country where asthma is considered to be an absolute contra-indication to diving.

I included all cases of decompression sickness and air embolism as one illness as many people believe you cannot separate them clinically in many cases. Only one of the chambers contacted failed to record if a patient was asthmatic, their data was not included. However all the hospital case notes were reviewed and asthma was not mentioned in a single medical history.

In the UK the joint medical committee representing BS-AC, the Sub-Aqua Association and the Scottish Sub-Aqua Club is happy, with our existing guidelines, to allow carefully selected asthmatics to dive, as we have no evidence that they are more at risk than the rest of the UK diving population.

Interestingly Corson et al² in their survey from "Alert Diver" found 279 asthmatics of which 26.4% had been hospitalised for asthma; 5.8% had been hospitalised six times or more and they had a highly significant increased risk of DCI. The authors commented that the risk needs quantifying according to the severity of the asthma. I suspect in the UK we would have advised many of the divers in this group not to dive.

I believe that the UK policy of enabling some asthmatics to dive has allowed us to exclude the more severe cases; and educate those who are allowed to dive as to the safest way to follow their chosen sport.

The medical ban on asthmatics diving has not prevented them diving in the rest of the world, where an unselected and uneducated group have been shown to be at increased risk of suffering from DCI.

The current UK joint medical committee is currently reviewing the old BS-AC asthma standard to bring it in line with the British Thoracic Society Guidelines for the treatment of asthma. This will be agreed I hope in March 1995.

I hope this different approach to the asthmatic diver may be of interest to our colleagues in the southern hemisphere.

References

- 1 Bove et al. *Skin Diver*. May 1992
- 2 Corson, Moon, Bennett et al. *Alert Diver*. 1992

This paper is based on a presentation to the BS-AC 1994 Medical Symposium.

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PROJECT PROTEUS

AN INVESTIGATION OF HEALTH FACTORS IN SCUBA SAFETY

Douglas Walker

It is now the rule that before starting instruction in scuba diving in Australia the applicant must provide a medical certificate of his or her fitness to dive. There is general acceptance of the inadvisability, for reasons of the perceived risk, of persons who have certain medical conditions being exposed to rapidly changing ambient pressures or being in a situation where any impairment of mental alertness or of physical capability would be dangerous. In practice most medical conditions present with a wide range of severity. This makes risk assessment difficult for those doctors who do not believe the "fitness guidelines" display an adequate awareness of individual variations. They are, however, hampered in acting on their beliefs by the lack of data, other than the morbidity of divers with such conditions. Furthermore there is an absence of data on those who suffer minor, or no, problems from their "disability".

There are several possible sources of information, but none free of problems. At present the most potentially available sources are the records of those treated by hyperbaric units, publications from diving incidents report schemes (Australia, UK, USA), reports from doctors who are involved with the examination and treatment of divers, and inquest documentation for diving deaths. Project Proteus intends through this project to collect reports not only from these sources but also to develop awareness among those who have dived, despite such "contraindications", using compressed air, both scuba and surface supply (hookah), for the recording of their experiences.

Doctors are inhibited from deciding on a case-by-case basis about the applicant's fitness to dive, rather than basing a decision rigidly on the advisory code, by a fear lest at some time in the future the diver suffers some morbidity (not necessarily a consequence of the health problem) and their "fitness" decision then has an examination under the retrospectroscope.

Divers who have any "medically adverse condition" are inhibited from making public their actual diving experiences by a fear that any such disclosure might invalidate their diving certification. This investigation is designed to collect information and analyse it. Medical confidentiality of information is a basic requirement. This will hold whatever type of problems are reported. All information will be treated as confidential and names never revealed. To do otherwise would defeat the object of the investigation as then no one would report their adverse experiences.

Some divers may accept that medical views about the adverse potential of their medical problems have validity, but believe they have the right to decide for themselves what risk to take with their lives. Without analysis of vastly more reports than are available now it is not possible to assess the risk posed to any particular person by their medical condition and type of diving. Some potential divers do not disclose their true medical history in order to avoid a refusal of the desired certificate of fitness. This is a natural, and effective, response by applicants determined to learn to dive. This situation will continue till those who have some "adverse" medical condition are convinced that their problem will receive an adequately researched and informed evaluation.

There are at present significant differences to be found in medical advice between the views of the British Sub-Aqua Club and those at present espoused in Australia concerning not only asthma and diabetes as contraindications, and the frequency of obligatory medical fitness to dive assessments, but in willingness to discuss the subject openly. In the UK the major diving organisations have now formed a joint medical advisory committee to adjudicate in cases where the applicant disputes a "medical fitness" assessment. Such an approach requires an accurate and wide ranging data resource if decisions are to stand up against a challenge in court at some subsequent date.

Any more flexible approach to reaching a better fit to dive assessment where there is a history of asthma, diabetes, cardiac or other adverse condition will require more than a medical approach but this must surely be the first step. There may need to be some change in certification to include specifically limited grades of permitted diving, and design of legally watertight disclaimers for signing by persons who wish to dive despite medical advice. There is sense in accepting that some people will find a way to dive, with or without formal training, and ensuring that their risks are minimised by legitimising their training. Project Proteus is limited to the collecting information to form the basis for later action.

Readers, wherever they live, doctors or not, are invited to become involved with Project Proteus, both by collecting information from and about any divers they identify as coming into the category of having a type of physical or medical condition usually considered as adverse to safety in diving, and by following up any persons they have passed as fit to dive who have such conditions. Information is particularly important to enable evaluation of the correctness (or otherwise) of our criteria. Data on divers with an history of diabetes or asthma is of special value as these conditions can be readily concealed by a determined applicant yet have a reputation for being of serious import in the diving situation. At all times reports will be treated as medically confidential and no diver is to be placed at risk of loss of certification whatever

history of problems they disclose, though they may be advised as to whether they should continue diving.

This survey is designed to create a data bank and there is no assumption made or implied that present medical standards lack validity, only that they now require scrutiny. The lack of data of this type has produced the present situation where rigid criteria of fitness have produced a group of divers who have either evaded recognition of their asthma, diabetes etc. when they were examined by a doctor, or are diving without a pre-training medical examination. This project offers an opportunity to begin remedial action for this state of affairs, with information based on actual dive histories rather than morbidity reports as the basic data input for the first time. This project will not be limited to Australia and will be ongoing. Success requires the participation, interest, and dedication of many people. Please enrol.

If you are interested in becoming involved in this Project you are invited to write to:

Dr Douglas Walker, Project Proteus
P.O. Box 120
Narrabeen, New South Wales 2101, Australia

JOB SATISFACTION IN QUEENSLAND SCUBA INSTRUCTORS

Jeffrey Wilks

Introduction

To many people, work in the tourism industry is perceived as both glamorous and exciting. According to McMillen and Lafferty:¹ "Tourism interests explicitly cultivate a "youthful" image to attract young workers, with notions of a relaxed lifestyle and a variety of career opportunities".

For some workers, especially those employed in marine tourism, it is possible to enjoy a special type of lifestyle along with paid employment. In one study, Volard surveyed employees of two north Queensland island resorts and found what they most liked about working at the resort was the natural beauty of the island, followed by the low cost of living. Ranked third was the type of work they did.² An interesting finding from this study was that most staff did not intend to make a career of working at the resort. They saw their present employment as an enjoyable working holiday, a chance to save money while on the island, and an opportunity to live and work with like-minded people. This transient aspect of employment is

fairly typical of the tourism industry, with a large portion of the workforce periodically moving from one location to another.³⁻⁵

While employment at an island resort or a large hotel chain may provide unique job opportunities for some workers, the reality is that most tourism and hospitality operators in Australia are small businesses, defined as having less than 20 employees.⁶ A good example of small business in the marine tourism area is that of the scuba diving operation. In Queensland many dive operators are sole traders or work in partnerships. They employ a limited number of staff, and there is a high turnover rate among their employees. One reason offered for this high turnover is that employees do not see diving as a career. Rather, their work is an extension of their hobby, which often ceases to be fun when it is pursued for a living.⁷

In order to achieve their desired lifestyles, scuba instructors are prepared to forgo many standard employment benefits. These include overtime pay, holiday pay loading, and superannuation. At the same time, instructors report enjoying some fringe benefits from their jobs, including discounts on meals and accommodation, and special staff prices for equipment and services.⁸

While a majority of scuba diving instructors, both in Australia,^{8,9} and overseas,^{10,11} say they generally enjoy their work, there is currently no information available on specific aspects of job satisfaction within the diving industry. This information is important if staff turnover is to be reduced, and a stable career path developed for workers in this area of marine tourism. In addition, previous Australian studies have found that workers with low job satisfaction tend to report more physical health problems, greater levels of stress, and more accidents travelling to and from work.^{12,13} Since workplace health and safety has recently become a major issue for the recreational diving industry,^{14,15} it is timely to examine workers' job satisfaction and job characteristics in greater detail.

Method

A total of 202 registered Queensland scuba diving instructors participated in the study. The sample contained 57% full-time and 43% part-time instructors. Most respondents reported that they were married or in a permanent relationship. Average age was 33 years, with a range from 21 to 55 years. The various employment categories were 19% business owners, 48% salaried staff, and 33% independent instructors. Figures obtained from the training agencies show that there were 616 certified instructors in Queensland at the time of the study. The sample therefore represented 33% of all Queensland instructors.

TABLE 1
PERCENTAGES, ROUNDED TO NEAREST WHOLE NUMBER, OF SCUBA INSTRUCTORS' SATISFACTION WITH JOB FACETS

	Dissatisfied	Neither dissatisfied nor satisfied	Satisfied
1 Having a say about the way I do things in my job	12	10	78
2 Being able to change the things I don't like about my job	24	14	62
3 The chance to use my abilities in my job	12	15	74
4 The people I talk to, and work with in my job	4	17	80
5 The chance to get to know other people in my job	3	18	80
6 The chance to learn new things in my work	14	17	70
7 The amount of change and variety in my job	20	22	58
8 The chance to do different jobs	15	23	62
9 Being able to do my job without a supervisor worrying me	7	5	88
10 Having enough time to do my job properly	27	21	52
11 Chances of really achieving something worthwhile	16	23	62
12 The amount of pay I get	46	26	28
13 Promotion opportunities	36	36	28
14 Quality of supervision	12	34	54
15 Physical conditions at work (cleanliness, noise levels)	12	19	69
16 The amount of pressure or stress	17	36	47
17 Opportunities to do challenging and interesting work	16	27	58
18 Opportunities to grow as a person and be yourself	12	17	71

TABLE 2
SATISFACTION REPORTED FOR EACH FACET OF THE JOB: PERCENTAGE OF RESPONDENTS BY GROUP

Job Facet	Adelaide workers	Rank	Scuba instructors	Rank
Able to do job without supervisor interfering	81.7	1	87.9	1
Co-workers	80.2	2	79.8	3
Chance of getting to know people	76.5	3	79.8	2
Having a say about way of doing job	75.6	4	77.8	4
Chance to use abilities	74.1	5	73.7	5
Enough time to do job properly	71.4	6	52.0	15
Amount of change and variety	69.4	7	58.1	12
Opportunities to grow as a person	69.3	8	71.2	6
Chance to learn new things	67.9	9	69.7	7
Amount of pay	66.9	10	27.8	18
Chance to do different jobs	64.5	11	61.6	11
Physical conditions	62.9	12	68.7	8
Chance of achieving something worthwhile	62.5	13	61.6	10
Quality of supervision	61.9	14	54.0	14
Pressure or stress	60.0	15	47.5	16
Opportunities for challenging and interesting work	58.6	16	57.6	13
Able to change disliked features of job	57.2	17	62.1	9
Promotion opportunities	48.8	18	27.8	17

All participating instructors completed a 16-page confidential questionnaire covering a range of topics related to their work in the dive industry. Full details of the development, pilot testing and administration of the measure are reported in an earlier paper.¹⁵ In relation to job satisfaction, instructors completed a standard 18-item Australian scale measuring various job facets.¹² Responses to each item or facet of job satisfaction were made on a 5-point scale (1 = very dissatisfied; 5 = very satisfied). The items had previously been used and validated with a 0.5% household sample drawn from metropolitan Adelaide using the technique of multi-stage cluster sampling to obtain adequate representation of occupations and socio-economic status. A total of 1383 employed people were included in the Adelaide sample.

Results

Table 1 (page 25) presents the various amounts of satisfaction Queensland scuba instructors reported for each facet of their jobs. For ease of reporting "very satisfied" and "satisfied" have been collapsed into one category. Similarly, "very dissatisfied" and "dissatisfied" are reported together.

Table 1 shows that a majority of the sample (> 50%) were satisfied with 15 out of 18 facets of their jobs. Least satisfaction, and greatest dissatisfaction, was reported for the amount of pay received and promotion opportunities. Less than half the sample were satisfied with the amount of pressure or stress they experienced on the job, though a third of the sample gave a neutral response to this aspect of their work. Other areas of dissatisfaction that emerged from the analysis were having enough time to do the job properly, changing disliked features of the job, and the amount of variety provided by the job.

To test whether job satisfaction reported by scuba instructors was similar to, or different from, that of other workers a comparison was made with the 1383 Adelaide employees on which the original job satisfaction items were developed. Table 2 (page 25) presents these results.

Table 2 shows a generally similar pattern in the proportion of workers who were satisfied with each job facet, with the exception of scuba instructors showing much lower ratings for amount of pay, promotion opportunities, and pressure or stress. While these three job facets were ranked lowest in the list by instructors, and differed from the rankings made by the Adelaide sample, both groups of workers shared a similar pattern of agreement on the five most important facets of the job (autonomy, co-workers, getting to know people, having a say in the job, and a chance to use abilities).

As an empirical test of the similarity between the two groups of workers, a Spearman's rank-order

correlation coefficient (r_s) was calculated.¹⁶ The high correlation ($r_s = .71$; $p < .01$) shows a strong similarity in the overall rating of job facets. Table 3 confirms the similarity across groups, with the scuba instructors' overall mean on job satisfaction (66.35) being closest to that of clerical and services staff from the Adelaide sample, and slightly higher than workers in the transport or trade sectors.

TABLE 3

MEAN JOB SATISFACTION LEVELS BY OCCUPATIONAL GROUP

Occupational group (Adelaide sample)	Number	Mean job satisfaction	Standard deviation
Professional	213	69.92	10.03
Administrative	94	70.14	8.90
Clerical	251	66.80	11.30
Sales	130	69.41	11.28
Transport	90	65.59	10.85
Trades	415	63.69	12.92
Services	143	66.79	11.68
Total	1383	66.71	11.73
Scuba instructors	202	66.35	12.58

Finally, a series of exploratory analyses was conducted to identify relationships between job satisfaction and other work-related measures for the sample of scuba instructors. In contrast to the findings of many other studies, there were no significant relationships between job satisfaction and age, sex, or length of time working in the industry. However, job satisfaction was positively correlated with intention to remain in the dive industry during the next 12 months ($r = .40$; $p < .0001$) and with intention to remain in the present job during the next 12 months ($r = .51$; $p < .0001$).

Discussion

After reviewing the international literature, Mitchell and his colleagues concluded that job satisfaction levels in Australia have remained relatively stable in recent years.¹³ This finding is supported by the present study, where comparisons between a sample of Adelaide workers surveyed during the late 1970's, and a sample of Queensland scuba instructors sampled in the 1990's, revealed a similar pattern of job satisfaction overall. Both groups reported most satisfaction with their autonomy on the job, co-workers, the chance of getting to know people, having a say about how they do their jobs, and the chance to use their abilities.

Scuba instructors, however, differed most from the Adelaide workers in expressing particular dissatisfaction with the pay they receive. The topic of fair remuneration has been a long-term issue for instructors in the United States,¹⁷ and while Australian instructors are currently paid salaries at least at the level required by the union award,⁸ an independent study by James Cook University showed that few financial incentives were currently available for scuba instructors.⁷ Indeed, the authors of that study suggested that in order to overcome the extended hobby attitude to dive employment, instructors should be made to feel part of the business. This might involve inclusion in decision-making processes, and some form of incentive, bonus or commission structure as an essential business practice in the recreational diving industry. These suggestions have not been acted upon by the dive industry to date, though they clearly have the potential to address most of the areas of job dissatisfaction identified in this research.

One of the most notable findings of the present study is the positive correlation between job satisfaction and intention to remain both in the dive industry, and more specifically, in the present job over the next 12 months. The correlation means that the more satisfied an instructor is in their current job, the more likely they are to remain in that job. This finding is really common sense, but combined with the other results highlighting the main areas of dissatisfaction (salaries and career opportunities), it gives employers some solid ground on which to make changes so as to ensure they do not lose their current staff.

While employment as a diving instructor in marine tourism may appear to be glamorous and exciting to those outside the industry, in reality it is a job much the same as any other job. Admittedly, the work environment is more attractive (the ocean, sun, and meeting new people who are in a holiday mode), but this is off-set by lower salaries and few opportunities to develop a career.

In order to advance the degree of professionalism in the industry, it is necessary to provide incentives that will encourage long-term, stable employment. This will have important and positive implications for customer satisfaction and safety, as a result of instructors staying in the one geographical area and being familiar with their company's equipment, local dive sites, weather conditions, and available emergency services.

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**DIVING'S WELL KNOWN FACTS MAY FACE
THE ACID TEST SOME CONSEQUENCES OF
THE "AMERICANS WITH DISABILITIES ACT"**

Douglas Walker

There are said to be only two certainties, death and taxes, and the impact of these can usually be significantly reduced, although not completely eliminated, for anyone who has sufficient money to employ those skilled in dealing with these matters. But now there is a new danger which is likely to prove rather more difficult to keep at bay as it is being brought to us by those terrible twins, Noble Sentiments and the American Legal System. It has a potential to spread like a plague to other countries, even Australasia. The Americans with Disabilities Act¹ appears to be designed to prevent employers excluding those who are thought to have some "possibly-adverse" health factor from being employed, while presumably retaining the presumption that there is no such thing as an "accident" and that the employer should anticipate and remove all, even remotely, dangerous elements from the employee's environment. The critical element now is that the "adverse medical factor" must have been proved to be a serious risk to the person and one which cannot be eliminated by changes in the work situation.² To believe this approach to the rights of those with disabilities will only involve work situations in America would be to misread the augers. Those who remember the injustice and disruption caused when an American court awarded a diver damages for his back trouble, after which lawyers and insurance companies decreed that nobody with a vertebral abnormality shown by X-ray should be employed in commercial diving³, will smile wryly at this complete reversal of employment guidelines. So too will the British Sub-Aqua Club after fighting off the claims of a diabetic diver's widow after he suffered decompression sickness and later committed suicide.⁴

The critical new requirement appears to be the need to demonstrate not that the medical condition is generally believed to constitute a potential danger, but that it has been investigated and proved to be a serious danger. For example, as epileptics are "forbidden" to dive there are no sources of information about the degree of risk this condition constitutes to any diver. Therefore there is no statistical basis on which to justify denying to him (or her) a medical finding of fitness to dive. There will certainly be an "expert" neurologist willing to testify that such people should be allowed to pursue any occupation or recreational activity they wish with as great freedom as any other member of the community. However if such a person later had a fit while diving and drowned or suffered a cerebral arterial gas embolism it is easy to predict there would be a flood of claims raised on behalf of the victim and no problem in finding expert witnesses to pillory the doctor who had provided such a "fitness" certificate. There appears to be only one option an examining doctor can

safely take. That is to state whether the applicant meets standards set by lawyers and to offer no opinions concerning fitness, leaving risk assessment to statisticians (and lawyers) who have created the situation. Ah! Brave New World!

Although this American act will, at present, only apply to those who are seeking employment as commercial divers and not those intending to dive recreationally, it will certainly be capable of application to those seeking to become diving instructors in America. There are close ties binding the major diver training organisations here in Australia and New Zealand to their US parents. The problems which this could cause will provide a bonanza for enterprising legal minds. It will be an interesting situation if diving instructors are to be medically evaluated to a less rigorous standard than that by which their pupils are judged !

Before dismissing this as an academic and scaremongering approach one must remember the slender data base for both course content and medical standards. It is often claimed that there are absolute, relative and temporary medical contraindications to safe diving and these define whether or not each applicant is assessed as having medical fitness to dive. Although such medical fitness standards have certainly been quoted with approval, where this has helped a plaintiff, they have yet to be seriously challenged in an action claiming that they are without adequate statistical basis and based on beliefs rather than facts. This criticism could well be correct. This should not be taken to mean the accepted medical standards are incorrect or unreasonable, merely that they are only opinions, not statistically validated facts. In any Court of Law a declaration that one's beliefs are based on common sense, or a "gut feeling", would carry little weight. This American act requires that the medical condition would constitute a serious, and unavoidable, risk in the proposed work situation. The common medical beliefs in Australia and New Zealand concerning the ineligibility for diving of those with a history of asthma, diabetes or epilepsy could well be contrasted with opinions in the UK⁵ and a decision reached on purely legal rather than medical grounds.

There is no data to show that practice of out-of-air ascents, one of the shibboleths of American diving organisations, is of value. Nor has practice of in-water ditching of equipment, of practicing shared-air ascents, or in-water CPR been shown to be of value for those on basic courses. This is not to say that they are without value, only that the new American act could result in these (and other) matters being declared to be "unreasonable requirements".

This result would be a deserved, but (possibly) regrettable, result of the diving community's chronic failure to collect data and to practice case analysis. There has been (and largely still is) a reliance on anecdotal evidence and selective, sporadic reporting of cases in both

the medical and instructor organisation arms of the diving community. The power of the legal system to subpoena incident reports and confidential medical records has, naturally, played an important part in perpetuating the habit of avoiding a written record of misadventures. We hope that some day the Law will recognise the value of research to identify and reduce dangers and seek to reward safety efforts rather than hamper them.

What is the answer to this potential problem? The same one that was required when the hyperbaric world was put in turmoil by the paper which questioned the claims that hyperbaric oxygen therapy was useful, or even an effective, modality. Only then was it realised for the first time that clinical impressions might be a good guide but lacked conviction without a sufficiency of hard facts to back them up. Indeed the situation can best be managed by the diving community taking seriously, and actively supporting, the creation of a diving data bank with input from all the various groups involved in recreational and commercial diving. It would be nice if this proposal could be implemented before someone or some organisation is called upon to appear in a Court to face a well prepared

legal cross examination concerning the factual basis for some long held and cherished beliefs, and on the documentation and data justifying past actions and opinions.

References

- 1 Americans with Disabilities Act. 29 CFR Pat 1630 et seq. 1992
- 2 Miniclier PC. The Americans with disabilities act: the disabled diver in commercial diving. *Pressure* 1993; 22 (2): 1,3,5,6
- 3 Low back X-rays and diving fitness. *SPUMS J* 1980; 10 (4): 4-8
- 4 BS-AC on trial. *SPUMS J* 1981; 11 (4): 10-11
- 5 BS-AC medical standards. BS-AC, 1990

Dr Douglas Walker is the founder of Project Stickybeak, from which the Provisional reports on Australian diving-related deaths, which appear regularly in the Journal, are compiled. His address is PO Box 120 Narrabeen, New South Wales 2101, Australia.

DIVING DOCTOR'S DIARY

DIAGNOSIS OF A DIZZY DIVER

Carl Edmonds

Case report

A 30-year old male, of artistic nature, but also a gentleman adventurer, took up diving in 1994. He completed 16 non-decompression dives in 5 months. He was also an aviator, sky diver, hang glider, snorkeller, swimmer and sailor.

One month previously, in calm seas, he performed two beach dives on the one day, both to a maximum of 10-15 m and with a surface interval of 90 minutes. He was nowhere near decompression requirements. The total time of each dive was about 35 minutes, of which the last third would have been spent at depths of less than 5 m.

He felt a slight tendency to unsteadiness after the first dive, but only in retrospect. On the second he felt nauseated and vomited after he ascended, whilst swimming back to shore. He made the interesting observation that, if his eyes were closed and he tilted his head, he would notice a spinning sensation. The dizziness only lasted for an hour or more, but he then felt tired and exhausted.¹

He was seen by a general practitioner who observed haemorrhage on the tympanic membrane, and noted the presence of nystagmus. Despite the relatively minor dive exposure, it was felt prudent to dispatch the diver to a recompression chamber, and a full course of treatment was given, presumably because of the possibility of decompression sickness (DCS) causing generalised and cerebral symptoms.²

A month later he returned to his diving and descended to 12 m for 35 minutes. Again, about a third of this would have been spent doing a very slow ascent. On the surface swim, when returning to shore, he noted that if he looked to his left he would become dizzy. He then observed that he was unsteady while walking. The dizziness increased if he closed his eyes. "This was not my normal balance, and it stayed like that for an hour or so". His hearing felt "not clear", and muffled.³ He was also aware of a high-pitched continuous sound on the left side. He then slept for hours, being tired and exhausted. By the next morning the tinnitus had gone.

He took aspirin,⁴ on medical advice, and stayed in bed.

When he was seen two days later, he had decided not to undergo another proposed recompression treatment, as the previous one didn't seem to do much good. He then

visited the Diving Medical Centre.

On examination, apart from the Grade I - II middle ear barotrauma effects, there was no abnormality to be detected at the time I examined the diver, and he was quite capable of performing the Sharpened Romberg test.⁵ One would have been forgiven for assuming that this was a fairly simple case of middle ear barotrauma, as there was only objective evidence of Grade II barotrauma of the left ear, Grade I on the right.

Unfortunately the pure tone audiogram revealed the following.

Hz	500	1000	2000	4000	6000	8000
Right	15	10	10	15	10	10
Left	10	10	5	10	25	30

Why did we not compare the pre-incident (pre-diving) audiogram, which should have been performed during his recreational diving medical, that same year ?

Unfortunately the original audiogram, as recommended (**should** was used rather than **shall**, which in Australian Standards implies **must be done**) in the Australian Standard 4005.1, was not performed. Another one of the Mickey Mouse Diving Doctor examinations characteristic of North Queensland!

The treatment, seeing him two days after his second diving accident, was to

- 1 avoid all medications including aspirin, and middle ear equalisation manoeuvres,
- 2 avoid any exercise or activity, straining (defecating, coughing, sneezing, sexual activity etc.)
- 3 spend most of the next week in a sitting up position, optimal for the repair of a possible round window fistula,
- 4 repeat pure tone audiograms to ensure that the hearing loss did not progress.

The pure tone audiogram performed a week later appeared to have improved considerably, so that even the presumed high frequency hearing loss had disappeared, suggesting that it was a temporary threshold shift, and thus indicative of inner ear damage.

The diver was sent to one of the top vestibular function laboratories in Sydney and the results showed no evidence of spontaneous nystagmus (verifying the observation that he had compensated for the damage, or inhibited it). Caloric stimulation showed no response to hot or cold water on the left side, and a slightly impaired response on the right. Iced water calorics produced exactly the same negative result.

Diagnosis: Vestibular damage especially affecting (L) side.

Prognosis and advice

WHAT TO DO WITH HIM AS A SCUBA DIVER?

Well he is obviously one of those people who are not particularly sensitive to the effects of middle ear barotrauma. On closer questioning it did appear as if there had been evidence of muffled hearing after diving, and occasionally he would notice pressure on his ears during descent. He certainly descended slower than most of his companions.⁷

The diagnosis was inner ear barotrauma. He has now had two episodes, and he is likely to have many more with diving, with the main initial threat being vertigo and vomiting and the delayed effects the recurrence and persistence of tinnitus and possible high frequency hearing loss. As he is a musician, this can be catastrophic to his occupational future. Cease scuba diving.

FREE DIVING?

This is likely to cause more problems than scuba diving. Unfortunately with snorkel or free diving it is easy to not notice lesser priorities, such as middle ear pressures and the need for auto-inflation, when larger priorities such as the need to descend, dominate the diver's attention. Many free divers do not even attempt middle ear auto-inflation whilst diving, and most of them are not aware of the importance and value of a positive pressure middle ear auto-inflation technique such as the Valsalva, employed before the descent. There is no problem with surface swimming or snorkelling.

HIS ACTIVITY AS A PILOT?

This is somewhat hairy. If you have one vestibular system inactive, then expansion of the middle ear space during ascent is likely to produce a "alternobaric vertigo", which could be catastrophic. I would certainly advise these people not to pilot a plane, even though there is no clinical evidence of vestibular dysfunction (without provocation tests). Even though he has no vertigo or nystagmus normally, the inequality is seen with the ENG during the caloric tests. It can also become evident during ascent in recompression chambers and aeroplanes. I do not want to be a passenger in the plane if he is a pilot.

SKY DIVING?

This could be a problem. As he so much loves this sport, I have assured him that he could use a nasal decongestant before he enters the plane. He should also forcefully equalise his middle ear spaces, using a Valsalva technique, before the jump. This will ensure that he starts off his jump with the middle ear fully inflated and the tympanic membrane protruding. He was also advised to attempt middle ear auto-inflation during descent, and probably as soon as he lands. Considering most of the jumps

are from a height of 10,000 feet, this should probably be adequate to prevent further middle and inner ear damage.

PARACHUTING?

No problem, if similar restrictions and advice are applied as with sky diving.

LEGAL IMPLICATIONS?

One would hope that the diver would not take action against the physician who did the diving medical examination. Certainly, if he were to do so, the patient would probably win. Not only did the examining doctor not perform the pure tone audiogram, as required, but also he did not ensure that the diving candidate could equalise his middle ear spaces. A very good case could be made for the incompetence of this doctor. Certainly, if the diver had been advised of his physiological inadequacies, then he would have been much more reluctant to expose himself to the hazards of inner ear barotrauma, with its complications regarding his occupational and recreational activities, which are extremely important to him.

Footnotes

1 Vertigo induced by eye closure and head tilting strongly implies a peripheral (vestibular) more than a central (brain) lesion.

All diving physicians are aware that tiredness and exhaustion are manifestations of DCS. They are also very, very common manifestations of a vestibular disorder. It takes a lot of effort to maintain one's balance in the presence of a vestibular abnormality.

Also associated with vestibular disease is a feeling of disorientation and other psychological reactions such as irritability and depression. People with vestibular disease also find it hard to concentrate. They do not have to have DCS for this to be so.

2 I would have thought the signs and symptoms were much more consistent with ear disease due to barotrauma, than DCS. But often it is very difficult to send a diver away from the chamber, while he still has symptoms.

If middle ear barotrauma is observed, the possibility of inner ear barotrauma (with damage to the cochlea in 40% of the cases, vestibule in 10% and both in 50%) is to be considered. Tinnitus is, however, often the major symptomatology.

3 The history of muffled sound, followed by cracklings as the gas bubbles mixed with the middle ear effusion and are affected by jaw movements, is also

fairly common in middle ear barotrauma. Tinnitus, high frequency hearing loss (a temporary or permanent threshold shift) and/or unilateral ENG verified vestibular dysfunction all point to a peripheral lesion of the 8th nerve, not usually a brain lesion

4 The pathology of inner ear barotrauma can be either a round window fistula (not rare, but certainly not the commonest), inner ear haemorrhage, air bubbles traversing the stretched round window and entering the perilymph, or possibly some internal membrane rupture within the inner ear. One thing for certain, aspirin with its haemorrhagic complications is not a recommended form of treatment. Nor are vasodilators, but thank heavens people have stopped using them.

5 I am worried that the Sharpened Romberg is too often used as an investigation of exclusion. This is not valid. It is quite possible for the diver to have received damage, which was more or less being compensated by him allowing a normal Sharpened Romberg assessment. This test does not exclude vestibular damage.

6 This is the most dubious of all results. By any normal standards, the pure tone audiogram was acceptable, but if the left side had originally been the same as the right, as it usually is, then he may have lost 15 to 20 decibels in the high frequencies (6000 - 8000 Hz), consistent with inner ear barotrauma.

7 This is a very common feature with people who have Eustachian tube insufficiency. They descend slowly so that their middle ear effusion can replace the gas space contraction due to Boyle's law. The muffled hearing, and occasional crackling sounds in the middle ear, following the dive is evidence of this middle ear effusion.

Dr Carl Edmonds address is Diving Medical Centre, 66 Pacific Highway, St Leonards, New South Wales 2065, Australia.

Continued from page 58

problems in diving. An up to date list of the names, addresses and telephone numbers of these doctors can be found on the back of the Medical Form.

Dr Sandra Domizio is the Secretary of the UK Diving Medicine Committee.

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SPUMS NOTICES

SOUTH PACIFIC UNDERWATER MEDICINE SOCIETY DIPLOMA OF DIVING AND HYPERBARIC MEDICINE.

Requirements for candidates

In order for the Diploma of Diving and Hyperbaric Medicine to be awarded by the Society, the candidate must comply with the following conditions:

- 1 The candidate must be a financial member of the Society.
- 2 The candidate must supply documentary evidence of satisfactory completion of examined courses in both Basic and Advanced Hyperbaric and Diving Medicine at an institution approved by the Board of Censors of the Society.
- 3 The candidate must have completed at least six months full time, or equivalent part time, training in an approved Hyperbaric Medicine Unit.
- 4 All candidates will be required to advise the Board of Censors of their intended candidacy and to discuss the proposed subject matter of their thesis.
- 5 Having received prior approval of the subject matter by the Board of Censors, the candidate must submit a thesis, treatise or paper, in a form suitable for publication, for consideration by the Board of Censors.

Candidates are advised that preference will be given to papers reporting original basic or clinical research work. All clinical research material must be accompanied by documentary evidence of approval by an appropriate Ethics Committee.

Case reports may be acceptable provided they are thoroughly documented, the subject is extensively researched and is then discussed in depth. Reports of a single case will be deemed insufficient.

Review articles may be acceptable only if the review is of the world literature, it is thoroughly analysed and discussed and the subject matter has not received a similar review in recent times.

- 6 All successful thesis material becomes the property of the Society to be published as it deems fit.
- 7 The Board of Censors reserves the right to modify any of these requirements from time to time.

ACKNOWLEDGMENT OF DONATION TO SPUMS

13/12/94

Ms Christeen Buban, Vice-President of Marketing
Submersible Systems Inc.
18072 Gothard Street, Huntington Beach
California 92648, USA.

Dear Ms Buban

Thank you for your generous contribution to the costs of the 1993 SPUMS Workshop on emergency ascent training and practice. Your support is greatly appreciated by the Society's Committee and members.

Des Gorman
President

MINUTES OF THE EXECUTIVE COMMITTEE MEETING OF SPUMS

held in Cairns on 21-23 October 1994

Present

Drs D Gorman (President), Tony Slark (Past President), C Meehan (Secretary), J Knight (Editor), D Davies (Education Officer), C Acott, G Williams, and J Williamson.

Apologies

Dr S. Paton (Treasurer), connected by speaker telephone for specific parts of the meeting.

1 Minutes of the previous meetings

Read and accepted as a true record with minor corrections.

2 Business arising from the minutes:

- 2.1 Job description of the SPUMS journal editor was reviewed and discussed. An Honorarium for Dr John Knight of \$12,000 per annum for producing the quarterly journal was agreed on. This is to be reviewed annually. Proposed by Dr Slark, seconded Dr Davies.
- 2.2 The use of a secretariat was discussed at length, and it was decided to not follow this avenue with the ANZ College of Anaesthetists at present because of the possible high costs. The pro-

posed service was also not yet available. To ease the burden on the Treasurer it was decided that the Diving Doctors List be produced bi-annually, in December and June. The compiling and updating of this list is to be taken over by Dr John Williamson at the Diving Emergency Service. Further more the Treasurer and Secretary were encouraged to make more use of a wage-slave to help with the routine work involved in their jobs. This they were to organise themselves as the need arose. In addition the Treasurer was asked to consider the need to upgrade or replace her computer system with the view of increasing the efficiency and ease of the management of her job.

- 2.3 It has been decided that two face to face committee meetings should be held during each year. The first would be held at the annual ASM. This meeting would be attended by all the committee members who were in attendance at the ASM. The second would preferably be in Adelaide when Dr Gorman is there. This committee meeting would be attended by all the committee members. The aim of this meeting would be to look at the tenders for the travel arrangements of the ASM in one and a half years time. A protocol has been formulated and submitted by the Treasurer to cover the travel expenses that are likely to be incurred at this meeting. This protocol was accepted, contingent upon review being a courtesy. Proposed by Dr Slark and seconded Dr Meehan

3 Treasurers report

Received.

4 Fiji ASM 1995

Dr Davies gave a brief report on arrangements for this.

5 Venues for future ASMs

It was decided that the venue for the 1996 ASM be the Maldives. This was because of the ease of access for the Europeans. It was hoped that a combined workshop with the European Undersea Biomedical Society would be possible. Dr Acott was to co-ordinate this. Dr Williams is to be the convener. The proposed theme is technical diving. The bulk of the meeting may take place as a workshop. A proposed speaker for this was David Elliott. Bill Hamilton from the USA was also suggested. The meeting should take place in early May when the weather is more favourable, and the venue should be as far away from Mali as possible.

Tenders are to be put out immediately. The tender documents are to be delivered to the ANZ College of

Anaesthetists by the 31 January 1995. The successful tenderer will be announced on the 1 March 1995.

Dr Williamson is to research further into the suitability of Kota Kinabulu as a future venue.

6 Correspondence

- 6.1 Project Proteus, from Dr D G Walker for our comments. The Committee supports the project. Dr Gorman is to sign the attached statement, which can then be returned to Dr Walker.

7 Other Business

- 7.1 ANZHM
Dr Williamson gave an update.
- 7.2 SPUMS Policy on Diving Medical Officer Courses, pending production of a template for the Diving Officer Courses. It was decided that the 3 day courses were acceptable for inclusion on the Diving Doctors List for carrying out recreational dive medicals, but that completion of a full five day course which was internationally recognised was required for doing occupational diving medicals. AODC approval is required for recognition of DMT courses. Proposed by Dr Gorman, seconded Dr Knight.
- 7.3 Upgrade of the facsimile for the Secretary was approved. Proposed by Dr Davies, seconded Dr Slark
- 7.4 New recording device for the ASM to be looked into by Dr Williams.
- 7.5 The pulse-oximeter for PNG has been purchased. Dr Acott to establish contact with Vonapope Hospital and organise transportation of this to them
- 7.6 It was decided that Dr Mike Davies, as chairman of the New Zealand chapter of SPUMS, should be included in all the committee meetings.

NEW ZEALAND CHAPTER OF SPUMS

ANNUAL GENERAL MEETING 1995

The NZ Chapter meeting will be held on 7, 8, 9 April 1995 at The Pacific Harbour Motel, Tairua. As usual this will combine a scientific meeting, annual business meeting, and practical diving activities, principally at the Alderman Islands.

Part of the meeting will be devoted to a workshop on fitness for diving so that a New Zealand consensus may then be taken to the SPUMS ASM workshop later in the year. Original papers for a free papers session are now invited from members. We would also be very pleased to hear from New Zealand members of topics they would like discussed.

Enquiries should be addressed initially to

Dr Chris Morgan, 9 Amohia Street, Rotorua, New Zealand (phone (07) 347 8350);

the Secretary, Dr Rees Jones, Northland Pathology Laboratory, P.O.Box 349, Whangarei, New Zealand (phone (09) 438 4243; fax (09) 438 4737),

or the Chairman, Dr Mike Davis, P.O.Box 35 Tai Tapu, New Zealand (phone (025) 332218 or (03) 329 6857, fax (03) 332 8562).

SPUMS ANNUAL GENERAL MEETING 1995

will be held at

Castaway Island Resort, Fiji,
on Saturday June 27th at 1800.

Motions, in writing, for discussion at this meeting must be in the Secretary's hands by April 14th 1995. Allow at least a week, and preferably longer as letters have to be forwarded to Dr Meehan from the Australian and New Zealand College of Anaesthetists in Melbourne.

ANNUAL SCIENTIFIC MEETING 1995

Castaway Island, Fiji.

Sunday 21/5/95 to Sunday 28/5/95

The Guest Speaker is to be Dr A A (Fred) Bove, Chief of Cardiology at Temple University in Philadelphia. He was the Guest Speaker at Madang in 1982. The Convener of the ASM is Dr David Davies, Education Officer of SPUMS. The theme of the meeting is Fitness to Dive. The Workshop theme is Asthma.

Those wishing to present papers are asked to contact Dr Davies at Suite 6, Killowen House, St Anne's Hospital, Ellesmere Road, Mt Lawley, Western Australia 6050 (Fax 09-370-4541) as soon as possible. The same applies to those wishing to contribute to the Workshop on Asthma, especially if unable to attend the meeting. Dr Davies intends to prepare their written submissions to distribute to those attending the meeting. This means that such contributions will need to be in his hands by the middle of April 1995. Intending speakers are reminded that it is SPUMS policy that speakers at the ASM must provide the Convener with the text of their paper, ready for publication, before they speak.

The Official Travel Agent for the meeting is Allways Dive Exeditons, 168 High Street, Ashburton, Victoria 3147, Australia. Telephone (03) 885 8863, Toll Free 1-800-338-239, Fax (03) 885 1164. From overseas dial 61-3-before the last 7 digits of the telephone and fax numbers.

LETTERS TO THE EDITOR

ROUND WINDOW RUPTURE

118 Remuera Road
Auckland 5
New Zealand
2/12/94

Dear Editor

There seems to be some confusion over this topic and I would like to correct some of the suppositions which occurred in the SPUMS Journal.^{1,2} The first letter should have the short answer "that the diver can go back diving." The only provisos are that he should observe are those which should be taught to all divers. Such items as clearing the ears, slow feet first descent, slow ascent, no diving with a cold etc. This is all standard diving technique. The PADI Safe Diving Practices should always be observed.

Two items should be appreciated by those approving or disapproving a return to diving. The risk of a re-rupture of a round window membrane is low if the repair operation has been radically carried out. It is usual to use a relatively large plug of fibrous tissue usually temporalis fascia, to repair the membrane after removal of the epithelium of the round fossa and membrane. From experience with having a second look at the stapes after operations for otosclerosis, where temporalis fascia was used, quite a thick membrane occurs as the end result. However recurrences of round window ruptures after repair are reported in the non-diving population so there maybe some factor predisposing to re-rupture not related specifically to diving.

The second item is that the round window rupture is not randomly occurring in laterality. It occurs twice as often on the right side than on the left. Because of this laterality, there is in any person some reason that causes

TABLE 1
21 CASES OF ROUND WINDOW MEMBRANE RUPTURE

Cause		Treatment		Years diving since
Rapid descent	10	Surgery	14	4, 1, 6, 1, 16, 9, 1, 2, 12.
Difficulty in clearing ears	7	Medical	6	16, 14, 6, 1, 1.
None recorded	7	None	1	23.
Totals	24		21	Dived again 15
Repaired and never dived again	3	Medical treatment and gave up diving	1	No follow up 2

that particular ear to be affected. If there is to be a recurrence it will be in the predisposed ear, the one that has already been affected. Thus if deafness is a factor to be concerned about it will only be in that one predisposed ear. So the threat of total deafness should not be used as it would statistically be rare or in my guess 1 in a 100,000. Even with total deafness in 1 ear the NAL (Commonwealth National Acoustic Laboratory) Hearing Handicap is only 16%.

However before anyone rises to my contentious statements, there are rare cases of rupture of both left and right round window membranes at the same time. The only case I have been involved with was a member of a police diving team who after repairs of both ruptures retained normal hearing and was forbidden to dive in his profession, but carried on diving for recreation on my advice.

I have treated cases of round window rupture and I have never told the diver to give up diving. What I have said is that if they develop any further trouble they should telephone me as soon as possible for advice. This was what the diver with the crayfish in his ear did.³ Two cases of repaired round window rupture have carried out over 10 years each of diving since the operation (Table 1). I have even operated on a diver who ruptured her round window membrane 3 weeks before she went diving.

Noel Roydhouse

References:

1 Fitzpatrick P. Diving after round window rupture. *SPUMS J* 1994; 24 (3):144
 2 Knight J. Diving after round window rupture. *SPUMS J* 1994; 24 (3):144
 2 Roydhouse N. Diver's ear pain or claws 2. *SPUMS J* 1988; 18 (1): 32-33

AURAL BAROTRAUMA

Suite 2, 37 Gordon Street
 Mackay, Queensland 4740
 1/12/94

Dear Editor,

I wish to report a recent case of aural barotrauma from Hayman Island.

The 35 year old male undertook a resort course, and in his own words, was a little alarmed as was his wife at the number of disclaimers he signed before the dive. There was, as is usual, only a questionnaire and no formal medical examination.

The patient experienced severe pain at 3 m, continued to 9 m and then experienced unusual whistling noises on ascent. His ear remained painful the following day and he was referred to me.

I found the right ear had evidence of chronic otitis media in as much the incudostapedial joint was eroded and the drum adherent forming a myringostapedopexy. Bubbles of fluid were quite obvious in the middle ear. The left ear had both evidence of otitis externa and middle ear fluid. His nasal septum was grossly deviated to the left.

The patient insisted that he must fly back to England within 48 hours against my wish to treat the infection and barotrauma conservatively.

If I had seen this patient before commencing a scuba course I would have declared him unfit for diving, and explained why, on the basis of his chronic otitis media and gross septal deviation. It is not uncommon for barotrauma to arise in such patients who are relatively asymptomatic. Despite all the disclaimers signed, it is my view that the diving agency is culpable and I believe it is only good fortune rather than good planning, that is preventing the operators being sued.

I am aware of the numerous arguments about the needs for diving medical clearances but I must add my

voice to those who say that no person should commence scuba diving in any capacity, including a resort course, unless they have a proper medical examination.

John Robinson

MANAGEMENT OF DIVING ACCIDENTS

17 Contour Drive, Mullaloo
Western Australia 6027
4/12/94

Dear Editor

I have some comments on the paper *Management of Diving Accidents* by Des Gorman (SPUMS J 1994; 24 (3): 148-157). I thought that the paper was, in general, very good but I did notice that a few small details were missing from the discussion about stage and bell recovery. These details are small but important, and possible the difference between a successful recovery and a failure.

All stages and wet bells should be fitted with a harness, or positive securing arrangement, capable of holding the unconscious diver in his seat or in a position to allow successful removal of his helmet or mask. All wet bells should carry a "rigid collar" as part of the bell kit.

The section on closed bell recovery is very dangerously worded. Recovery of an unconscious diver into a bell should always be done by floating, or pulling, the diver into a flooded or partially flooded bell.

The water should always be left in the bell until resuscitation is successful or the diver is proven dead. He will be adequately heated by his hot water suit. On no account whatsoever should an unconscious diver be winched into a dry bell. I refer the reader to page 169 (*Impaired consciousness, near drowning*) and to pages 171-78 (*Circum-Rescue Collapse: collapse, sometimes fatal, associated with the rescue of immersion victims*) of the September 1994 Journal.

A rigid collar should be considered an essential item of the bell medical kit, it is not at present, and should be placed on the rescued diver as soon as possible.

I would also refer readers to my own book *The Diver's Bible*, pages 38-40 covering bell diver recovery. The recovery procedure described was formulated from my own experience.

In the early 1970s I was employed as a diver in the North Sea. I was unfortunate enough to have to recover three unconscious bell divers, at different times. All three recoveries were successful. The decision to leave the water in the bell until full recovery was my own common

sense decision. In those days most company manuals said to blow the water as soon as possible.

Later I ran a bell diver training school in South East Asia for Comex. During this period, participating in hundreds of diver recovery exercises, we had partial loss of consciousness by two divers, hanging in the harness, when the water was blown out of the bell. Full recovery was made when the bell was re-flooded. The divers then had their gear removed and assisted with the re-stowing of gear in the bell. These experiences confirmed to me that to winch a diver in dry, would risk killing that man.

Phill Henderson

PRE-SCUBA DIVE MEDICALS AND AS 4005.1

40 Anderson Street,
Templestowe, Victoria 3106
18/1/95

Dear Editor

I am disturbed that, over the past few weeks, I have seen three instances where candidates have been passed "Fit To Dive" when it is my opinion, and by my interpretation of AS4005.1 standards, they should not have been.

The first case was a novice certified fit to dive when he was not fully examined from a neurological point of view. The diver denies he had a Romberg test done nor was asked to do Serial 7's. He said that he was not asked whether he uses puffers, which he does although he felt that he did not suffer from asthma at the time. He used to get just a little wheezy and would use his sister's Ventolin at times. He presented to me the day after diving, and was referred to the Alfred Hospital for treatment of decompression illness (sickness) after 3 shallow dives in 5 m (maximum) at the start of an Open Water Course. His instructor was so concerned about his profound lethargy that he was refused to continue with the course until he was cleared medically. He had 5 treatments over 5 days and been advised to cease diving. His pre-dive respiratory function test was apparently very borderline but not followed up. There was no pre-dive recorded serial 7 time nor a Sharpened Romberg score.

The second case was a young woman who had had trouble for a long time with "popping her ears" whenever she went flying or car driving in the mountains. She claims that her examining doctor did not ask her about this history. On examination he allegedly blew some air into her ear canals. She was not asked to do a Valsalva manoeuvre whilst he looked at her ear drums nor was an impedance tympanogram performed before and after such a manoeuvre. She had experienced great difficulty in her

pool work at only 2 m at the start of her scuba course, with ear pain that she could not relieve by any method demonstrated to her by her instructor, who asked her to get a second medical opinion. On testing there was no evidence of any hyperbaric injury done to her middle ear cavities. On impedance tympanography it was evident that she could not pressurise her middle ear cavities by a Valsalva manoeuvre. She could not even get her pressures to atmospheric pressure after several attempts. It was suggested that she should refrain from further attempts at scuba diving.

The third case is a candidate that I had failed earlier on several grounds, only to find out several weeks later that he had been passed "fit to dive" by another doctor, recommended by the dive school after the candidate was told he should not dive. I had spent some considerable time discussing all the reasons why he should not dive. I am informed that the dive school knew that he had failed and told him to get another medical from another doctor! I failed him because of his known previous aggressive and sometimes compulsive and illogical behaviour, IV drug use, the fact that he was Hepatitis C positive, a heavy tobacco user and had a mild peripheral neuropathy. He had been a patient of mine for a couple of years. His respiratory function showed he had a sub-optimal FEV₁ and a FEV₁/FVC ratio of 63%. His lung function was confirmed by a hospital respiratory function unit which demonstrated an 18% fall after a histamine challenge and a very prompt recovery after inhalation of Ventolin. His ratio was still documented at 63% after a couple of weeks of alleged non-smoking. I am told that his ratio had risen to 73% on the second dive medical which is still below the 4005.1 standard of 75%. He has undergone an Open Water Course !

I believe that possibly due to some form of perceived competition some doctors who are on the SPUMS Diving Doctor List, are doing quick and cheap dive medicals but are not necessarily following the AS4005.1 guidelines. I believe that one or two dive schools are not taking "NO" for an answer and thereby losing an intending student. They seem to be recommending the intending candidate to get a clear medical from another doctor who may not be quite as thorough. I can not for the life of me see how a complete history, examination, audiology and respiratory functions tests can all be done within the space of half an hour and costing only \$40 or so.

The point that I am making is that it is quite obvious to two of the students that something in their dive medical examination went wrong, and that they were allowed to dive when, as is now clearly apparent to them, they should not have dived. They have wasted their \$300 or more on a course they should not have undertaken in the first place. The third case was someone who was going to learn to dive regardless what was said to him and a dive school accommodated him!

I accept that we can not predict who is going to get decompression illness whilst undertaking safe diving practices, as in the first case. However it appears that the initial dive medical was not complete and information that could have been made available to the doctor was not given or found out because the appropriate questions do not seem to have been asked and the examination seems to have been incomplete.

Now that dive medicals are taking their rightful and respected role at the beginnings of a student's experience in scuba diving, it is not helping the cause when doctors, with the proper training, seemingly are not doing the right thing by the candidates. Unfortunately dive medicals are sometimes seen by some dive schools as something that is a waste of time and money for the student. If properly trained doctors do Mickey Mouse medicals, which are a waste of time, how are we going to keep the support for medicals from the responsible members of the diving industry?

Ross G. Wines

TECHNICAL DIVING

IANTD Australasia
PO Box 696, Petersham
New South Wales 2049
28/12/94

Dear Editor,

I was surprised to read Dr Gorman's statement, "The issue of technical recreational diving is one where a close liaison between the Society (SPUMS) and these agencies will be of mutual benefit" in the President's Report 1994 in the December 1994 edition of the SPUMS Journal.

Dr Gorman has also recently announced that the Society's 1996 Annual Scientific Meeting will be devoted to a workshop on technical recreational diving.

This is different approach to that previously adopted by both SPUMS and several prominent SPUMS members since recreational mixed gas diving was first introduced into Australia in 1991.

I recall Dr Gorman's editorial in the January 1992 edition of this Journal in which he stated "In view of the above, it is not surprising then that the SPUMS policy on 'HighTech' recreational diving is that it should be actively discouraged and that this Society will not oppose any government who consequently legislates some limit on recreational diving."

I can also remember statements such as “Say No to Nitrox”; “It would be in the public interest to regulate against helium-oxygen diving without a recompression facility onsite”; “All diving doctors are opposed to the use of nitrox for recreational sport diving”; and “I do not support the use of Nitrox by recreational divers” from prominent SPUMS members.

When technical diving “came out of the closet” in the late 1980s, many prominent overseas hyperbaric authorities realised that a “head in the sand” attitude would not make the problem go away. These authorities therefore chose to work closely with the technical diving community so that the new technology could be introduced as safely as possible.

The actions of Dr Gorman and several other prominent diving doctors, who I presume to be members of SPUMS, have undermined their professional credibility in the eyes of the Australian technical diving community. Why should the technical diving community trust them now?

Rob Cason
Director

IANTD stands for International Association of Nitrox and Technical Divers.

Mr Cason will be interested to see that the Prism Rebreather Seminars are brought to members attention on page 58.

BOOK AND VIDEO REVIEWS

SAFE DIVING (6th Edition, 1993)

Stracimir Gosovic,
Best Publishing Company, P.O.Box 30100, Flagstaff,
Arizona 86003-0100, U.S.A.
Price from the publishers \$US 55.00. Postage and packing extra.

This is an English translation of the fifth edition of a previously Yugoslavian, now Croatian, text. Dr Gosovic has for many years dominated diving medicine in a large section of eastern Europe. The original title was *Ronjenje U Sigurnosti*.

The book underwent five editions, last printed in Zagreb, prior to the English translation by Carolina Udovicki.

The format has not changed appreciably over the years, although the material has. This is not a textbook of diving medicine. Nor is it a diving manual. It is, however, a successful combination of both. As such, it has both pros and cons.

The book introduces the reader to a wealth of both practical and theoretical information, from both East and West. It also deals well with the historical developments of the subjects that it encompasses.

The translation was excellent. It is easy to read, and always understandable, even though some of the terms may be a little different to those we are accustomed to. No problems understanding what is meant.

Some of the history, especially that dealing with the Soviet block countries, was particularly fascinating. I was surprised to find that the helium tremors (HPNS) were first described by a Russian group in 1961, long before our

American and French colleagues entered this field. Similar factual information was given regarding the development of various pieces of equipment, offsetting the bias towards the western countries, inherent in most of our current diving texts.

About half the text is devoted to diving equipment, or techniques. This is probably what it makes it such a valuable aid to the diving physicians. They can easily reference the material that is readily available to dive instructors, professional divers and dive masters. Some readers will be perplexed when they encounter the discussions on equipment that is no longer available except in museums.

Historical equipment is given precedence over current. Knowledge of maintenance of a twin-hose regulator is not often required by present day divers. The photographs of this, and the buoyancy compensators, are definitely outmoded. Nevertheless, such material is of interest and value to others, and I personally had no problem with maintaining an interest while reading about the past.

There were certain anomalies which would possibly cause disagreement, e.g. the description of the International Sport Diving flag as being bright red with a diagonal white stripe. Fortunately, elsewhere in the text there is an actual photograph of the genuine International Diving Flag, Flag Alpha.

The second half of the text deals with diving medicine. There is no question regarding Dr Gosovic's expertise in this field, however his terminology is again somewhat outdated. Thus terms such as “squeeze”, as opposed to “barotrauma” are used. And many of the claims could well be questioned. This is especially so as regards

to the marine animal injury treatments, which are certainly no longer appropriate, if they ever were. The advice, ostensibly given by Dr Russell, for treating coelenterates is to use "concentrated alcohol, followed by weak flour, baking soda or shaving foam". This is presumably for treatment of coelenterates, although the term "venomous marine invertebrates" is used in its stead. I also note the advice to energetically scrub the wound. Not in most areas, one doesn't.

Many of the symptoms of otological problems would be called into question. For example I have yet to see middle ear barotrauma cause unconsciousness, and nor am I sure that loss of consciousness is often preceded by vertigo.

Despite the above comments, it must be realised that this textbook has an enormous amount of data for the diving physician. Most texts would never achieve this information density. As such, there must inevitably be some areas in which the standard is not maintained. Most of the text is accurate and specific. This is not the latest or most comprehensive work in diving physiology or diving medicine, but it is a valuable addition.

In my opinion diving physicians, especially those who investigate and treat diving accidents, should have this text. It will be of more value to the knowledgeable diving physician, for its description of diving techniques. For the diving instructor, it is probably of more value for the medical aspects. Both groups would benefit by its acquisition.

Carl Edmonds

ENCYCLOPEDIA OF UNDERWATER INVESTIGATION

Corporal Robert G.(Bob) Teather, C.V., Royal Canadian Mounted Police
Best Publishing Company, P.O.Box 30100, Flagstaff,
Arizona 86003-0100, U.S.A.
Price from the publishers \$US 75.00. Postage and packing extra.

Bob Teather is a diver in the Royal Canadian Mounted Police and this book is based on his experiences in over 500 underwater investigations. These included recovering bodies, cars, aeroplanes and firearms and investigating murders, thefts, frauds and scuba diving accidents. Besides describing in detail the procedures that need to be carried out for the various investigations he takes the reader through the legal processes including acting as an expert witnessing an actual murder trial where the body was found in the water close to where the victim

had been seen swimming earlier. Unfortunately for her murderer it was clearly demonstrated that the underwater obstructions and current action carried floating objects across the river from the swimming beach. Corporal Teather, who holds Canada's highest honour for bravery, the Cross of Valour, in his evidence as an expert, refused to answer a number of questions, stating that the questions were outside his area of expertise. An excellent example for medical witnesses in diving related court appearances.

The book is written for Public Safety Divers. In Australia the functions of these people are normally carried out by police divers, but on occasions recreational diver have to search for one of their group who has failed to surface. The two sections on locating the body are full of useful advice and emphasise that very much more often than not the body is close to where the swimmer or diver was last seen.

The chapter, Drowning - what really happens, is graphic. The sections on diving physiology are reasonably accurate but unfortunately in two places epiglottis has been used when glottis was meant.

The author stresses the need for investigative divers to dive safely and emphasises that the recovery diver must be observant and look thoroughly before moving the body or object to be recovered. He recommends photographing the scene before moving anything. He tells the diver to make notes, soon after getting out of the water, of what he, or she, saw and did underwater. These notes can then be used, in the witness box, to refresh the speaker's memory.

It is a fascinating read for a diver, or a medical witness in diving cases, and provides an excellent insight into North American underwater investigations. As water is water wherever it is the author's lessons can be applied everywhere. The book is already in use in Police diving circles and the next review is written by Sergeant Barry Gibson of the Victoria Police.

John Knight

Once every so often a reference comes your way which relates directly to your line of (morbid) work and immediately you relate to it. The *Encyclopedia of Underwater Investigations*, certainly fits the bill and will no doubt become a Police Divers' bible. In this, Corporal Teather's latest publication, the words from a song by Roberta Flack, "Killing me softly with his song", come into my warped mind. He is actually telling our story (police divers) relating to death back to us and the rest of the world. The book gives vivid descriptions of the duties performed by Police divers and how to manage those tasks. It is a show and tell of the experience and knowledge gained by Police divers during the past twenty years.

Some years ago I obtained a copy of *The Underwater Investigator* by Corporal Teather of the Royal Canadian Mounted Police. I recall reading it at the time and saying "finally a Police diver has made time to write about his work underwater". This was to the prelude to the *Encyclopedia of Underwater Investigations*. I believe he has now realised one of his life long ambitions and given us his most significant work to date in this highly specialised area.

You have all heard of the "Mounties" credo of always getting their man. Although there are numerous connotations to this credo, I wondered if this credo is still politically correct and how these "Men in Red" fared in the pursuit of the wayward fairer sex. This publication is ample evidence that they do it just as well underwater, thank you!

The manual uses over 500 underwater recovery operations in North America which provide an extensive information base to explain many of the observations and experiences. It gives many first hand accounts of actual incidents based on different scenarios using evidence obtained and post mortem observations by the diver at the scene. The chapter on drowning is an interesting insight into a victims final moments of life.

It contains arresting chapters on Body Recovery, Investigation of Death, Scuba Fatality Investigation, Court Testimony and Types of evidence. It dispels many of the myths and mysteries relating to the movements of a dead body in water. The book provides a rational and unemotional foundation from which to launch a competent underwater investigation.

We are all aware of the medical terminology "acute angina" but does everyone know the meaning of "Cutis Anserina". The mind boggles, especially for this layman, but its meaning is to be found in the Glossary of Terms which list the more common terms used in pathology reports to the coroner. Commonly called "goose bumps" in Australia, it is the bumpy appearance of the skin caused by contraction of the erector muscles at their base of the hairs. In a body it is as a result of rigor mortis. In a living person it is caused by fear, cold, etc.

The chapter on Court Testimony provides persons involved with courts an insight into what to expect and how to prepare for the courtroom contest. The chapter, Transcript from a Murder Trial, gives a fascinating real life account of a trials and tribulations of an expert witness in the legal arena. It also highlights the fact that some underwater investigations will be the subject of close legal scrutiny and therefore require accuracy and a high degree of competency.

The book contains some very graphic material from actual incidents which will no doubt upset and offend

many people. However the publication is primarily directed for use by Public Safety Divers (Police divers in Australasia), pathologists and relevant members of the Judicial system. It gives an honest, no holds barred, account of the expectations of Police divers and how those expectations can be met.

Those persons with special interests in Scuba accident/fatality will find the chapter, Scuba Fatality-Accident Investigation, enlightening to say the least. Most of the procedures for the investigations are similar to those carried out in Australasia and it is interesting to note some of the, Common Observations - Open water Scuba Fatalities. The beacon from this chapter is in the Conclusion. The victim generally was located "on the bottom" with the "weight belt still on".

The *Encyclopedia of Underwater Investigations* will become a helpful resource and reference manual for those persons involved in underwater investigations, pathology and the judicial system. It will also provide a valuable insight for persons entering this field and those interested in Police diving operations.

Sergeant Barry Gibson
Victoria Police Search and Rescue Squad

WHO'S WHO IN SCUBA DIVING

Best Publishing Company, P.O.Box 30100, Flagstaff, Arizona 86003-0100, U.S.A.

Price from the publishers \$US 24.95. Postage and packing extra.

This 436 page paperback is prepared under the auspices of the Academy of Marine Sciences and Underwater Research, and published by Best Publishing Company USA. It is stated to be an annual publication, and this perhaps explains the very poor quality paper, as an attempt to keep the costs down.

It is divided into nine sections. The first and largest section deals with prominent individuals; the second with agencies, foundations and institutes; the third with equipment manufacturers and suppliers; the fourth with publishers and magazines; the fifth with dive destinations and resorts; the sixth with travel agents; the seventh with dive retail stores in the US; the eighth with commercial divers and commercial diving schools; the ninth with recipients of major awards in diving.

Do not let the Science and Research affiliation lead you into a belief that this is anything other than a recreational, dive industry and commercial address book. If you are interested in diving science or technology, physiology or medicine, this is not a worthwhile purchase. If

you are interested in the diving marketing industry, scuba diving magazines, etc. then this list of addresses, telephone and fax numbers might be of value to you.

The "individuals" section is not, as one would have thought, a list of significant individuals in the world of diving medicine, physiology or science. It is essentially a list of people who are prominent in scuba diving magazines, connected to the glamour, dive travel and instruction. Also, it tends to be restricted to the USA, although Ron and Val Taylor from Australia do get a mention. It does not even extend to the remainder of the North American area. For example, Ron Nishi has not been included, despite his decades of brilliant involvement and innovation in the diving world. But such celebrities as "The Grateful Dead", a rock group who dives with Captain Don Ruth, on a live-aboard vessel in Hawaii, do rate a mention. It also includes all the actors and actresses who have been involved in scuba diving in the movies. Essentially it is a book of scuba diving stars, as opposed to research or scientific contributors.

Under the "awards" section, it seems as if you stand more chance of being noted if you have won a spear fishing award, than a scientific one. Thus, the Beaver Lake (Arizona) spear fishing champion of 1967 would be recorded, whereas none of the Undersea and Hyperbaric Medical Society awards, even the most prestigious, have been mentioned.

Under the "agencies, associations, etc" the DCIEM does not get a guernsey at all, so I do not suppose one should be too worried that hardly any of the other major diving establishments throughout the world, other than in the USA, have been mentioned.

To refer to the many noteworthy omissions from the other sections would be virtually repetitious. They all follow the same pattern of being essentially lists of USA operators or agencies, involved in the recreational and glamour aspects of the diving world.

That is not to say that the book is not of value. If you are interested in recreational diving, and wish to contact a high profile person, agency, equipment manufacturer, popular dive magazine, dive resort or travel agent, or to make contact with some retail dive store in the USA, then the book is of value. The information you get will not be substantially different from what you would obtain as a subscriber to dive magazines, if you read the advertisements, but it is all between the covers of the one text. Thus, for an American dive instructor or dive master, or even an enthusiastic diver, the text is some value.

Even though it is now August, 1994, the book that I received dealt only with addresses and events up to 1992, many of which are now outdated. Thus, as the publisher infers, if the book is of any interest to you whatsoever (and

it certainly would not be if you are an Australian), then it would be worthwhile to put in an order to update the text annually on publication.

I was surprised to see that the scientific genius of diving medicine and physiology, Albert Behnke, did receive mention, albeit in less than two lines, and as the recipient of a New Orleans Grand Isle award, in 1969. Had Al still been alive, I am sure it would have caused him some amusement, to be remembered for this. Now, had he played the guitar underwater, then.....

Carl Edmonds

**TREASURE OF THE CONCEPTION.
THE ARCHAEOLOGICAL RECOVERY OF A
SPANISH GALLEON.**

William M Mathers and Nancy Shaw.

APA Publications (HK) Ltd. 1993

ISBN 0-931234-56-7

Review copy supplied by Best Publishing Company, P.O.Box 30100, Flagstaff, Arizona 86003-0100, U.S.A.

Price from Best Publishing Company \$US 34.95. Postage and packing extra.

Readers of the National Geographic whose memories go back to 1990 will recognise the cover of this book, for the painting appeared in that issue. This beautiful book containing a newer and longer telling of the story of the Manila galleon trade and the wreck of the Concepción in 1638 gives more details of the wreck, its finding, excavation and the diving that recovered the treasures.

Our forebears braved the seas in overcrowded, overladen and often unseaworthy, small ships and often came to grief. The Nuestra Señora de la Concepción was the largest galleon of her time at 2,000 tons. Even so she was only 45 m (150 ft) long, not very longer than a modern patrol boat, but with a very different shape for her beam was 15 m (50 ft). Into this hull was crammed provisions and water, in heavy earthenware pots, for six to eight months as well as some 400 passengers and crew, to say nothing of her cargo. Her safe arrival in Acapulco was handicapped by an incompetent commander who set the wrong course, insubordinate officers and bad weather. A combination which saw her dismasted off the southern coast of Saipan in the Marianas. She was driven onto a reef close to shore. The story of the few survivors who eventually reached Manila reveals the esteem in which the Spaniards were held in those parts. The survivors were the few who were not killed as they came ashore.

The locals salvaged what they could reach but the Spaniards did not come until 1674 when they salvaged most of the ships cannon. No one appears to have attempted any salvage until Mr Mathers started in 1987.

NOTICE OF A NEW PUBLICATION

**MEDICAL ASSESSMENT OF FITNESS TO DIVE
AN INTERNATIONAL WORKSHOP AT THE EDINBURGH CONFERENCE CENTRE**

David Elliott

We all know that to dive safely requires one to be physically, medically and mentally fit but medical examiners also know that it can be difficult to make this assessment in some divers. Guidance from sports diving agencies and government bodies contains useful advice but, in many individuals, the deciding factors on fitness to dive are not obvious and the decision ultimately depends on the knowledge and experience of the examining doctor.

The navies of the world have always set high standards but these probably eliminate many candidates who could have dived safely. In contrast, some recreational divers, insisting on their personal freedoms, have demonstrated, in some circumstances at least, that safe diving is compatible with medical conditions which certainly would disqualify them for work as divers. The sports diving instructor and other working divers lie between these extremes and, like the recreational diver, should benefit from the lessons of both.

A 4-day international workshop on the assessment of fitness for diving was held in Scotland last year and was attended by around 200 diving doctors from some 20 countries. One session was devoted to the need for a new approach to the frequency and content of these examinations: one recommendation was that, after a stringent initial examination, adherence to a conventional format could be reduced for some years until augmented by a flexible series of periodic assessments by diving medical specialists.

DAN Europe organised a review of particular problems encountered in recreational diving. Each organ system was then reviewed by a consultant and evidence, if any, for the absolute and relative contraindications discussed. Also addressed were the appropriate levels of fitness for an ageing population of divers; the difficulties of assessing the safe resumption of diving after an illness, injury or diving incident; the need for bone necrosis and other long-term health surveillance, particularly in the deeper divers; and the collection of data from the working diver for the epidemiology of diving-related illnesses and sequelae. From all this, changes to existing guidance were recommended. Transcribing the discussions from the tapes was a lengthy and onerous task but the result is essentially a verbatim account, catching the spirit as well as the substance of each debate.

The European Diving Technology Committee held an open meeting in Luxembourg one month later on the international harmonisation of operational safety, training, equipment certification and medical standards. The proceedings of its medical sessions are not being published but references to its recommendations are made in editorial commentaries within the Proceedings of the Edinburgh Meeting (Editor: David Elliott). The outcome is a comprehensive review of the considerations which make up an assessment of fitness to dive safely, whether this be for work or pleasure. Also, it provides the reader who was unable to get to this workshop, some new perspectives on the assessment of fitness for safe diving.

Prof David Elliott is Chairman of the European Diving Technology Committee and is at the Robens Institute of Health & Safety, University of Surrey, England.

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Enquiries: Fax (44) 181 786 7036

The diving was conducted with snorkels, surface supply with a full helmet and scuba. Oddly enough the deep work (to 75 m) was done with scuba. Presumably this was because the surface supply compressors could not cope with the depth, though there is no mention of the reason. It was a well equipped expedition with a recompression chamber, submersible compression chamber (diving bell), mini-sub and ROV. There is little to be learnt from the text about the technical side of the diving.

The items recovered are now in a museum on Saipan. How they got there gives an insight to the problems of financing such an expensive exercise. One wonders why archaeology figures in the title of the book. From the text it was mostly a treasure hunt. Very little except some metal objects, including a cannon and an anchor, and many storage jars remained of the ship. The excavation of the Mary Rose off Portsmouth was truly archaeology.

The photographs and illustrations are magnificent and show quite clearly the diving problems and the beauty of the artefacts recovered. At the advertised price it is excellent value for money.

John Knight

VIDEO REVIEWS

DIVE SAFELY - VIDEO (PAL VHS Version)

Available from Scuba Enrichment and Awareness, 16 Orchard Way South, Rockville, Maryland 20854, U.S.A. Fax 301 424 2796
Price \$US45.00. Postage and packing extra.

This is a 42 minutes video tape, prepared by a well-respected trio of Arthur Bachrach, former US Navy Diving researcher and scientist, Dr James Vorosmarti, former US Navy Diving Medical Officer and Philip Sobocinski, Jr., a dive instructor.

It has been available in the NTSC version for 2 years, but it is now available in PAL VHS, suitable for Australian television viewing.

It is essentially a video for established, but not very experienced, divers who are about to return to diving or embark on their annual diving holiday. It is thus of considerable value to many diving physicians, and divers of moderate experience.

Firstly there is a good reminder of the etiquette and safety aspects of boat diving.

Secondly, it does deal with some of the diving accidents, such as panic, middle ear barotrauma, air embolism

and decompression sickness, but these are dealt with superficially, more suitable for a non-medical or paramedic audience, although interesting to everyone.

Thirdly, it is a well constructed and professionally produced video, lasting 42 minutes, suited for commercial operations (dive instruction, dive boat charters, dive specialty courses etc.)

It is available from Scuba Enrichment and Awareness at a cost of \$ 45, but contact them directly to find the exact cost with packaging and postage which varies with the current exchange rate and skyrockets with air mail postage. Any entrepreneurs interested in franchising the video in Australia or New Zealand, take note.

It is essential to specify the PAL version, as I had some difficulty in obtaining my first copy. Nevertheless, they replaced my incorrect copy very rapidly and at no extra cost.

Carl Edmonds

UNDER PRESSURE. Managing decompression illness A 3902.

42 minute video. Year of production 1993
Services Sound and Vision Corporation, Chalfont Grove, Narcot Lane, Chalfont St Peter, Gerrards Cross, Buckinghamshire, England SL9 8TN. Tel (UK) 0494-871-773. Fax 049-872-982.

Price £40.00 Postage and packing £6.00. These must be paid in UK currency before despatch.

The aims of this Royal Navy video are to consider the laws of physics which govern the effects of decompression illness (DCI) on the human body and to describe the new worldwide system of classification being developed to define the various manifestations of the illness and its emergency care and treatment. The principles of management of DCI are illustrated by an incident involving the rescue and treatment of a diver trapped underwater. The production is directed at all ranks of Service divers and, having an Unclassified security rating, is freely available to civilians.

I feel that the aims are amply achieved. The video begins with flash footage of a seabed incident followed by an over-rapid ascent resulting in a neurological bend. A historical note is introduced by mention of the first records of decompression illness which were made some 150 years ago, and the path of the processes of understanding the disorder as well as the various refinements developed in its treatment are briefly outlined.

The key advance in clinical observation which this video describes particularly well has been the discarding

both of the old classification of cause by site and the newer classification of Type I (mild) and Type II (severe) forms of decompression sickness, the latter being of limited practical value. The Royal Navy and most other diving medical authorities in the developed world now favour a functional classification based on total clinical manifestations and their development with time in each individual case.

The physiological basis of gas dissolution in human body fluids and tissues is shown by excellent graphical representations of Boyle's, Dalton's and Henry's Laws in action, and the Schlieren photography used to depict nitrogen dissolving into tissues is quite the best I have ever seen. The need for decompression stops on ascent in order to allow off-gassing is described in conjunction with the statement that bubble formation is thought to start off decompression illness either when the capacity of the lungs for bubble extinction is exceeded to a physiologically intolerable level, as in a rapid ascent, or else when arterial gas emboli originate from a ruptured lung, or are carried into the systemic circulation through patent cardiac foramina. That either mechanism can produce the same clinical result is the rationale for now using the all-embracing term DCI. In addition the role of endothelial damage caused by bubbles in the circulation in the pathogenesis of decompression sickness is shown in cartoon form, as is the action of bubbles in stretching the blood vessels surrounding the white matter of the spinal cord, thereby interfering with the local flow of blood.

The reconstruction of the diving incident is both dramatic and brief enough to hold the attention of an audience. The short history taken by the diving supervisor from the patient is well acted, and a simple but effective neurological examination described and partially demonstrated (one of the video's directors told me that as the "patient" remained clad in his neoprene long-johns testing of lower limb reflexes was not performed!). Attention is paid to the importance of adequate hydration in the care of the patient as well as of bladder function as a diagnostic sign. The changes of symptoms and signs in the neurological, cardio-pulmonary, cutaneous, lymphatic and general constitutional areas are monitored with time in a dynamically based system, thus ensuring accurate reporting of progress, and the relaying of a clinical summary from the site of the incident in Gibraltar to the diving medical specialist in Portsmouth is shown. On the basis of this information a decision is made on the appropriate recompression regime to use and the patient closely monitored whilst on it. After full recovery the final approval of a diving medical specialist is still needed before the patient returns to diving, a Service regulation much observed in the breach by civilian victims of DCI.

As a teaching video this production impresses by the quality of its graphics, the clarity of its photography and the balance of its sound. Some, like the Final Judging

panel at the December 1993 British Medical Association (BMA) medical video competition may be put off by the rigid commands and procedures of Royal Naval diving as well as by the Devon accent of the dive supervisor. But the fact that this production received a BMA Silver Award nomination (I had hoped for Gold) is testimony to the skills of its makers. A quibble can be raised over the decompression schedule to be used for the dive profile described, a dive between 20 and 25 minutes in duration requires the 25 minute schedule for the depth concerned, but this apart, the reviewer recommends it to all novices in diving medicine, divers and doctors alike. Together with "In Deep" its sister film on diving physiology, which is available at the same price from the same address, this production stimulated both a high level of recall of the salient facts and a strong desire to learn more when it was shown to an incoming class of British Army medical officers, few of whom had any previous experience of hyperbaric environments. What more needs to be said?

Nick Cooper

IN DEEP. The physics and physiology of diving A 3791

33 minute video. Year of production 1991
Services Sound and Vision Corporation, Chalfont Grove,
Gerrards Cross, Buckinghamshire SL9 8TN, UK.
Price £40.00 Postage and packing £6.00. These must be
paid in UK currency before despatch.

This 1990 training video on diving safety, made for the Royal Navy, covers the basic physics and physiology of diving, nitrogen narcosis, buoyancy control, carbondioxide toxicity and decompression sickness. It is an introduction to the perils of diving and discusses why they occur and how to avoid them. It is aimed at the ship's diver, the basic diver trained by the RN. To the recreational diver the gear is strange, dry suits and full face masks with twin cylinders mounted valve down. But the physiological problems faced by a naval diver are the same as those imposed on any diver and so this video will be of interest to all those who dive or are thinking of learning to dive.

The dive team is large and the diver is tethered to a tender by a surface line and to his companion by a buddy line. The dive boat has a chamber on board and a diver with a sore elbow is started on oxygen and compressed. No dithering about wondering whether to treat a suspected decompression illness. A far cry from the usual recreational diver, many of whom use denial as treatment for the first few hours.

There are a few surprising features. The use of the word squeeze to describe the effects of pressure can be defended, but it and the use of "reversed ear" in the

discussion of aural barotrauma makes the subject less clear than describing the process as barotrauma of descent and of ascent. There was no mention of the common appearance of blood in the mask following aural barotrauma, probably because using a full-face mask it is seldom seen.

There is a good discussion of the dangers of high oxygen partial pressures and for this reason alone this video would be worth showing to all budding technical divers.

The video makes it quite clear that diving safety comes at a price, learning about the effects of pressure and

then learning how to avoid the dangers, learning about the equipment and how it works and then practicing using the equipment under supervision, with help at hand, until doing the right thing is second nature.

However the video does not go into the subject as thoroughly as the RN's 1970s films on diving physics and physiology and decompression sickness. The explanation of pressure changes in the former remains in the mind of anyone who has seen it as Newton apples are used in the explanation of pressure measurement, in Newtons.

The video is expensive, but worth the money.

John Knight

ARTICLES OF INTEREST REPRINTED FROM OTHER JOURNALS

PARALYSIS STARVATION OR FAMINE THE MISKITO DICHOTOMY CONTINUES

Bob Izdepski

Universal Diver Editor's Note

As we are reaching a new and broader audience with *The Universal Diver*, I am going to reprint a condensed version of "Paralysis, Salvation or Famine: The Miskito Dichotomy" for the new readers and add an updated ending that starts on page 15, under the title "A History of Exploitation", so that my old readers can skip the beginning and then read the latest findings of our further investigations that continue to lead the pack in the hunt for facts, in this, the most brutal case of maritime exploitation to ever curse the pages of seafaring history.

I hesitated, feeling that I was being led into a tomb. I was about to face my nightmare, the fear of every deep sea diver. Dr Norvelle Goff motioned me into a cinder block shed beneath the jungle clinic. I resolved to show no emotion, though I was feeling a whole body revulsion.

An emaciated man was collapsed on a cot in the thin grey light. Another man struggled on a parallel bar apparatus, dragging his dead legs behind him.

Dr Goff told the men that I was an American "journalista", as well as a fellow deep sea diver, who had come to interview them about their accidents in order to help other divers in the Honduran lobster industry. Would they mind being interviewed and photographed? Each man smiled bravely and said that he would help.

The doctor gave her clinical descriptions of each man's paralysis, well-used crutches hanging on the wall behind her. She turned and spoke to the man on the parallel bars in a Miskito Indian dialect. His name was Reginaldo Garcia.

He said he had become paralysed after a dive to 25 brazos (48 m or 150 feet). Upon surfacing, he had had pain in his back, and shouted for his dugout canoe tender to come to his aid. He had struggled into the canoe and then lost all feeling and movement in his legs. The tender paddled him back to the mother ship, a steel hull shrimp boat, where crewmen dragged him aboard. He lay on the decks of two different ships for five days before reaching the recompression chamber on Roatan, where he received oxygen recompression treatment from the Episcopalian medical mission at Anthony's Key Resort.

This diver's paralysis was caused by the "bends", a condition resulting from exceptional exposure to depth. If a diver stays underwater too long, his body tissues absorb more nitrogen from his breathing air than can be released upon ascent without traumatic bubble formation. The enlarged bubbles then clog his capillary system, impeding the flow of oxygen rich blood to vital tissues, causing tissue death: in many cases, nerve tissue death.

The only treatment for the bends involves recompression. Typically, the victim will enter a pressure chamber and be recompressed to an equivalent depth of 18 m (60 feet) of sea water to shrink the size of the air bubbles in the body. The victim breathes pure oxygen to purge himself of the excess nitrogen.

Regrettably, the treatment came too late for this diver. Recompression therapy is most effective if administered within minutes of a decompression injury. The

paralysis of this man was permanent. There are many hundreds, if not thousands of divers paralysed in Moskitia. There are 900 recorded paralysis cases, but many others go undocumented due to rudimentary communications in the region.

That region is known as "The Mosquito Coast", a name given to the tribal territories that straddle the Honduran and Nicaraguan border and touch the Caribbean Sea. It is a modern name for an ancient land, a steaming jungle marsh that received its forbidding name from some long-forgotten navigator. He saw fit to warn his fellow mariners away from its malarial swamps; his message in its name. Today, the Honduran segment of Moskitia is encompassed by the province known as "Gracias a Dios" or "Thanks be to God".

The coastal marshlands are spider webbed by rivers that recede into low lying rain forests and then snake up into fog whiskered mountains. To this landscape we add the Miskito Indian tribal peoples and a very few outsiders. Mix these players with their driving forces: Superstition, Hunger, Ignorance, Desperation, Third World Politics, Faith and Hope and there lies the skeleton of this tale, demanding from me its voice to speak to you with purpose.

The root of my story reaches back to Sabine Pass, Texas, in the summer of 1985. After supervising the load out of a ship for a three or four week commercial diving operation, I met a trim built man in his 50's. He had the cracked leather face of a green sea windshipman: sparked by iceberg eyes.

He claimed ownership of a 36 m (120 foot) workboat tied up at the dock, astern of us, ripples of heat rising from it. It was decorated with yellow tape: the words "US FEDERAL MARSHAL" imprinted on it. The ship owner cursed something about how his captain, "the rotten bastard" had been caught smuggling drugs.

He knew nothing of that low-minded activity, of course. He was suffering grave injustices at the hands of the federal authorities; his ship having been seized, his freedom being in doubt.

I did not care for the flavour of his hard luck story and heeled leeward to drift toward some shade and a cool glass, glad that I was ever free from the ensnaring troubles of a smuggler's life.

Turning, I saw a coal black man leap the 10 or 12 feet from the bow of the impounded ship into the water.

He swam and cooled himself, then laid hold of a three quarter inch line that hung from the bow bit. Hand over wet hand, he climbed that rope, grabbed the gunwale and swung aboard.

I was impressed with the man's hand and upper body strength, though I acted cool. Frankly, I couldn't have made that climb with the sea afire and a gaff in my lip. "Who's that?" I asked the ship's owner.

"One of my lobster divers." came the satisfied reply. "You can buy one for five or ten bucks a day."

This guy was bad, but he certainly had gotten my attention. He said that he owned an island off Belize and fished lobster in those waters.

"My Indians can dive all day at 21 to 35 m (70 to 120 feet)." he boasted, then laughed. "They'll last a couple weeks and then start bitching about pains and a little paralysis. I fire them when we hit the beach, and buy a few more. There's hundreds of them leaping for the job. The trick is to keep them from breaking your compressor when they get grumpy after a while at sea. The little bastards will throw parts overboard when they want to go in."

I tried reasoning with him to try to make him understand that if he ran a proper dive station with a recompression chamber aboard, he wouldn't have to be re-training his crews all the time. His men could be healthy and want to stay aboard for work. They would not be sabotaging his gear and he could have an efficient, profitable team of divers. I didn't even try to broach morality with him. It would be a waste of time. but I thought that he might recognise his own economic self-interests.

He chuckled at his perception of my naivete. "A chamber costs \$15,000 to \$20,000. It'd take a long time at five bucks a day to touch that." he said. "Dime a dozen, these pukes. Why waste money on 'em?"

This man, not ignorant of diving procedures, was without excuse for his actions. He had rotted his soul. I spat tobacco on the ground at his feet, looked him in the eye, smiled and left. I'd found my cosmic enemy: not the man, but his ruling spirits: Greed and a slaver's prejudice.

Eight years later, I was thinking about him as I made preparations to investigate reports of similar diving atrocities; on a massive scale, off the Mosquito Coast of Honduras. This time, I could do something about it; I had a magazine.

The reports I had heard were factually anchored by Dr Tom Millington, Medical Director of the Hyperbaric and Diving Medicine Department at St John's Pleasant Valley Hospital, Camarillo, California. The good doctor backed up and elaborated upon the unbelievable scope of Type II Decompression Sickness ravaging the Honduran fishing banks.

Tucking away a short list of names and towns, supplied by Dr Millington, I started to pack my expedition

gear along with my "home schooled" 14-year-old son, Jesse, who was coming along for some third world education; which started with packing. I threw half the contents out of his bag (hairbrushes, cologne, shampoo, etc.) and started over. Jungle boots, 100% DEET insect repellent, poncho, one short and one long set of clothes, compass, knives, water purification tablets, first aid kit, camera, video gear, butterfly stitching tape, antibiotic cream, canteen, mosquito net, space blanket, snake bite kit, 30 m (100 feet) of one-eighth inch nylon parachute rope, toothbrushes, and little else. We had started taking Chloroquine (Malaria) tablets two weeks prior to our flight. In Honduras, we would buy Penicillin, in case of sickness or wounding. If a bush plane goes down in Mosquitia, it is an instant survival expedition.

We dropped out of the thunderstorm in a plane built during the Bogart era and saw beneath us an endless marshland, Mosquitia, painted with every shade of green and brown. Thick vegetation clung to the banks of the larger rivers which interlinked shimmering lakes. Grass-roofed huts stood on stilts at their shorelines. Lone dugout canoes were poled along by tiny brown men and small herds of cattle spotted the marsh grass. This was "high adventure with no referees" and I felt great.

We landed on the dirt runway of Puerto Lempira, and asked directions to Mopawi, a "peace corps" type organization dedicated to the education of the Miskito Indian people.

The town is the unofficial capital of Moskitia and is home to about 1,000 people. It is on a bayou about 40 miles from Nicaragua, 10 miles from the Caribbean and 150 miles from the nearest donkey trail into the main of Honduras.

A light sea breeze carried the organic smells of Caribbean life to me, highly seasoned with wood smoke and tortillas. Chickens, pigs, cows and laughing children were everywhere among the palm frond roofed huts of the town. Whole families, babies through grandparents, lived together, as evidenced by the local "porch life". I saw a young man with emaciated legs, lying on a porch mat with his family tending to him, they acted defensively when I raised my camera. I left them in peace.

As we neared the Mopawi Educational Center, the rising cries of seagulls were followed by the tidal smells of aquatic life. The Mopawi compound was on the waterfront and there I found Paul Stevens, an English social worker who's name was on the list supplied to me by Dr Millington.

After settling down, Paul Stevens briefed us on lobster diving. "The Miskito diver knows nothing of diving physics. He only knows that the more lobster he catches, the more he is paid. Sometimes they dive with bleeding ears, due to the water pressure. That is considered

"macho". When they get bent, most think that it was caused by mermaids. They dive without pressure or depth gauges and without watches. Many die offshore and are never recovered. Drug use on the boats is common. The money they earn is five or six times what a labourer earns. They're literally dying to dive. One hundred per cent of the divers are always bent and show central nervous system impairment. Often the divers support whole family trees. There is very little other work in Moskitia."

The lobster boats are typically 12 to 27 m (40 to 90 feet) long and they will anchor off the coastal towns and sound their horns, calling the men to sea.

Paul Stevens summed it up. "Thirty to 50 men paddle dugout canoes through the surf to meet each mother ship and board her. Then it is a 60 to 300 mile trip to the fishing banks, spent on deck or sleeping on pallets packed into the ship's hold. The men are divided equally as divers or cayuca (canoe) tenders. The injured divers or boys (typically aged 14-17 years old) paddle the 15 foot long fibreglass cayucas carrying one diver and his scuba tanks. The mother ship will anchor on a reef structure in a depth known only to the captain, and the teams will leave in their cayucas at dawn, separate and hunt the lobster. The men will dive, tank after tank, until lunchtime. Eat, grab more tanks and go back to diving for the rest of the day. Each man consumes eight to 20 tanks of air each day at depths of 24 to 48 m (80 to 160 feet). Two or perhaps three tanks a day would be close to the U.S. Navy diving tables limit. The diving done in the lobster industry is suicidal, if the men were aware of the risks: criminal, since they are kept ignorant by captains and boat owners who do know. During the day, all divers will experience joint pain and other symptoms of damage from the bends. Some are paralysed right away, most work on in pain through the 12 to 15 day excursion; all are sick beyond their knowledge. They make \$200 to \$300 (US) per voyage. The average labourer's day rate is \$3.00 (US).

Paul Stevens continued, "In the last three months, since the government lifted its lobster fishery moratorium, we have been able to document 10 diving fatalities among the Miskito divers of the Gracias a Dios Province. There may well be more. It is difficult to tell with only word of mouth communications. This is a huge area with a population of 45,000, at least 4,000 of those people are lobster divers."

Lesser incidents, like paralysis, had not been calculated yet, though it was sure that recent "incidents" far outnumbered fatalities. Paul said there are lots of paralysed divers lying out in the bush just waiting to die.

"To realise the impact of this industry here, calculate that we have 22,000 males, one-half of them are either too young or too old to be divers. Of the remaining 11,000, at least three-quarters are divers or disabled divers.

This is not only a vital industry; it is the ONLY industry. Without it, the economy stops, causing all manner of hardship and leading to starvation."

The next morning, Jesse and I caught a single engine bush plane to the Clinica Evangelica Moraza in Ahuas. Home of Dr Benno Marx and the only recompression chamber in La Moskitia.

We had prayer and breakfast with Dr Marx, his sweet wife and four well-mannered children. After talk with coffee, I went on rounds with the doctor, toured the clinic, the operating room and saw the Vickers 2.8 atmosphere monoplace chamber. We met up with Dr Norvelle Goff and Dr Marx left me in her care. She asked if I'd care to visit the two paralysed divers in physical therapy. I tensed and said. "That's why I'm here."

After meeting with the two paralysed divers and hearing the story of Reginaldo Garcia's decompression accident, I asked Garcia, "Why it had taken him five days to reach the recompression chamber on Roatan?" It was because the captain would not leave the fishing banks. After about two days, he was transferred to another ship that was heading for Roatan: then two more days sailing time.

There had been 30 working divers and 30 cayuca tenders, plus the ships crew. It would be very expensive to stop work and transport a sick man to a chamber. Sometimes the divers would strike to force a captain to seek medical aid for one of their divers. He had, himself, stood up to different captains during his 13 years as a diver, demanding and winning medical aid for other men. Now that it was his turn to be the victim, he saw that the other divers feared the captain and none would stand for him, their fallen brother. He stopped with an ironic laugh that could not hide the wetness in his eyes and stared past me into empty space. I wanted that picture to tell his story, but I turned aside, out of respect for the man. Words will have to do.

The man on the cot was in much worse shape. He looked like a starved coyote, slurring his words like a drunk with confusion clouding his eyes. He had organic brain damage, total paralysis from the chest down with absolutely no feeling below his heart. He had shown no response to any chamber therapy.

He is Eliceo Alvarez and he had been a diver for 12 years. Eliceo said that he had been diving in 35 brazos (210 fsw) when he became paralysed. The details were not clear, but his ship had abandoned him on the coast and he had spent five days crawling through the brush in search of a Brujo (or witch) to cure him. He found her and was treated with herbs and potions, to no avail. Though the Brujos may be skilled in some treatments, this was a new disease. Type II central nervous system bends was caused

by a demon she could not exorcise. In desperation, she made a poultice of gasoline and toilet paper and set it afire in an effort to "jump start" his legs. It did not work and the resulting ulcerous burn was not healing. Four days later, or nine days after his accident he flew into the clinic for a chamber treatment which produced no beneficial results.

It was a moot point that Benno's chamber can only descend to 18 m (60 feet) of pressure and that the man probably needed treatment at 66 m (220 feet) on the Royal Navy tables. Treatment should take place within a few minutes of the onset of the bends in order to resolve the problems; even so, it is not always successful. Treatments administered days or weeks later have very little hope of accomplishing much at all. In Eliceo's case, nada is all he got, nothing is what he has, no future except a slow death. In fact this burn may kill him if it continues not to heal.

When I got out of there, I wandered around for a while to give it all time to sink in. Cruel times and bitter problems.

Frustrating too, because we have answers to most of these diving problems; solutions that are not only feasible but economically desirable !

If oxygen were available on every boat, injured divers could be treated "on site". They could hang off underwater at the end of a 9 m (30 foot) hose and breathe oxygen through it, purging their systems from the bends. (This may not be the best treatment in a perfect world, but it is a workable stop-gap solution for the third world.) No longer would hatred and fear rule the divers and the boat crews. No longer would productive workers be continually lost to the fleet, to society and their families. No longer would everyone be helpless to assist their wounded comrades. (The only treatment now is to soak the victim in used diesel fuel.) No longer would captains be forced to choose between continuing work or halting production for days and travelling a few hundred miles to reach medical treatment; no small expense. Not only that, but, when the boat reaches port, all the divers traditionally jump ship so that they can sit under a palm tree until their money is gone.

The fact is that having oxygen supplies on board would save the fleet money and enhance the productivity of their diving crews, setting aside the deep moral implications of not having oxygen available. The problem is that no one has cared enough about these "Indians" to bother themselves with safety considerations. The irony is that everyone would benefit from this simple change in operations.

There is too much suffering in this world caused by greed and exploitation for profit, to have to put up with brutal injuries that result from callous ignorance and end in economic loss.

I interviewed Dr Benno Marx after his work that day. Up until 1991, when he received a donated chamber through the work of Dr Tom Millington, he had treated paralysed divers with hydration, steroids and oxygen, with frustrating results. He sees the number of bends victims growing exponentially as the shallow waters have been depleted of lobster and the divers are forced to hunt even deeper, now to depths of over 48 m (160 feet). He has treated about 100 cases of diver paralysis since he set up the chamber and has seen fair success with partial recoveries, considering that the average time to treatment is five days and that oxygen supplies have to be rationed. The doctor has been overwhelmed at times, with the chamber running 24 hours a day while half a dozen paralysed divers awaited their turn. Following a period of 'no diving' in the summer of 1993, over a six week period Dr. Marx treated an average of six divers per week and heard that an equal or greater number of men were being treated by the Episcopalian Ministry on Roatan. After the men have been diving steadily for some time, the case load slows down somewhat, perhaps due to the little understood phenomena of "acclimation", whereby divers seem to get used to pressure changes; but scientific studies have not been done.

Dr Marx receives all the funding for his outpost clinic from the Moravian Church. He says that some groups have ventured down to talk with him about support of the clinic, (which was started by his father, Dr Sam Marx in the 1930's), but aside from the chamber donation, nothing has ever materialised.

After I interviewed Dr Marx, I realised something interesting that he had hidden from me. The old 2.8 Vickers chamber was really a 2 atmosphere chamber, rated to be used at 33 feet of pressure. The good doctor was using that yellowed acrylic chamber to treat divers at twice its working depth (60 feet) because he knew that he attained better results with the deeper table, even though he risks his life with every treatment. The paralysed patients know they have nothing much to lose.

You can go to any village and find a paralysed, impotent diver, fatherless children, and divers' widows who have turned to prostitution to feed their families. All this from an honest job.

Maritime history is rife with extraordinary labour abuses, from slave galleys through maroonings, cruelties hidden from the sight of landmen; but, none ever worse than those taking place today. This is the Moral Armageddon of the diving world. Its history follows.

A History of Exploitation

After the 1972 oil embargo, wooden shrimp boats that packed production ice were replaced by steel freezer

boats, enabling the Bay Island shrimping fleet to travel farther and remain at sea longer. Lobster trapping gradually became an alternative to shrimping during the less productive months of the year. It was more fuel efficient than dragging nets for a smaller catch.

Fuel prices were rising and lobster trappers soon realised that they could cover a large area of reefs while at anchor by employing divers who could work from "cayucas". The divers could fish the reefs more thoroughly, faster and at less expense than the trap boats. The lobster diving industry was born.

The prime motivator in starting this industry appears to be the Red Lobster restaurant chain. Dick Monroe, head of Red Lobster Public Relations, told me that in the early and mid '70's, Red Lobster gave Albert Jackson (of Roatan) "more help that was usual" in setting up the first lobster processing plant in Oak Ridge on the Eastern Roatan Coast. So much help that I am told Red Lobster held exclusive lobster buying rights from suppliers for five years after the plan went on line and remains to this day, the largest single buyer of Honduran lobster at an estimated 25% of the total catch. That's a lot of lobster, especially since the Bay Island lobster fleet is easily the largest in the world.

From the beginning, indigenous Indians from the Miskito Coast were sought for the diving work, showing that the dangers of this diving were recognised immediately. Despite the good money, Islanders rarely dove. Instead, an illiterate group of Indians who spoke another language, were given dive gear and put to work without any diving instruction at all. As a result, thousands of Miskito Indians have been injured and paralysed and hundreds killed during the two decades of this industry. None of the Miskito Indians understood why.

Last winter I brought this problem to the attention of Red Lobster's Dick Monroe, in hopes of getting this corporation to assist in the educational and medical needs of the besieged Miskito divers. Since then, I have received no help; nor has anyone else, to my knowledge, though several agencies have tried. The only discernible response I saw from Red Lobster was to cancel their 800 number (too many angry callers) and run a huge television ad campaign declaring last March as "lobster month".

I know of plans to organise demonstrations at Red Lobster Restaurants, which could help them decide to provide some assistance to the Miskitos! Red Lobster has built its empire with the blood of the Miskito Indians, and refuses to acknowledge any debt to those people, or any responsibility for the environmental disasters they have profited from, hoping to slither free and penetrate other remote regions. Do they realise how many divers eat at their restaurants? Perhaps they insult us by under estimating the revulsion America feels toward human and

environmental devastation. Maybe they are right about the apathy of people. I don't think so.

From 1979 through 1988, during the Sandinista rule in Nicaragua, U.S. special forces teams were in Honduras and offered free diver training to the lobster fleet. Interest was almost nonexistent. During this same period, the Honduran fleet was able to double its fishing area because Nicaragua was not able to defend its territorial waters. The lobster "gold rush" was on! Money was so good that 10,000 to 12,000 dollar high pressure compressors were thrown away rather than lose time repairing them. Still no one was interested in funding a recompression chamber for the Miskitos.

Depth and pressure gauges have never been supplied to the Indian divers, much less buoyancy-compensation vests or watches. Only the boat captains knew the true depths as the shallow waters were systematically depleted of lobster and progressively deeper waters were fished. The bends rates increased with depth.

In 1985 "in water O₂" was introduced to Roatan by Doc Radowski and we have video proving its effectiveness in treating paralysed divers. This revolutionary cure was ignored by the lobster fleet.

In 1986 A.D. Stone, with the help of Oceaneering International, Inc. and the Episcopal Church, brought a chamber to Roatan. Unfortunately it sat idle for two years due to lack of local interest and funding. Finally, in 1988, the Episcopal Missionaries got help from Anthony's Key Resort and established the recompression chamber there in a building thankfully donated by the resort. The chamber has treated hundreds of divers in the intervening years, 90% of whom have been Miskitos.

More dive regulators were sold to the Bay Island fleet during this period than anywhere else in the world, without anyone reacting to the lack of accompanying safety gear.

The industry, which started in 12 to 15 m (40 to 50 foot) depths, progressed to 27 m (90 feet) and beyond, until today, when depths of 48 m (160 feet) are common. In the mid 1980's, the 27 m (90 foot) level was broached and that became the "red line" for severe decompression sickness. Quadriplegia became more common. Since the late '80's, the bends rates have grown exponentially with each foot of depth, growing into the loathsome plague that ravages the Caribbean today. There have been reports of quadriplegics being cast overboard, marooned at sea! The cover story is "shark attacks". We have not been able to confirm these reports as yet.

As intense overfishing devastated the lobster populations and forced the divers ever deeper, the economic pressures to produce worthwhile catches rose

with the depths. Steel tanks holding 72 cubic feet of air at 2,450 psi were replaced by 90 cubic foot aluminium tanks holding 3,000 psi.

Tanks that were once "hot filled" on deck, were now cooled while being filled, substantially increasing the amount of air that they could hold. This new efficiency enabled the divers to remain in depth longer and catch more lobster. Ironically, what was good for the hunt was bad for the hunter, as the longer dives promoted decompression sickness and further destroyed the breeding stock of the lobster.

The economic pressure to meet market demands also led to ecological disasters. Faced with a dwindling lobster supply, operators of this literal Navy of 200 ships started buying thousands of gallons of chlorax. The divers would inject this poison into the reef structures, flushing out lobsters from the honeycombed labyrinths, indiscriminately killing all life forms in the affected area. Done in secrecy, miles from any witnesses, no one can tell the extent of the damage to the heart of the Caribbean, a huge area extending from the Bay Islands through Nicaragua and north to Jamaica and beyond, into Columbian and even Cuban waters; likely further. The Honduran fleet is the largest poaching fleet in the world.

Belatedly, the Honduran government has just established a fishing season for lobster as the demise of the fishery looms near. As for the problems of the ethnic minority of Miskito Indian divers, "further studies are needed". As ridiculous as it may sound, the Honduran government classifies working divers in the lobster industry as "sport divers", and therefore not entitled to the protection of labour laws or the benefits of social security. They are only Indians.

The Miskitos are really quite a famous people, under a different name, one that you know very well. After Somoza fell from power in Nicaragua, the Sandinistas found that the Miskitos were fiercely independent and would not yield to communist power and influence. War was used by the Sandinistas to try to either control or exterminate the Miskito Indians. Thousands of Miskitos fled across the Honduran border to swell the ranks of the "Contras". Over the years many "Nicaraguan Miskito Indians" stayed in Honduras, as the entire region is their ancestral homeland, regardless of national borders. Once these people were our allies, now we have forgotten them.

The U.S. Navy donated a recompression chamber and facility to the Honduran Navy at a cost of some \$200,000 (U.S.).

The Hondurans keep the chamber well inland and discourage its use by the lobster divers. I am told that sick divers have been turned away from the unit: at any rate, it is in a very inconvenient location for its purpose.

Vast fortunes have been made in the lobster industry, so that the profits are referred to as "red gold". The money has been diversified into many industries: shipping lines, real estate, travel agencies, cable television and ironically, dive resorts.

There is hope on the horizon. and one of the brighter points comes in the person of Bob Armington, an ex-New Orleanian and a graduate of the Diver's Institute of Technology, in Seattle. Bob spent time working offshore in the "oil patch" before being contacted by Dr Marx about the problems in Moskitia. He travelled to Honduras to see the problems first hand and was so moved by the injustices there, that he started a diver training school with his own money. Since then, he has been funded by the Moravian Church to the tune of \$100 U.S. per month, both to live on and to run the school. He has received some donations from the fishing fleet, for which he is very grateful, but for the most part his efforts are hindered by a lack of finances. In spite of this, he has persevered and made great strides in diver education.

My son, Jesse, and I were in the village of Cocobillia in October 1993, when he graduated his first class of 10 proud commercial divers. Earlier that day, he had buried an Indian diver in the jungle.

Bob is a Viet Nam veteran who sees his vision for the school as his second chance at dealing with third world people. He is determined to hold on and make the school reach its potential in spite of obstacles that would stop a lesser man. He is succeeding.

I returned alone to Cocobillia this last March and found that Bob had graduated 70 divers from his school and had trained a Miskito named Roberto, an ex-diver and assistant pastor of the local Church, to teach while he opens a new school at Kalkira, east along the coast. Though few in comparison to the overall number of divers, his graduates are being well received by the industry and have managed to avoid paralysis through using in water stops and by increasing their surface intervals between dives. In this case, less is truly more and the men have not only been productive enough to please their captains, but have astonished themselves and their fellow divers at their lack of joint pains, a symptom of the bends. These men feel comparatively healthy and are spreading the word through the industry! Bob deserves high praise for this educational breakthrough, but there is much more to be done and he could use your help. He can be reached through this address: Robert Armington, Mopawi, Puerto Lempiro, Gracias a Dios, Honduras.

Other breakthroughs are taking place. I have been able to get the word out through The Working Diver magazine (now The Universal Diver) and have been privileged to speak at the tek '94 and DEMA shows on this subject. Pressure Magazine, the journal of the Undersea

and Hyperbaric Medical Society has thankfully printed Dr Millington's and my article and reprints are being requested internationally. Interest is snowballing. Cal Dive and Oceaneering International, Inc., have located chambers and perhaps other equipment for me to funnel through to Moskitia for the medical emergencies of divers. PADI has donated Spanish dive manuals; Hyperbaric Oxygen Therapy Systems of Denver is donating surface oxygen supply units and chamber plumbing. Those good people have even started fundraising events to assist me with some expense money. DEMA tells me that they're mailing out my press releases to their membership.

We've got our hands around the throat of this problem, but it's still slimy and strong. A little bit of good right now can tip this evil balance and change this historic tragedy for the better. Together, we are very close to ending the emergency part of this "epic of abuse" in Honduras so right now...PUSH!!

I am hoping that a success in Honduras can be used as an example for the rest of the third world. Reports are filtering in that confirm any suspicions that the epidemic of decompression sickness in Honduras is just the fin of the shark.

You are eye to ink with the first report that states that there is a worldwide pandemic of decompression disease in third world fisheries. I have reports that certain villages in remote regions are suffering a rate of paralysis that reaches 40% of the male population! Africa, South East Asia, Pacific Islands, India, South America, all have regions that are plagued by killer decompression sickness. I can see the monster taking form now and I'm telling you that this investigation will tear the cloak off the most brutal case of international maritime exploitation to ever blacken the pages of seafaring history!

I could use a little help. You know what they say, "The only thing necessary for evil to triumph, is for good men to do nothing". We've got chambers from Cal Dive and Oceaneering International Inc., valued at \$35,000 to \$40,000 a piece; however, I still need compressors, oxygen generators, radios, transportation costs and operating capital. I have incorporated SOS (Sub Ocean Safety), a non-profit educational organization, in order to accept your donations. I also want to form an expeditionary medical investigation team that could take on the project of documenting this worldwide pestilence and come up with proposals for action.

Call, fax or write: The Universal Diver. P.O. Box 834, Lacombe, Louisiana 70445, USA. Phone: (504) 649-3692. Fax (504)649-3682.

Reprinted by kind permission of the Editor, from The Universal Diver 1994; 1 (1): 4,8,11,15 and 18.

YOUR LIFE IN THE HAND OF GOD IF YOU SIGN THAT LIABILITY RELEASE

Robert Ewald

David Reuther was going diving in the Cayman Islands. On the way to the dive site, the charter boat he was on encountered a huge wave and he was injured. A federal court in Indianapolis applied British law and allowed him to pursue his claim for negligence, because the release he signed did not waive his rights arising from careless operation, although it did cover diving-related activities. Had Mr. Reuther's injury occurred while he was actually diving, he would have had no claim, no matter how grievous the fault.

Don Hewitt was taking an advanced open water scuba course when he disappeared in Puget Sound. No trace of him or his diving equipment was ever found. His heirs attempted to bring suit against the instructors, claiming fault on their part. A Washington appellate court found that Hewitt had signed a release in which he gave up all rights against the instructors, no matter how careless they were; therefore, no suit could be maintained.

Susan Mitchell drowned after becoming entangled in underwater guide lines set up by her instructor while participating in an advanced scuba course. A Wisconsin appellate court held that the release she signed, supplied by PADI, absolutely prevented her or her estate from bringing any claim for negligence against her instructor.

These cases demonstrate that releases divers sign are probably enforceable according to their terms, at least as to claims of fault resulting from carelessness or negligence. Many of these releases, which divers sign without reading carefully, provide for waiver of virtually all rights which a diver may have for injuries or even death resulting solely from the fault or misconduct of the dive operator.

I have reviewed copies of releases used by several live-aboard dive operators, some of which call for complete and total release of all rights. Several releases are unconscionable, demonstrating a callous disregard for the rights of divers who sign them. Some operators wait until after the diver has paid all fees and is aboard the boat before demanding execution of such a release. This is totally unfair for it leaves the divers without a choice.

The release used by one large live-aboard operator provides that the diver waives absolutely all claims that may arise against the operator, no matter how serious the fault. Even though death may result, the live-aboard will completely deny any responsibility. Furthermore, they even deny all liability if their boats are unseaworthy. For example, if they do not properly maintain safely equipment

and the boat explodes or burns, maiming or even killing the passengers, the live-aboard is relieved of any liability. Likewise, if they fill a tank with bad air, which you don't discover until 140 feet down on the Blue Hole dive, they will pay nothing even though you could prove the bad air that caused your injury was solely their fault.

Another leading live-aboard operation is no different. Their release provides for a complete waiver of all claims. Although the release does not specifically deny liability for an unseaworthy boat, it does something just as bad. It provides that equipment is rented "as is". It specifically places the burden on the diver to inspect the equipment and denies any responsibility whatsoever for any defect. Unless you are trained to detect hidden defects in a regulator, don't rent one from them for they refuse to stand behind the quality of what they supply. You might expect this from a used car dealer, but not from a well respected live-aboard operator. If your rented regulator fails solely because of sloppy maintenance and you die, they can hide behind the release and say "tough luck to your wife and kids, I rented the regulator as is and it's your responsibility to find the hidden defect."

How about another top live-aboard? They also demand a release in which the diver agrees to waive all claims. If the operator hires an incompetent captain who runs the boat aground and a diver is killed or injured, the live-aboard will deny all liability because you signed their release. "We're sorry our captain got drunk, but don't expect us to pay for the damages. We're no Exxon and this wasn't the Valdez".

It gets worse. According to the release form, if someone else sues the live-aboard, it may recover its costs from everyone who signed such a release. It is true! The divers all agree to reimburse the live-aboard for "any and all claims...by whomever or wherever made or presented." While it is doubtful that such a clause could be enforced, it suggests that many dive operators have no respect for divers' legal rights and will seek to take advantage of their customers to the maximum extent possible in order to minimize the costs of their own mistakes. The live-aboard operator will allow exclusion of this last clause if the diver complains. The live-aboard operator also advises they are in the process of changing their form.

Is there anyone out there who attempts to be fair? Yes! The operators of the *Little Cayman Diver*, in a short straightforward and understandable document ask the diver to agree to take responsibility for his or her own safety and not hold the operator liable for accidents occurring in the normal course of diving. This does not release the operator from liability for its own fault. Congratulations to this dive operation for being reasonable. While the release does limit liability for property damage, its language is clear and understandable.

What happens if the diver complains about the language of the release? I frequently line out the offending language on releases and the operators seldom object.

Do these operators really understand what they are asking the diver to give up. Did some non-diving lawyer somewhere prepare the strongest release imaginable for the operators to pass on without thinking? Well it is time the operators became more responsible. It is time that divers started objecting. It is time the so-called consumer organisations insist that these releases be more fair and reasonable.

I have been aboard two of the boats criticised here. The actual operation of these boats does not reflect the lack of responsibility indicated in the releases. The boats were safety conscious and well run. I doubt they would supply a defective regulator or an incompetent captain, but they need to rethink their releases.

Diver/author Robert Ewald is an attorney in Louisville, Kentucky, who normally represents the defendant, not the plaintiff. As an avid diver who loves the sport he wants to share the view from the other side.

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HOW DO YOU SPELL RELEASE ?

ASSUME RESPONSIBILITY, BUT DON'T SIGN AWAY YOUR RIGHTS

Dear *Undercurrent*

The article in your October 1993 issue, "Your Life Is in the Hand of God If You Sign That Liability Release," cited a couple of examples where the courts in Washington and Wisconsin sided against plaintiffs who had signed releases. If I sign such a wavier in the state of California, am I signing away all of my legal rights even if the boat owners or the dive operation is negligent?

This all comes up now, for me, after a recent unfortunate hassle with the divemaster on a local dive boat, the *Atlantis*. For some time, I have been crossing out waiver provisions with which I couldn't agree. In this case, the divemaster saw me start crossing out lines on the *Atlantis* waiver and asked what I was doing. When I told him, he responded that I would either sign the release as it was written or get off the boat. In view of the blatant legalese relieving the boat of any and all threat of action even in the event of their negligence or unseaworthiness, I opted not to sign and was denied passage.

The following Monday, I called up the owner of the boat to discuss the matter. He pooh-poohed my concerns, saying that in the state of California "no one can sign away their rights." I asked him why did he bother then, and he had two answers. One was that it discourages frivolous lawsuits, and the other was that his insurance carrier required him to do this. He also refused to return my money for the trip since, in his opinion, I had voluntarily gotten off the boat.

Since that time, I have solicited an opinion from an attorney who specialises in personal injury liability appeals for a plaintiff firm and got some discouraging advice. He indicated that in view of the trend toward more conservative judgments in the courts and more comprehensive language in the releases, a plaintiff would have much less than a 50 per cent chance of recovering for loss or injury after having signed a liability waiver.

Cory L Gray, Long Beach, California

Since our initial article on waivers in the October 1993 issue of *Undercurrent*, Captain Preston Colby of the US. Merchant Marine sent us a copy of federal law, Title 46, Section 183(c), passed in 1992. In essence, it states that waivers that try to void or limit the responsibility of the owners (or those working for the owners) for negligence are unlawful and have no effect. However, the law is limited to vessels operating from United States ports. It is also limited in that it does not cover anything outside the duty of a common carrier. Diving most likely would fall into a category outside the duty of a common carrier.

A recent decision (Nov 1993) in the state of Washington confirms Mr Gray's suspicions that most waivers, including those that release the operator from responsibility for his own negligence, are being upheld in court. In this case, an instructor took inexperienced divers using dry suits for the first time to 30 m (100 ft) on tanks containing only 1,600 pounds of air. The divers ran out of air, and one died. Because the divers had signed a waiver before diving, the wrongful death suit was denied. Without the release, the instructor probably would have had some liability.

The author of our original article in the October 1993 issue, Robert Ewald, who is a diver and an attorney in Louisville, Kentucky, has drafted a release that he believes is fair to both the diver and the operator. We've reprinted it on the following page so that you can use it in advance to negotiate with any operator whose release seems overly inclusive.

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LIABILITY AGREEMENT

I am a certified scuba diver, trained in safe diving practices, and the purpose of my diving activity is strictly recreational. In consideration for engaging in diving activities with I certify, acknowledge, and agree to the following, each paragraph of which I have initialled:

I recognise and understand that diving involves unavoidable risks and dangers, including malfunctions of equipment, risks due to environment, animal or sea life, risks due to currents and other changing conditions, all of which can result in injuries and loss of life, and I expressly assume such risks;

I affirm that I am in good mental and physical condition for diving, but I understand that diving is a physically strenuous activity, that I will be exerting myself during this dive excursion, and I expressly assume the risk of such activity;

I will not dive under the influence of alcohol or drugs; any medication I am taking is solely my responsibility, based upon consultation with physicians who have approved its use while diving;

I understand that even if I follow all of the appropriate dive practices, there is still some risk of sustaining heart attack, decompression sickness, embolism, or other hyperbaric injuries, and I expressly assume the risk of such injuries or illnesses;

I agree to follow the recognised and established safety practices associated with scuba diving, but I realise that even though such practices are observed there is still a risk of accident or injury, and I expressly assume such risks;

I understand that diving with compressed air involves certain risks and that diving activities are often conducted under circumstances where medical attention is not immediately available, and I expressly assume the risks involved in diving under such circumstances;

I acknowledge that I alone am responsible for my own activities while engaging in scuba diving and I cannot rely upon anyone else to advise me of my own improper or unsafe procedures and practices while diving. I will exercise care in my own activities while engaging in scuba diving and I assume full responsibility and liability for injury or harm which occurs as the result of any lack of good care on my part.

Name (type or print legibly)

Signature

Date

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The address of UNDERCURRENT is 1001 Bridgeway, Suite 649, Sausalito, California 94965, USA.

**DIVING SAFETY
WHOSE RESPONSIBILITY ?**

John Lippmann and Tom Wodak

For many years providers of services in the United States, whether they be doctors, dentists, or members of other professions, have been sued over dissatisfaction with a service provided. Scuba diving instructors and suppliers of diving equipment and tours have also been subjected to such damages claims. Despite some delay in following this trend, Australians have also begun to sue. Often when there is a mishap, a search for someone to blame begins.

An obvious target for blame, rightly or wrongly, is the provider of instruction, equipment, or a service. If the provider is believed to be insured, there may be a greater incentive to pursue a claim. In the hands of an industrious and aggressive lawyer, a painstaking scrutiny of the available evidence can result in at least an arguable case against the provider. The person claiming to have been injured, or the family of someone killed will often have the psychological advantage of sympathy in court proceeding.

Whilst the provider being sued may have been at fault, whether substantially or to a minor extent, what is often lost sight of is that the "victim" may have also contributed to, or even caused the mishap. However, if there is an available scapegoat, it is increasingly likely that a claim, and perhaps litigation, will follow.

The purpose of this article is not to suggest that legitimate claims should not be made. Nor is it suggested that providers of services should not do so responsibly, morally and legally. Rather, the emphasis is on the need for everyone concerned, consumer or provider, to acknowledge that each has a role in safeguarding life and limb.

Mishaps sometimes occur without anyone being at fault or negligent. On occasions, the cause of the incident is obvious and the person(s) responsible easily identifiable. In the quest to find (the truth) fault with any party involved, the conduct of every participant including the consumer should be examined.

What follows is an analysis of two diving fatalities, each of which has resulted in consideration of the facts by a legal tribunal. The first case involved a coronial inquest

and, subsequently, a civil claim for damages. The second case, to date, has led to a coroner's inquest.

Case 1

A diver died while diving several years ago. The diver's widow claimed damages against the dive school which trained her husband and gave the diver the name of a person he could contact about diving in another State. She also sued the interstate diving operation which provided some equipment for the diver, and helped to arrange for him to go on the particular dive on its dive boat.

The diver had completed an Open Water Course (OWC), followed immediately by an Advanced Open Water Course (AOWC). During these courses, the diver was taught a certain amount about the hazards of deeper diving, including nitrogen narcosis, exhaustion of air supply, buoyancy control and other things.

The diver had completed a total of 9 dives before the accident. Seven of these dives were shallower than 6 m, one was to around 10 m, and one dive to a depth of 24 m. All the dives were training dives, with other students, under the direct supervision of an instructor.

The diver was enthusiastic, intelligent (having several tertiary qualifications) and a high achiever. He had little trouble with the practical and theory components of training and gained certification at each level.

One month later, having done no further dives, the diver decided to dive interstate. Through a dive shop in that other state he hired equipment, and using the contact he had been given, booked onto a dive to a wreck lying in 43 m. At the subsequent trial, evidence was given that although both the diver and his buddy held very recently issued (temporary) qualification cards, they were asked very little, if anything, about their diving experience, before being booked onto this dive to 43 m. The diver's buddy was a friend who had participated in the same courses, but who had also done one further dive, for a total of ten.

These two inexperienced divers were buddied together. Despite their inexperience, since they were the last divers to enter the water, they were given the task of freeing the anchor at the end of the dive.

What went wrong during the dive remains largely speculative. However the diver was later recovered, probably already dead, in 45 m depth. His buddy had made a very rapid, possibly out of air ascent, but luckily escaped uninjured.

Both divers were much too inexperienced to undertake such a dive. What on earth were they doing there? Who, if anyone, was at fault?

The court was not given the opportunity to answer these questions. On the 11th day of hearing of the civil damages claim, the parties agreed to resolve the dispute, without any decision of the court. Because of the agreement made by all of the parties, the basis of the settlement will never be publicly known.

Case 2

This involved an off duty policeman who commenced a shore dive in circumstances which seemed suitable for an inexperienced recreational diver. The dive was on reef at a depth of about 5 m. During the dive, the buddy observed that the victim was breathing normally, displaying good buoyancy control and apparently relaxed.

After about half an hour, the buddy signalled to the victim to reverse direction. The signal was acknowledged and they started to return. After a few minutes, the victim stopped suddenly, looked at his gauges and gave an ascent signal, to which the buddy responded. The victim then ascended rapidly from about 5 m. When the buddy surfaced he observed that the victim appeared to be calm and rechecking his compass bearings. It was not known whether he inflated his buoyancy compensating device (BCD). The divers were about 1 to 1.5 m apart on the surface and about 100 m off shore. Waves were then about 1 m high. There was no conversation. The buddy gave a descend signal which the victim acknowledged. The buddy descended. Underwater he looked for but did not see his companion, rotated 360° and ascended, then descended before finally ascending without locating his companion.

Because of the waves, surface visibility was limited. After about 30 seconds, the buddy heard a distressed howling sound and saw a group of divers on the shore looking in his direction. The buddy heard a short muffled cry, but saw no-one and yelled out not to panic and to inflate the BCD and ditch the weight belt.

Divers on the shore came to assist and the buddy left the water. A proper and systematic search was instituted. The victim's mask and snorkel were found on the sandy bottom in about 6.5 metres depth and approximately 150 metres off shore. The next morning the victim's body was found, lying on its back (with the weight belt still on and the BCD not inflated) with nothing near or attached to it preventing ascent. Subsequent examination of his diving equipment revealed no sign of failure or malfunction which might have caused or contributed to the mishap. Death was deemed to have been caused by "immersion in association with asthma".

The victim was aged in his mid 30's, had been a good all round sportsman and was very conscious of retaining fitness. Since the age of 15 he had experienced bouts of asthma. He was considered to be cool headed and

methodical and had a background of army, flying and police training and experience. He had gained his OWC less than two months earlier. His buddy had 15 years diving experience and held several advanced diving qualifications.

Before starting his OWC, the victim underwent a diving medical examination by a doctor selected by the victim and known to him to be both an asthmatic and a scuba diver. The doctor was not his regular doctor. The victim completed a "Student Medical Statement", circling "asthma". When questioned by the doctor, he stated that he had suffered from it when younger, but that it was no longer a problem. The doctor discussed with the victim the danger of asthma and diving and physically examined him. The examination was normal. Spirometry and a chest X-ray were performed. These revealed excellent respiratory function, no evidence of airway narrowing and showed the heart and lungs to be normal. The doctor concluded that the victim no longer had significant asthma and passed him as being fit to dive.

The victim completed an OWC, which included instruction in surface problem management, including anxiety, inflation of BCD and weight belt ditching. However, at the inquest, the Coroner found that he had not followed this procedure immediately before his death. The Coroner was satisfied that the training and certification of the victim was appropriate, as was the content of the course. He found that the victim was an asthmatic at the time of his death, and that had this been known to the doctor who examined him, a certificate of fitness to dive would not have been issued.

As part of his investigation, the Coroner considered whether the victim had contributed to the cause of his death. This required an investigation of whether the victim knew that he was a current asthmatic. The evidence before the Coroner disclosed that whilst travelling to the dive site on the day of the fatal dive, the victim had used a Ventolin inhaler intermittently for about 10 to 15 minutes. (Ventolin is a broncho-dilator prescribed for and used by asthmatics). The victim had also taken Sudafed, a decongestant containing a weak heart stimulant, before diving that day.

In the 14 months before his diving medical examination, the victim had attended a medical clinic on four occasions, obtaining prescriptions for Ventolin and another asthma medication. However, none of this was known to the doctor who passed the victim fit to dive at the time of his examination of the victim. When informed about these matters at the inquest, the doctor stated that this level of medication was consistent with severe asthma and that had he been aware of it, he would not have certified the victim fit to dive.

That history, coupled with the finding of a Ventolin inhaler in the victim's BCD pocket led the Coroner to

conclude that the victim was aware of having current active asthma. However, the Coroner was unable to determine whether the victim deliberately sought to mislead the doctor. Interestingly, although the victim was a smoker at the time of his examination, on his Student Medical Statement he declared that he was not. According to the Coroner, this tended to support the view that he may have deliberately sought to mislead the doctor.

Ultimately the Coroner concluded that in failing to fully and properly disclose his medical history and condition, and in diving with an awareness of the dangers confronting asthmatics who dived, the victim had contributed to the cause of his death. The Coroner also found that in the circumstances the medical examination of the victim was appropriately conducted, and that it was reasonable for the doctor to certify him as fit to dive.

Discussion

What can be distilled from these two cases, apart from the tragic fatal conclusions to what were intended to be enjoyable, recreational dives?

When considering the circumstances of the first case, the question which will forever remain unanswered is "What were these two divers doing on that dive?".

It is puzzling that two highly intelligent persons, one a doctor and the other a lawyer, could be so incautious or ignorant of the potential dangers of such a dive, and of their lack of training and experience to participate in the dive. To try to answer these concerns, we have reviewed the course texts presented to the divers during each of the courses. The texts certainly provided some information and cautions about deeper diving. The texts advised that nitrogen narcosis can occur on dives deeper than about 30 m, and can debilitate divers to varying degrees; that air is consumed more rapidly at depth and needs to be monitored more closely; that there are increased risks of decompression illness with deeper dives; and that during the AOWC, they would be trained and qualified to dive to depths of 30 m and not deeper. The texts also explained and discussed techniques for buoyancy control.

Despite these warnings, and the limitations of their training and experience, one month later, these divers considered that they could dive to 43 m at a completely unfamiliar site. One could argue that the training let them down. It could be said, for instance, that although certain warnings were given, these were simply not strongly enough emphasised. However, most novice divers do not attempt to stretch their newly acquired skills so far, so soon.

Several training agencies offer a course, the title of which includes the word "Advanced". Such courses are often available to divers very soon, if not immediately after

completion of the OWC. Dive schools often encourage divers to participate in such courses as soon as possible. Although the extra training is valuable, the name of the course may give some inexperienced and vulnerable divers the illusion that they are far more skilled and knowledgeable than they really are, despite the cautions and limitations expressed during the course, both orally and in writing.

Deep diver courses, usually in the range of 30 to 40 m, are available for divers who plan to conduct deeper dives. Most such courses delve into the theoretical aspect of nitrogen narcosis, decompression illness, dive tables and air consumption. The courses involve the participants in one or more dives to 30 or 40 metres, under direct instructor supervision. One potential benefit of such a course is for the participant to actually experience some of the effects of diving to greater depth, such as narcosis, increased air consumption, buoyancy problems and denser air, under the watchful eye of the instructor.

Reading about narcosis, and experiencing it are two very different matters. A diver does not really comprehend narcosis until he or she has become disoriented at depth, concerned about air supply, and tried to decide what to do about it!

Unfortunately in an increasingly litigious environment, commercial pressures have led to most deep diver courses involving fewer dives than in the past, so that a diver has less opportunity to carry out deeper dives and develop the necessary skills under such close scrutiny.

There can be no doubt that the diving industry owes the consumer moral and legal obligations in training divers and in supplying and servicing equipment and selling dives and tours. The onus is a heavy one, especially as recreational scuba diving is an activity which exposes its participants to risks of serious injury or death. Perhaps less well understood and accepted, is the proposition that the consumer must exercise responsibility and care for his or her own safety as well. It is not enough merely to rely upon the diving industry when one may be risking one's life. The Coroner's findings in the second case illustrate the extent to which a diver may have some responsibility for any unwanted and unexpected tragedy.

At times, it may not be easy to determine where the duty of care owed by the diving industry ends and where the diver's duty of care for his or her own safety commences.

The entire diving industry, including retailers, manufacturers, suppliers and instructors, must set and adhere to standards to ensure the delivery of goods and services reasonably suited to the requirements of recreational scuba diving. This has already been addressed to some extent.

Safe diving practices require good will, frankness and co-operation between the dive industry provider and the consumer or diver. Whilst the diving industry is and must be commercially motivated, this leads to a difficult balancing exercise. Recreational diving must and can honestly be promoted as an exciting and enjoyable pastime in order to encourage participation in it. At the same time, it is not an activity suitable for all. A person interested in diving should be made fully aware of the physical and mental requirements and health criteria which need to be satisfied, and of the potential dangers associated with scuba diving. During any training, students should be clearly informed of the nature and extent of the qualification sought and of the limitations associated with it.

During training, divers are educated to identify some potential hazards of diving and are given certain tools to reduce and manage the associated risks. Although in general this has proved to be effective, the process is not perfect and agencies and individual instructors should constantly assess the effectiveness of their programs and improve them, where necessary. Divers must be willing to accept that diving is an adventure sport, where the risks are real, and be prepared to accept responsibility for managing the risks. Thus, divers and their families must be prepared, to a reasonable extent, to acknowledge their responsibility for any unfortunate consequences of venturing underwater whether during or after training.

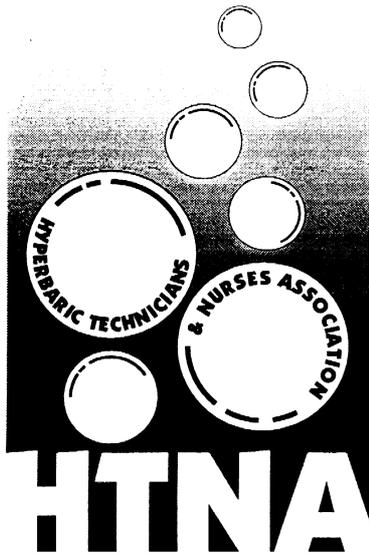
Dive charter operators and divemasters should question divers about their experience with respect to a particular planned dive. They should be prepared to refuse to allow a diver to participate in a dive if it is considered that he or she lacks adequate experience and appropriate supervision. Sometimes it is possible to provide an alternative (safer) dive plan. On the other hand, divers must be open and frank, with medical examiners as well as divemasters, in revealing relevant factors about their health or physical capabilities and diving training and experience. Any temptation to suppress relevant information, whether it be of medically significant matters or diving experience, must be resisted and all relevant information given. In addition, divers should not be afraid to ask questions about a planned dive and should refrain from diving if concerned about their ability to conduct it safely.

If all parties concerned work together conscientiously and honestly, diving can remain what it is and should be, an exhilarating recreational activity with a reasonably low incidence of serious mishaps.

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Tom Wodak is a scuba instructor and a barrister specialising in medico-legal litigation. He has appeared in litigation concerning diving accidents.



HYPERBARIC TECHNICIANS & NURSES ASSOCIATION THIRD ANNUAL SCIENTIFIC MEETING

**Conference: 3rd Annual Scientific Meeting on
Diving and Hyperbaric Medicine**

Date: 22nd to 23rd September, 1995

**Venue: Carlton Radisson Hotel
Melbourne, Victoria, Australia**

This is an international scientific conference which is being hosted by the Australian Hyperbaric Technicians & Nurses Association. The Association was formed in 1990 and despite being a newcomer on the hyperbaric scene has a membership of 145. The conference will cover hyperbaric medicine on the Friday and diving related issues on the Saturday. Keynote speakers will be Dr. Richard Moon and Dr. Cuauhtemoc Sanchez. Dr. Moon, from the Duke University Research Facility, is the current President of the Undersea Hyperbaric Medicine Society and has published extensively on diving and carbon monoxide gas poisoning. Dr. Sanchez is the Director of National Hyperbaric Services in Mexico.

Conference Arrangements:

Kevin Fabris or John Houston Telephone: (03) 276 2323 Facsimile: (03) 276 3780

Closing date for abstracts (maximum 250 words) is 12th May, 1995

John Lippmann is the Executive Director of DAN Australia. He is an instructor and is the author of Deeper Into Diving, The Essentials of Deeper Diving and Oxygen First Aid for Divers, co-author of The DAN Emergency Handbook and co-editor of Scuba Safety in Australia. His books are available from J.L. Publications, PO Box 381 Carnegie 3163, Australia.

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THE UK DIVING MEDICINE COMMITTEE

Sandra Domizio

The BS-AC Medical Committee, which has been in existence now for nearly 30 years, recently joined forces with the Medical Committees of the Scottish Sub-Aqua Club and the Sub-Aqua Association, to become the UK Diving Medicine Committee. The doctors on the Committee come from a wide variety of backgrounds including hospitals, general practice and research posts, with their main interest being a specialisation in scuba diving medicine.

The Committee also regularly updates the UK Amateur Divers Medical Form and arranges national and

PRISM REBREATHING TOUR

The inventor of the PRISM Rebreather Unit, Peter Ready, will be conducting forums and introductory courses in Australasia as follows

Perth	30/3/95-4/4/95
Adelaide	6-11/4/95
Melbourne	13-18/4/95
Sydney	20-25/4/95
Townsville	27/4/95-2/5/95
Brisbane	4-9/5/95
Wellington	11-16/5/95
Auckland	18-23/5/95

In each city there will be a free evening forum open to all interested parties. There will also be a one day introductory course involving theory and in water work (\$A99) and ocean dives after the course(\$A65).

For further information contact Rob Cason, IANTD Australasia, PO Box 696 Petersham, New South Wales 2049, Australia. Phone (02) 550 0830, Fax (02) 560 3872

international diving medicine conferences every two years. These help to forge closer links with overseas specialists.

As well as the Committee there are 57 other Medical Referees throughout the UK and abroad who have the specialist knowledge to help advise on medical

Continued on page 31

ROYAL ADELAIDE HOSPITAL HYPERBARIC MEDICINE UNIT

Diving Medical Technicians Course

- Unit 1 St John Ambulance Occupational First Aid Course. Cost approximately \$A 500
- Unit 2 Diving Medicine Lectures. Cost \$A 500
- Unit 3 Casualty Paramedical Training. Cost \$A 300

Dates

February 1995

- Unit 1 13/2/95 to 17/2/95
- Unit 2 20/2/95 to 24/2/95
- Unit 3 13/2/95 to 3/3/95

July 1995

- Unit 1 3/7/95 to 7/7/95
- Unit 2 10/7/95 to 14/7/95
- Unit 3 3/7/95 to 21/7/95

November/December 1995

Dates to be fixed

Diver Medical Technician Refresher Courses

Dates

- 20/2/95-24/2/95
- 10/7/95-14/7/95

November/December dates to be fixed.

Cost \$A 350

For further information or to enrol contact

Dr John Williamson, Director, HMU,
Royal Adelaide Hospital, North Terrace
South Australia, 5000.

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Overseas 61 8 224 5116
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Content Discusses the diving-related, and other emergency indications for hyperbaric therapy.
 Dates to be fixed November or December 1995
 Cost \$A 500.00

\$A 800.00 for both courses

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 Royal Adelaide Hospital, North Terrace
 South Australia, 5000.

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 Overseas 61 8 224 5116

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**FIT TO DIVE 1995
"HAZARDS TO HEALTH"**

A major recommendation of the 1994 Edinburgh "Fit to Dive" meeting was that prescriptive pass/fail standards of fitness to dive should, wherever possible, be replaced by a greater emphasis upon the assessment of each individual diver. The essential foundation for any assessment of a diver is a detailed knowledge of the hazards to health and safety at the diver's workplace. Professor David Elliott and Dr Nick McIver will describe these. They will review the diver's tasks, his working environment, the equipment that he has to use and the diving rules and emergency procedures that need to be followed. There will also be a detailed review of the clinical aspects, including management of barotrauma, in-water loss of consciousness and acute decompression illness, which are needed for an assessment of fitness to return to diving.

There will be two weekends available for this course. **7th-9th April 1995** at the Atlantic Hotel, La Moye, St Brelade, Jersey, Channel Islands. and **12th-14th May 1995** at the Viking Hotel, North Street, York, England.

For further details contact
 Biomedical Seminars, 7 Lyncroft Gardens, Ewell, Epsom,
 Surrey KT17 1UR, UK.
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