PROVISIONAL REPORT ON AUSTRALIAN DIVING RELATED DEATHS, 1980

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SUMMARY

Four (4) deaths were identified where the victim was either using a snorkel or was breathhold diving, two cases being the result of surfacing in the path of motor boats. Of the other two, one was a poor swimmer who was inexperienced in the use of a snorkel. He apparently lost his equipment while on the surface a little out of his depth and either attempted to recover it or immediately started to flounder about at the surface. He sank and drowned before nearby people realised that he was in difficulties, his shouts not being recognised as calls for help. The remaining deaths occurred when an inexperienced skin diver was so keen to try out his new, first wet suit that he entered the rough sea alone. This was probably the first time he had dived in open water off rocks. It is presumed that he drowned from surface difficulties in the white water zone around off-shore rocks.

Five (5) scuba diving deaths have been identified and another one is thought to have occurred. In every case the victim was very inexperienced and in four the incident occurred at the surface, the exception being at 30 feet depth. Buoyancy vest problems were highly significant in three cases, while two victims were without vests. In one incident an apparently tightly organised class dive ended tragically through a sequence of circumstances: the group became split and each instructor thought the victim and partner was with the other, a strong current was encountered and separated the three groups, and the victim and buddy failed to operate their buoyancy vests correctly despite a pre-dive inflation check by every pupil. They also failed to drop weight belts or immediately use their scuba air at the surface. Rough water compounded their difficulties. One fatality occurred because the recently certificated diver lacked the self confidence to undertake a surface snorkel swim of 70m, failed to drop weight belt or inflate the buoyancy vest, didn't realise that some air still remained in the tank, and got carried by current into dangerous water. One very inexperienced, part-trained diver had no CO_2 cylinder in his vest and was not sought for after separation from his experienced buddy in a thick kelp area: he was not, in fact, entangled but seems to have drowned through some minor misadventure.

It is clear that inexperience is the single most important critical factor in fatal incidents and that confidence with buoyancy vest inflation, weight belt ditching and the use of snorkel in diving conditions may be vital for survival.

CASE REPORTS

Because of the difficulties experienced in identifying cases and in deciding on a fair assessment of what actually occurred the following case reports should be regarded as illustrating the probable critical factors rather than being the total details of every fatality which occurred in 1980. The inclusion of those using a snorkel at the surface may appear to be an unfair application of the title "diving related" but the intent of the report is to improve awareness of factors influencing safety rather than to manufacture low statistics, and the snorkel should be regarded as an important piece of equipment, the correct use of which requires training. Factors which are thought to have contributed to the death appear in italics at the end of each case report.

Case Snorkel 80/1

This 18 year old inexperienced skin diver purchased his first wet suit a few days before going on a camping trip with several friends. He was keen to try it out so walked along the nearby beach, with a friend, until he came to what seemed to him to be a suitable place to enter the sea, a rocky area. He swam out and his friend saw that he was being pushed about a little by the swell so tried to signal to him to indicate a safe exiting area, but this action may have gone unseen by the victim. The swimmer was seen passing behind a large rock about 25 feet from the shore in disturbed water. The friend then lost sight of him despite moving to another vantage point, became alarmed and called the Police. When they arrived they enlisted the aid of a couple of nearby skindivers, who searched the area where the victim had last been seen. They soon found the body on the sea floor the 12lb. weight belt still on. This is believed to have been his first open water dive from rocks and he misjudged the power of water near to rocks. *(ALONE. INEXPERIENCED. NO VEST. WATER POWER)*

Case Snorkel 80/2

The victim, aged 28, was with his wife and two children in an area frequented by others. While his wife was choosing a place on the river bank near a shallow area, he was swimming on the surface with mask, snorkel and fins. He wore only swim trunks as the water was not cold. The river was tidal and it was near full ebb tide, the water being calm and with little or no current apparent. Small children were amongst those in the water near to him. Two young girls saw him floating on the surface looking down through his mask and a little later they observed him thrashing about and shouting something which they were unable to make out. He seemed to be without his equipment at this time and to be disappearing beneath the surface from time to time, though it is unknown whether he was trying to retrieve his equipment or in panic loss of buoyancy. When he failed to resurface, the girls became alarmed. Less than a minute later they found him floating on the river bed in about three feet of water, carried there by the water movement. They had to summon help before he could be raised and brought ashore. Resuscitation was unsuccessful. The maximum water depth in the river was 9 feet.
(ALONE. VERY POOR SWIMMER. INEXPERIENCED WITH SNORKEL. OUT OF HIS DEPTH)

Case Snorkel 80/3

While two friends remained in the dive boat,

two spearfisherman entered the water. They had a float with a "Diver Down" flag about 20m from their boat but were not diving near it. They soon separated, one remaining about 60m away and the other (the victim) about 400m distant. This diver, aged 29, chose to spearfish in an off-shore channel used by speedboats travelling in this area. People in a boat using this route felt a bump, saw blood in the water, made an unsuccessful search for the shark or porpoise they assumed that they had hit, and then proceeded to their destination, where the propeller was taken for straightening. When the boat owner heard that a diver was missing in the area he had recently passed, he realised with horror what had happened. It would have been impossible for them to avoid this tragedy as they had no reason to expect a skindiver to surface in their immediate path. The victim, when recovered, was seen to have suffered immediately fatal injuries.
(ALONE. NO DIVING FLAG. IN BOAT CHANNEL. PROPELLER INJURY)

Case Snorkel 80/4

Family groups were picnicking on the river bank about 350 yards from the river's mouth. A number of power boats were drawn up on the bank about 50 yards downstream. The victim, a boy aged 15, was using a snorkel and diving in the nearest deeper water (12 feet) about 30 feet from the bank while one of his sisters was in the water nearer the bank. His father saw the girl tossed about by the wave from the power boat which came upstream rapidly as near to the bank as the deeper water allowed, and as he rescued her he became aware that the boat had hit someone further out in the river. He suddenly realised that the victim was his own son and rushed to attempt to rescue him. Unfortunately the injuries received were immediately fatal. A fisherman on the river bank saw the boy on the surface in the boat's path, but the driver of the boat failed to see him at any time. The boat was said to have been travelling too fast for the river conditions and the look-out may have been inadequate in the circumstances of there being swimmers in the water off the picnic area, and the choice of the course near to the bank inadvisable, but there were ripples on the water and the driver was facing into the sun so it would have been difficult to see a swimmer in the water straight ahead. There was no float or flag to give warning.
(ALONE. NO FLAG. BOAT AREA. PROPELLER INJURY)

Case Scuba 80/1

A number of divers proceeded in two aluminium boats to a noted diving area, some rocks a little distance off shore. The first boat carried four scuba divers, the second had three occupants. Two were spearfishers and therefore presumed to be breathhold divers, the third being the victim with his scuba equipment. They anchored, between 20 and 40m apart, in good diving conditions. The victim was a large man who is said to have been a heavy smoker. He had received no scuba training and had no medical check, was aged 32 and was making his 3rd or 4th dive. He wore T-shirt, jeans, mask, fins, weight belt and scuba tank with a regulator. He had neither buoyancy vest nor snorkel. After entering the water he appeared to have some minor surface problem through entanglement with one of the spearlines but freed himself and started to swim towards the other boat on the surface while his two companions went off in another direction.

At this time two of the divers in the other boat had descended while two were completing their preparation as they awaited the arrival of the victim. He was seen to start free style swimming, apparently without equipment and then to experience some problem, but he did not call out so no immediate action was taken. One scuba diver in the boat thought that his assistance might be required and said so to his companion in the boat. He then entered the water and descended to advise the other two scuba divers to wait where they were while he proceeded underwater towards the other boat. He came across the victim on the sea bed, here about 55 feet deep, minus equipment. He inflated his own buoyancy vest and surfaced the victim. It was difficult to get the body into the boat because of its weight. Resuscitation was unavailing. It is not clear why such an indirect response to a presumed need for assistance was chosen. There is no information concerning the ownership of the tank (which was borrowed) or whether it was turned on and no reason is apparent for the victim first ditching the equipment and then drowning in relatively calm water at the surface. Possibly he was overweighted and swallowed water, having no snorkel and apparently not thinking to use his scuba regulator for the surface swim.
(UNTRAINED. INEXPERIENCED. ALONE. SURFACE SWIM PROBLEM. NO SNORKEL. NO BUOYANCY VEST. SCUBA EQUIPMENT DROPPED. DIFFICULTY IN GETTING VICTIM INTO BOAT. BORROWED TANK.)

Case Scuba 80/2

A group of five divers had been together at 65 feet for 15 minutes when one of them accidentally dropped his weight belt and started an undesired ascent, his problem aggravated by the fact that he had inflated his buoyancy vest to adjust his buoyancy at depth. His buddy ascended with him and the others soon followed. It was decided that all would return to the shore, two going with this diver and the remaining two following in the rear. It was the victim-to-be and buddy who were the rear party. The buddy suggested that an underwater return would be best but was told that all air had been used. The suggestion that a snorkel surface swim must be undertaken to cover the estimated 70m to shore was greeted with horror as being too far. The water was somewhat choppy and a surface current was encountered so it was decided to go with the current rather than trying to cross its flow. Unfortunately this led them into even rougher water conditions, where they were hit by several large waves in succession. The buddy attempted without success to drop the victim's weight belt. He did not think to activate the buoyancy vest, as having none himself, he never thought about such an aid. The victim had not worn this vest previously: it was a type capable of either oral or tank feed inflation. Subsequent tests revealed that the tank still contained 450 psi

air. The victim lost consciousness and the buddy was lucky to attract the notice of some surfboard riders, who assisted bringing the victim ashore. Resuscitation had a limited success, the victim reaching hospital. Death occurred a week later from the pulmonary and cerebral damage which had occurred. This was the third dive made by the victim, age 22, since the recent completion of a scuba diving course.
(NEWLY CERTIFICATED. INEXPERIENCED. LACKED SNORKEL CONFIDENCE. CURRENT. ROUGH WATER. FAILED TO DROP WEIGHT BELT. FAILED TO INFLATE BUOYANCY VEST. BUDDY ASSISTANCE. DELAYED DEATH).

Case Scuba 80/3

This man, age 23, was an interstate visitor. His friend, a certificated scuba diver, hired scuba equipment for them both. The visitor had been learning to scuba dive for the past seven months but this was only his second open water scuba dive, the first such dive being on the previous day. They snorkelled on the surface from the beach the short distance to the rocky coast area and then dived. After viewing an underwater cave they became aware of a current and decided to return to the beach, but unfortunately soon became separated. The buddy therefore surfaced and looked around for his friend, who he saw on the surface nearer to the rocks than he was, with mask in hand and nose bleeding. His regulator was out and not retained even when the buddy replaced it. He advised the victim to retain his weight belt, lest he become too buoyant and get washed onto the rocks, and started to tow him. At one stage the victim seemed to be attempting to use his regulator and at some stage the weight belt and backpack were ditched, though it is not certain when or by whom. Rough water made exiting onto the rocks difficult. Resuscitation was unsuccessful. The victim who was not wearing a wet suit, had an 18lb weight belt.
(PART-TRAINED. INEXPERIENCED. SURFACE DIFFICULTY. ROUGH WATER NEAR ROCKS. CURRENT. EXITING DIFFICULTY. BUDDY ASSISTANCE. HIRED EQUIPMENT)

Case Scuba 80/4

There are many reasons for diving and the search for abalone seems to have been important to divers in this area. The victim was part-way through a reputable diving course, during which he had dived in kelp and survived its entangling properties without panic while collecting abalone, and on this occasion he was with a highly experienced diver on a abalone hunt. They were in a kelp area, snorkelling till they came to a deeper area which they judged was more likely to provide better hunting. The buddy noted a loss of contact with the victim but immediately afterwards suffered cramp and was forced to ascend, inflating his vest (CO_2 cylinder functioned correctly) and dropping some of his abalone. He managed to attract the attention of some friends on the shore and a dinghy was dispatched to collect him. They had been underwater only 20 minutes so he knew his companion would have sufficient air remaining for safety and it was not till he had been ashore for 15 minutes or so that he became worried and initiated a boat search for signs of the missing diver. The Police were alerted but darkness had fallen by the time they arrived. In the morning the body was recovered from the sea floor. It was lying at the base of some kelp but was not entangled. Water depth was 30 feet and all the equipment was still in place. The contents gauge indicated 700 psi remaining. He was wearing a buoyancy vest but it had no CO_2 cylinder, which was known to the buddy pre-dive. The reserve lever was in the "off" position. The autopsy on this 40 year old was unusual in that a Chest X-ray was performed and the mastoid cavities were examined to exclude the possibility that barotrauma had been a factor. This is not universally considered at autopsy investigation of diving-related deaths.
(PART-TRAINED. INEXPERIENCE. SEPARATION. USING SCUBA. BUDDY'S CRAMP DISTRACTED ATTENTION FROM RISK OF LEAVING VICTIM ALONE. NO CO_2 CYLINDER IN VEST. HAD OWN EQUIPMENT.)

Case Scuba 80/5

Although this diver had completed the usual course, certification had been withheld, by mutual assent, until greater facility with mask clearing had been demonstrated. The victim, age 20, was therefore with a class dive, intending to mask-clear at 20m as the final test. There were eight pupils, the chief Instructor and an Instructor-in-training. The dive was carefully organised, with a pre-dive description of the dive plan, the ABC check of each pupil, individual oral inflation of all vests and then individual water entry, the instructor awaiting them in the water outside the surf zone and his assistant bringing up the rear. There was a head count, then all deflated their vests and, one after the other, descended to the instructor waiting for them on the sea floor (10 feet depth), the assistant again following the last pupil. Visibility was about 10 feet in this place. Another head count was made. One of the pupils experienced some difficulty with ear equalisation so one of the instructors joined this diver (and buddy) while the condition was remedied. The other instructor now moved the group off a short distance, not immediately noticing the splitting of the class. However he noted the absence of his colleague and so assumed that each had four pupils. The instructor who had helped the diver with the ear problem was unable to find the remainder of the party when he again reached the sea floor so ascended and surface checked. A current was apparent and the two groups were considerably separated by this time so both made their way back to shore separately. It was only several minutes after they met on land that it was apparent that two divers were missing.

During the initial descent the victim's buddy experienced difficulty from excess buoyancy because some air remained in his vest. By the time the problem had been resolved the pair were unable to see any trace of the other divers. They ascended, noticing the current both underwater and at the surface, to find themselves far from the shore

in somewhat choppy water. Both divers attempted without immediate success to inflate their vests, the victim being seen pulling on the activating cords. It is supposed that the $C0_2$ was activated but that the venting valve was simultaneously opened, the buddy himself mentioning the difficulty of trying to pull the correct cord. They found themselves being submerged by the rough conditions and became separated. The buddy now realised that his regulator could provide him with air and this gave him some confidence until it ran out. Then he remembered to use his snorkel. He also managed to orally inflate his vest to a certain extent, but was getting exhausted and in danger of drowning when reached by rescuers. They activated his vest without any difficulty and brought him back to the shore. They were unable to see any signs of the victim, whose body was only recovered four days later.

When it was realised that there were two divers missing, the divers looked out to sea and could see two divers on the surface some distance away. The two instructors and two nearby experienced divers immediately entered the water and made a surface snorkel swim towards the missing pair, attempting to keep them in sight at all times. Unfortunately one disappeared from view.

The victim was known to use less air than others so had only been given a 50 cubic feet tank. Neither of the divers apparently thought to drop their weight belt in the stress situation of the rough surface conditions. *(WELL PLANNED CLASS BUT SEPARATION OCCURRED. INEXPERIENCE. BUDDY SEPARATION THROUGH ROUGH SEA. FAILURE TO OPERATE VEST CORRECTLY. FAILURE TO DROP WEIGHT BELT. CURRENTS)*

DISCUSSION

It is worth commenting, firstly, on the extremely small number of cases identified as having occurred in Australian waters. The search was diligent and it is believed that few additional deaths will be noted later, though persons knowing of such cases are requested to notify them. The low numbers illustrate the paradox that an obviously unsafe procedure, going underwater, can be made safe through careful recognition of factors critical to survival. Even these few deaths might not have occurred had a few factors been ordered differently.

Confident use of a snorkel is a skill which must be acquired, it not being natural to breathe through the mouth with the face submerged. It is a skill which may be vital for survival, for the body usually floats at equilibrium at the surface face down and submergence occurs if the head is raised above the water surface. Experienced divers often forget that period of their lives before they regarded the snorkel as a natural airway.

There is a tendency to underestimate the power of water. Many get to believe that a wet suit, mask, snorkel, fins and (possibly) scuba give mastery of the sea. The unfortunate few never get a second chance to learn better. The value of additional buoyancy, through the dropping of weights and inflation of a vest, may be forgotten in a surface stress situation of near drowning. The wisdom of the accepted dive procedure of surfacing while still having a reserve of air is obvious at such times.

Propeller driven craft can be heard underwater for a considerable distance but cannot be accurately localised. A “Diver Down” flag, if used, may alert the craft to remain clear and provides a certain moral advantage to the diver who encounters a moving propeller, but no physical protection. It is therefore wise to avoid channels or areas frequented by such craft and to use the Diver flag as an indicator of your immediate presence while being aware of the limitations of such protection. It is possible that the danger from propeller craft is increasing. A swimmer in the water is difficult to see from such craft and someone surfacing in choppy water, particularly if made inconspicuous by a black wet suit, gives even an alert driver little chance to change course to avoid a tragic encounter.

Scuba diver deaths this year reinforce previous observations that the inexperienced are disproportionately represented in the fatal incidents. Currents and rough water were critical in four, the fifth death probably resulting from some minor misadventure (such as loss of regulator) while alone underwater. In two incidents the buddy made valiant attempts to assist the victim but was unsuccessful. The outcome could have been different had there been adequate buoyancy for the victim and had there been air remaining in the cylinders in adequate quantity.

The need for efficient-when-needed buoyancy aids is tragically apparent in these cases. Oral inflation is an impossible option in any situation which has progressed to near drowning. There are very obviously problems with the $C0_2$ type vests on occasion (increased if there is no $C0_2$ cylinder!) and it is obviously impossible to pre-test the correct function of any cylinder before its once-only use.

Murphy’s Law operated at its most unjust in the class dive fatality, every usual and reasonable care having been taken in the management of the dive. However the co-existence of imperfect visibility, strong currents and minor problems experienced by two of the pupils initiated a train of events where problem compounded problem. The delay in recognition of the loss of two members of the class would have had minor consequences but for the surface current and choppy conditions. The pupils were unable to manage these conditions despite their training and their possession of scuba air supply, buoyancy vests and droppable weight belts. Correct use of any of these diving aids would have reduced the consequences of their separation.

It is axiomatic that fatalities represent one extreme of a spectrum of endpoints, many incidents occurring which result in minor or nil morbidity. Reports of such incidents are,

regrettably, rarely available. It is hoped that reading reports on the cases which have ended fatally will enable divers, including instructors, to recognise critical factors before they can progress to an irreversible degree. It is also hoped that appreciation of the value of the reporting of incidents which have been managed successfully will grow and that more will assist diving safety through the writing of CONFIDENTIAL REPORTS on what occurred.

ACKNOWLEDGEMENTS

This report could not have been made without the ready support and assistance of the Attorney-General's and Justice (or Law) Department in each State, the co-operative response of the Police to certain enquiries and the active interest of several organisations and divers. The active interest of the Water Safety Councils of NSW and WA in collecting information about drownings has been very helpful in identifying certain cases, and the support of the AUF and of FAUI is valued. It is hoped that other organisations will take an active interest in the future, joining the list of those who recognise the value of increasing our understanding of diving problems.

PROJECT STICKYBEAK

Project Stickybeak is an on-going project seeking to document diving-related events of all types and severities. Information, all of which is treated as being CONFIDENTIAL in regard to identifying details, is utilised as appropriate for current dissemination and retained for use by future investigators who will be bound by similar 'medical confidentiality" guidelines. Any person or organisation is free to use the printed reports to increase awareness of factors effecting diving safety. Reports may be sent to:-

Dr DG Walker,
PO Box 210,
NARRABEEN NSW 2101

OCTOPUS VICTIM

A newspaper report states that a Sydney tourist at South Stradbroke Island picked up a small octopus to show it to his two nieces and it bit him on the left hand. He was taken to the nearest hospital partly paralysed and dependent on a ventilator to keep him breathing, critically ill at the time of the report. Blue ringed octopus poisoning is expected to be of a limited duration of effect but the outcome of this case is not known at the time of printing.

SHARK - MAN - PROPELLER: A TRAUMATIC MIX

In January 1981 a game fisherman hooked a 4.5 m white pointer shark at Dangerous Reef, a favourite big game fishing spot 40 km from Port Lincoln, South Australia. In order to slacken the line, the boat was put into reverse. Suddenly the shark tugged the line strongly, pulling the man and his fishing seat out of the boat. The boat continued to reverse and ran over him. He was rescued by the other person in the boat and an urgent radio call for help was broadcast. He was rapidly transported to a hospital and treated for deep cuts in his right arm. The man recovered but the shark's condition was not recorded.

FATAL COMPLICATION OF WEARING A DRY-SUIT

The death, in September 1980, of an experienced diver in a Scottish loch illustrates the cumulative effect of a number of seemingly minor errors. He was involved in an underwater excavation accompanied by a student at the National Maritime Museum. They had begun to snorkel to the site when he decided that he needed more weights. When last seen he was wearing his own variable volume dry-suit and had his scuba unit on his back but was not wearing his mask and did not have the mouthpiece in his mouth. He carried 105 lb in total (cylinder 35 lb, weight belt 25 lb, shoulder harness 35 lb and 5 lb around each ankle) and was standing in 1.5 m deep water at the edge of the channel, their planned entry site. It appears that the buddy submerged leaving him to follow, later became concerned by his failure to join up and therefore started to search for him.

The victim was found on the bottom, head down and feet up. She found it impossible to raise him and it required the combined efforts of several people to raise the body.

It was found that he had ditched his weight belt but the chest harness containing weights had not been dropped because it had been put on before the scuba harness. It is surmised that he had fallen forwards into the 3 m deep water and had been unable either to reach his mouthpiece or drop all his weights. His inability to get into an upright position, a buoyancy maintained inversion problem long known to standard "Hard Hat" divers, denied him any hope of escaping drowning.

The basic critical factors were incorrect kitting up sequence, the buddy pair system being breached even before water entry, standing in a position where water entry could occur while being unprepared for such an entry and failure to ditch the scuba backpack and so release the total weights worn. But who in his place would have managed any better?