

buddy, appears to adversely effect safety by reducing the changes of assistance in the vital early moments of some crisis.

Medical factors may incapacitate a diver unexpectedly, immediate assistance being vital for survival. The medical conditions noted in this series (coronary artery disease, middle ear haemorrhage) might not be fatal if the victim receives immediate assistance. The history of asthma in one victim raises ethical and legal considerations which will not be discussed here.

In brief, those at greatest risk are the inexperienced, diving alone without buoyancy vests or contents gauges in environmental conditions beyond their ability to manage.

Acknowledgments

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Project Stickybeak

Readers are requested to support this research and thereby assist further raising the safety record of diving. Any type of diving-related incident however minor may hold clues to safer diving. No problem can be remedied until it has been recognised, no improvement occurs unless the information is shared. All information supplied is treated as confidential concerning the actual persons involved. Please write to:

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THE CORONIAL INVESTIGATION OF "SKIN-DIVING" FATALITIES IN NEW ZEALAND

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I have recently reviewed the New Zealand skin-diving fatalities for the period 1961-1973 (*NZ Medical Journal* 89:472-475) and found major deficiencies in the information made available to the coroners, on which they reached their conclusions. In only one case had an overall assessment of the facts been made by a skin-diving expert. The Coroner's Act states "The principle functions of a coroner shall be to enquire in

accordance with the provision of this act, into the manner of death of any person in any case where this act requires that the death be reported to the coroner". It seems reasonable to interpret this as requiring the coroner to investigate why the incident occurred rather than merely how the death occurred. To state only that someone "drowned by skin-diving" leaves too many questions unanswered. Why should these fatalities be investigated in such a way? I see two main reasons. First, to establish the factors that contributed to the fatality, and second that we may learn from the mistakes of others. These lessons can be incorporated into instruction programmes leading, hopefully, to safer diving practices.

The following 21 case histories illustrate the varied critical factors that have been identified in this series.

Case 1

This 50 year old had been a scuba diver for 2 and a half years and was thought to be competent. He was crayfishing with a buddy in 12m of water from a boat in calm conditions. All was well until he indicated that he was going to surface with a sack of crays. The buddy watched him ascend and then as he started to follow he saw the sack of crays come down. He recovered the sack and on reaching the surface saw the deceased face down in the water just below the surface. Frothy blood dribbled from the mouth. The rescuer dropped the deceased's weight belt and mouth to mouth resuscitation was given whilst towing the deceased to the boat, but to no avail. No buoyancy compensator was worn by the deceased. The equipment does not appear to have been checked following the incident. The postmortem showed signs of drowning and patchy atheroma of the coronary arteries with almost complete occlusion of the anterior descending coronary artery. It was concluded that death was a consequence of the coronary artery disease.

Cardiac arrhythmia or myocardial infarction are especially hazardous when they occur in the water. If buddy contact had not been broken at the time of ascent, it would have been theoretically possible to prevent drowning. The outcome would then be dependent on the severity of the cardiac arrhythmia or infarction.

Case 2

This 51 year old was a newly qualified diver and a member of an New Zealand Underwater Association club. He was diving with a buddy at an off-shore island from a boat. They had a shallow dive for 15 minutes, after which they surfaced and had lunch in the boat. One hour later they dived again for 25 minutes in water 10m deep. The deceased gave a signal to surface which they did together, and they found that they were 30 metres from the boat. The sea was quite choppy and the deceased was having difficulty in breathing.

The buddy had lost his own snorkel and both

divers were swallowing a lot of water. The buddy told the deceased to hang on to his tank and then started towing him back to the boat. After 10 metres he noticed the deceased had disappeared. Several other divers in a nearby boat were asked to assist. The deceased was found half an hour later in 5-6m of water with his weight belt still on. Artificial resuscitation was attempted but to no avail. No comment is made whether a buoyancy compensator was worn. The cylinder and regulator were borrowed and later testing revealed 1.95 litres of sea water in the cylinder and no air was present. There was considerable corrosion.

Sea conditions were not really appropriate for a newcomer to the sport. He was ill-equipped without buoyancy compensator, snorkel or contents gauge. He ran out of air and so could not use his regulator on the surface. The weight belt was not ditched.

Case 3

This 18 year old was an experienced snorkeller but had only two previous scuba dives. He was diving with two companions (T and W) at the Poor Knights Islands. After snorkelling a while they descended with aqua-lungs and spearguns to 45 metres, spending 5-10 minutes at that depth with a total time in the water of 20-25 minutes. "W" felt nitrogen narcosis coming on and signalled that he was going back to the surface. He moved up 10 feet and then the victim swam to him indicating that he was low on air and also wanted to surface. The victim grabbed "W"'s arm. Thinking the victim needed air, "W" handed his mouthpiece to him. A rush of bubbles obscured "W"'s vision and he then blacked out, dropping his speargun. He recovered on the surface without his mouthpiece in his mouth. In the meantime, the victim had diver deeper to get the dropped speargun. During this time "T" was also not feeling too good and had started to surface with "W". On seeing the victim dive deeper for the speargun, "T" went after him. The victim at this stage was attempting to turn on his tank valve (which was already on) and did not have his regulator in his mouth. "T" offered his regulator to the victim but this was refused. "T" then released the victim's weight belt and aqualung and then had to surface himself. In the meantime, "W" had changed to a new tank and when "T" told him the victim was still on the bottom, "W" descended and searched for him in vain. "T" then went down again and found him after a total lapsed time of 10 minutes. The postmortem showed signs of drowning and frothy blood in the right heart and pulmonary arteries. The cerebral and mesenteric arteries also contained air bubbles.

The deceased and far too inexperienced for such a dive and ill-equipped, not having a buoyancy compensator or contents gauge. The loss of buoyancy, nitrogen narcosis and exhaustion of air supply meant death was almost inevitable. The intra-vascular gas found at autopsy reflected the length of time the body was under pressure and did not indicate decompression sickness. It was

indeed fortuitous that his companions did not suffer from decompression sickness in their search for the deceased.

Case 4

This 27 year old was a weak swimmer and it was noted at a club training session one week prior to death that he was not happy with some of the tests. Over the few days prior to the dive, he was not feeling well. He went diving from a boat with two buddies. Gear was checked before entering the water but it was noted that the deceased's fins were not being worn. Buddy "A" and the victim went in and a strong current carried both of them away from the boat. Although they knew there was a current present, they did not appreciate that it would be as strong as it was. The buddy was able to make it back to the boat and he then swam a line to the victim who was then pulled back to the boat by buddy "B". He was left hanging on the back of the boat. Buddy "B" then swam the line to buddy "A" and they both returned to the boat. They then noticed the deceased on the bottom in 6m of water with his weight belt off and the waist strap of the tank harness undone. The tank was dangling from the neck by the regulator neck strap. A buoyancy compensator was worn but the cartridge had previously been removed. On recovering the body, it was seen that the face mask was half full of blood. The postmortem showed signs of drowning and the blood in the mask was a consequence of pulmonary congestion.

In view of his previous lack of competence, the deceased should not have been diving in a current. The pre-dive gear check was inadequate and drowning was directly attributable to the absence of fins and consequent difficulty in staying on the surface. The reason the deceased let go of the back of the boat is not known. Possibly he attempted to take off his belt prior to getting into the boat and on letting go of the back of the boat he sank. Another possibility is that he was so weakened from the previous ordeal that he did not have the strength to hang onto the boat. His buoyancy compensator should have been inflated by himself or his buddies.

Case 5

This 47 year old had no previous diving experience at all. He purchased new equipment five days prior to his death. The only instruction he had was given by a salesman who knew very little about the sport himself.

He went to search for a sunken mooring in a harbour at 7.00 pm in darkness. He was wearing a wetsuit and weight belt but no fins. An assistant was present in a 2 metre row boat. An 8m length of rope was attached from the diver's arm to the bow of the boat. The depth of the water was not recorded and water conditions were calm. After one minute, the diver surfaced and floundered around. His assistant pulled him half into the dinghy which then became swamped. He was unable to support the

diver who was at this stage limp and unconscious. When the body was recovered a short time later, the rope was seen to be tangled around his leg and the weight belt had not been released. No postmortem was performed

The sale of diving equipment by ignorant salesmen to ignorant people is to be deplored. Presumably death was due to drowning as a consequence of lack of buoyancy although pulmonary barotrauma cannot be excluded.

Case 6

This 29 year old had been a snorkeller for four years and had used scuba for 4 months, having taught himself. He and a buddy went crayfishing from a boat leaving the skipper topside. His first dive was to 9m for 10 minutes after which he surfaced and fiddled with his regulator as it was giving trouble. They then moved to another dive spot and 30 minutes after the last dive they descended again. After 10 minutes at 12m, the deceased surfaced with a large cray and swam to the boat. He seemed OK but did not take an oar that was offered to him by the skipper. He sank beneath the surface and bubbles were seen coming up from where he sank. The buddy dived but he immediately ran out of air.

After changing tanks he dived again but due to a leaking regulator took in water and surfaced in a distressed condition. Once he had regained his composure and fixed his gear up, he wanted to dive again, but the skipper thought it unsafe and left the site to get help. When the body was recovered a short while later, it was noted that the 6 kg weight belt was separate and the dry suit was torn. The diver recovering the body could not bring it to the surface until after he had removed the scuba. A post mortem showed signs of drowning. The navy tested the regulator and found it to be functioning satisfactorily. 990 ml of sea water was present within the tank.

Death appears to have been a consequence of loss of buoyancy after the dry suit was torn, presumably from the crayfish or a rock. Water would have entered the tank only after exhaustion of the air supply. A buoyancy compensator could have averted death. If the buddy had not exhausted his own air supply and had his own equipment in good condition he may have been of more use to the victim.

Case 7

This 29 year old was able to snorkel to 21m but his scuba training and experience were not known. Although he had eight hours sleep the previous night, he had been drinking and was described as "full as a bull". He dived with a buddy to 30m, both taking spearguns with them. The buddy experienced shortage of air and thought that his reserve was jammed. Consequently, the deceased commenced buddy breathing although the initiation of this was delayed due to a neck strap around the regulator. About half way back to the

surface, the deceased seemed to hold on to the regulator longer than normal. The buddy therefore tried his own regulator and finding it to be working, signalled all was OK. The deceased however persisted in holding out his regulator to the buddy who then moved rapidly to the surface in panic without purging his compensator. At that time they had been down 10 minutes. The deceased never reached the surface and fifteen minutes after the incident, another diver found the body in 30-40m of water. The postmortem showed signs of drowning with haemorrhagic fluid within the lungs.

The exact reason for drowning is not known although the possibility of air embolism occurring was high. It is indeed tragic when a would-be rescuer loses his life and the potential consequences of improper buddy breathing technique are obvious.

Case 8

This 24 year old was inexperienced and dived with an inexperienced buddy in search of mussels 20m from shore in 6m of water. Both surfaced after 5 minutes and then dived again. While underwater, the buddy touched the deceased, pointed up and surfaced. He returned to shore where he had trouble getting back on the rocks. The deceased then surfaced, shouted for help and appeared in difficulty. Help was summoned and the victim was found half an hour later lying on his back on the sand 40 metres out. Two weight belts and an empty sugar bag were found 3m away. Mouth to mouth resuscitation was unsuccessful. The postmortem showed signs of drowning. When the equipment was tested, 1200 psi of pure air remained in the tank. At an equivalent depth of 6m, no air could be sucked through the demand valve and operation of the purge caused a continuous air flow that could not be stopped. Disassembly revealed the rubber of the tilt valve seat protruding through the hole that the spindle of the tilt valve went through. The first stage was severely corroded.

Death seems directly attributable to an inexperienced person using equipment that had not been adequately maintained. Since the buddy was also inexperienced (his first ever dive), it is doubtful that a rescue could have been effected even if buddy contact had not been broken.

Case 9

This 30 year old was on a club dive trip. He entered the water and stayed on the surface for 10 minutes before descending with his buddy. The buddy had to surface because of difficulty clearing his ears but the depth when this occurred was not recorded. A few minutes later the buddy saw the victim floating in white water with his compensator fully inflated. Rescue attempts were hampered because the weight belt could not be released during the rescue procedure and the charter boat could not move closer to the victim as a result of nearby rocks and no dinghy was available. A resuscitator was used for 2 1/2 hours

without success. It was commented that "oodles of blood were coming out of his mouth". The postmortem showed signs of drowning and a very slight tracheal stenosis, a consequence of a previous automobile accident. An excellent airway was still present however.

Rescuers described "oodles of blood", but no mention was made by the Pathologist as to its possible source. Although drowning in the white water may have been the only problem, it is more likely that air embolism occurred either following a normal ascent, a panic ascent or accidental inflation of the buoyancy compensator.

Case 10

This 23 year old had no previous scuba experience and borrowed equipment from a person who himself had limited experience. The lender warned the deceased to have an experienced person with him. He ignored the advice and dived alone in a murky river dressed in corduroy trousers, football jersey and a 7kg weight belt. A non-diving companion was with him. After three minutes he surfaced struggling. His companion attempted to rescue him but was nearly pulled under and so the victim had to be left. The body was recovered 1 hour later in 4m of water at which time the weight belt was not attached. A post mortem showed signs of drowning.

Amurky snag-ridden river and an ignorant overweighted novice seem the perfect combination for death.

Case 11

This 37 year old was a heavy smoker and thought to be a safe diver, who usually dived in less than 6m of water. He had been diving for two years. He went diving with two buddies in a boat for the purpose of crayfishing.

He remained in the boat while the other two dived. When they had finished he put on gear and went down by himself. The tank and regulator had been used earlier in the day for 10 minutes by one of the others who commented that the mouthpiece was leaking. The deceased passed a remark about showing the others how to do it. Water conditions at the time were choppy. When he did not surface, a search was attempted for 10-15 minutes, but then abandoned since there was too much tide movement for safety. The body was found the next day with all gear on at a depth of 33m. He was not using a buoyancy compensator, depth gauge, reserve system or contents gauge. The autopsy showed signs of drowning. Testing of the equipment revealed a defect in the regulator's second stage non-return valve which allowed water to enter. The air was at 0 psi and analysis revealed a carbon dioxide concentration of 0.7%.

It seems likely that the victim ran out of air at 33m with his mental facilities impaired as a consequence of nitrogen narcosis and excessive inspired carbon dioxide. The lack of a buoyancy compensator would have meant increased effort to maintain a neutral position and consequently increased carbon dioxide production. A deep dive when alone, inexperienced and inadequately equipped is courting disaster.

Case 12

This 33 year old was thought to be a strong swimmer who was used to mask, flippers and snorkel. He had used scuba only twice before. Although healthy, it was reported that he was a heavy drinker and suffered from migraine and high blood pressure. The night before the fatality he was drinking until 2 am and on the morning of the fatality, he had only a cup of coffee for breakfast. He was suffering from a headache, shaking badly and admitted to feeling weary. He was diving alone for mussels from a boat in which companions were present. His equipment was borrowed and he used a 3 kg weight belt without a wetsuit. No buoyancy compensator was worn. He was diving in 1m of water initially. He then moved into 5m of water before surfacing and indicating that he was in trouble. A companion from the boat told the deceased to drop his sack of mussels and he then swam over to him. In the meantime, the deceased had removed his mask and regulator and sank. He surfaced again and the rescuer tried to undo the weight belt but both of them began to sink. At this stage the victim was limp. The rescuer had to let go of the victim who then sank. Help was summoned and the body recovered 1 1/2 hours later in 9-12 m of water. Resuscitation was attempted for one hour. It was noted that the waist strap of the tank harness was over the top of the weight belt and no air was left within the aqualung. The equipment was later inspected and found to be functioning properly. Water conditions at the time were calm although a current was present which pulled the victim and rescuer away from the boat. The victim had consumed two beers with his lunch. A postmortem showed signs of drowning and a blood alcohol level of 105mg%.

An inexperienced, intoxicated, overweighted diver who ran out of air while diving alone.

Case 13

This 28 year old had been scuba diving for two years. He was diving from a boat near rocks with a buddy in 12m of water. The purpose of the dive was spear fishing, but it was not specified whether the victim had a gun. The buddy surfaced and climbed onto rocks after completing his dive which he had classed as easy. He saw the victim on the surface 75m away and he appeared to be carried seawards by a strong current, although he did not appear to be in difficulties. The buddy signalled the boat to come around to give assistance, but on looking back the victim had disappeared. The body was never found.

The circumstances leading to death are not known, but certainly the lack of buddy contact and probable failure of the victim to drop his weight belt were factors.

Case 14

This 48 year old was said to be experienced. He scuba dived alone while his four boat companions line fished. After a bottom time of 20 minutes, he surfaced over 100m from the boat and waved. The anchor was pulled up and the boat headed towards him. When 30m away, the deceased went under the water for a few seconds and then came up and gasped before going under again. One of the boat members grabbed the anchor rope and dived down and found the victim head down close to the bottom in 5-6m of water. He grabbed the victim and then his companions pulled them to the surface by means of the anchor rope. The regulator mouthpiece was not in his mouth at this time. He was given external cardiac massage and EAR and after 15 minutes began breathing strongly. However breathing ceased two minutes later. The deceased was using twin cylinders which were completely empty. The postmortem showed signs of drowning.

Another death while diving alone and running out of air.

Case 15

This 37 year old and his female buddy were diving for paua from the shore. The depth and duration of the dive were not recorded. When the sack was full, the victim and buddy signalled to each other that they would go ashore. The buddy surfaced 20-30m from shore and the deceased surfaced 10m from shore and began using his snorkel. The buddy noted that he was near a rock and told him to move away but he said something about the bag and appeared to get caught up in the kelp. The buddy went over to him (which only took a few seconds), pulled him clear and noticed that he was limp and unconscious. She immediately removed his weight belt and tank, the latter being difficult. After a considerable struggle, he was brought ashore. Water was squeezed out of his chest and then EAR was applied for 20-30 minutes to no avail. The sack had been tied to his wrist and he had cut the string with his knife. The post-mortem showed signs of drowning.

Death was undoubtedly due to drowning due to entanglement as a result of tying the bag to his wrist. When he realised he was in trouble he should have reinserted his regulator mouthpiece. The short interval between entanglement and unconsciousness illustrates that drowning may indeed occur very rapidly, a fact not widely known.

Case 16

This 40 year old was a well known and very experienced diver who commonly dived deeply with disregard for proper decompression procedures.

The fatality occurred during a diving convention. The victim was buddied with his brother and together they descended to 75m. The brother ascended because his decompression meter showed it was nearing time to go up. The duration under water was not specifically recorded but was probably at least 10 minutes. The victim ascended later and met up with his brother at 16m. At this time the victim's decompression metre was well into the red danger mark. The victim ran out of air and then used his brother's tank. By the time the victim reached the boat, he was unconscious. He was transported to the Naval Decompression Chamber arriving there five hours after the accident. Death occurred four hours later. The postmortem showed congestion of the organs with no evidence of intravascular gas.

Death appears to be due to either severe decompression sickness or air embolism subsequent to surfacing after running out of air. The decompression treatment may well have altered the postmortem findings and accounted for the lack of obvious intravascular gas.

Case 17

This 33 year old had one year of scuba experience and was diving with two others from two boats looking for crayfish. The maximum depth of water was 23m. He ran out of air at 8m after a bottom time of 30-35 minutes. The two other divers remained underwater two minutes longer and when they ran out of air they ascended. The victim was seen to surface by companions in the boat who noted that he sank, came up again, raised his arm and then sank again. The boat anchor was unable to be raised and so the warp was cut to enable a search to begin. A surface search was unsuccessful. No below water search could be carried out since all scuba tanks were empty. The body was never recovered. Two weeks prior to the accident, the victim collapsed but did not see a doctor. The day prior to the fatal dive he said he thought he had sunstroke. However, he went out that evening returning home at 10.30 pm.

The cause of death cannot be ascertained. Air embolism as a result of a free ascent, inhalation of water due to choppy surface conditions, or medical illness are all possibilities. All three divers used their air up completely. Not only did this probably lead to the death of the victim, but it precluded underwater search by his companions. Buddy contact was broken. If it had been maintained tragedy may well have been averted. If a float had been attached to the anchor warp, then it could have been thrown overboard and so save time before initiating the search.

Case 18

This 37 year old was experienced and had dived all over the world. The victim was diving from a boat where water visibility was poor. Surface conditions were not recorded. The victim complained of headache prior to diving, which

cleared up after one hour of snorkelling. He then scuba dived with a buddy but buddy contact was lost in 9m of water due to the poor visibility. The buddy continued diving for a further 15 minutes and then surfaced. While the buddy was in the boat, he saw the victim 150m away on the surface for 30 seconds. When the buddy looked the other way, the victim disappeared and was never seen again. A search was made for air bubbles unsuccessfully. The water was 18-26m deep in the area the victim was last seen. The victim was wearing twin tanks and a buoyancy compensator and submersible pressure gauge. A spear gun was also carried. The body was washed up ashore 12 days later. The tanks were still attached with the left tank valve open and the right tank valve jammed closed. The weight belt was missing. There is no record of the equipment being tested following the tragedy. The body was decomposed too badly for postmortem to be of any use.

The significance of the headache prior to diving was not known. It is a pity the equipment was not checked following the tragedy. The right tank valve was jammed closed but it is not recorded whether air still remained within this tank and it is not known whether this jamming occurred prior to death or following death, as a result of contact with the bottom. Although the contents gauge registered zero, there may have been air left at the time of death with free flow occurring following death. Buddy contact was broken.

Case 19

This 19 year old was regarded as fairly experienced. He was diving for crayfish with a buddy from a boat in rough water with 1m visibility. The divers went initially to 27m and then ascended to 23m. While searching for crayfish at this depth they became separated. After completion of the dive and when the victim had not surfaced, an extensive search was carried out. A third party in the boat had noted previously that the victim's bubbles had not been moving from near a rock. The rough surface conditions and poor visibility hampered attempts at finding the victim. A large number of crevices were present in the area which raised the possibility of entrapment in a cave. The buddy made an adequate search without success and resulted in his DCP entering the red zone. The body was finally found 11 days later. The body was badly decomposed and only one glove and one flipper were present. Another flipper was nearby. The victim was not wearing a DCP or contents gauge or depth gauge. The body was badly decomposed and determination of the cause of death was impossible. There was no evidence to suggest a cause other than drowning.

The factors leading to death are unknown, although entrapment is possible. Continuation of buddy contact may have resulted in a happier outcome.

Case 20

This 30 year old was thought of as an "experienced diver" by his buddy who had dived with

him five times before. A party consisting of the victim, his diving buddy and two girls went to a bay on a deep fresh water lake by boat. The two men dived and at 38m the victim signalled to his buddy that he wanted to surface. He appeared alright. The duration of the dive was not recorded. Both divers surfaced but did not keep in sight of each other. When the buddy surfaced the victim was not to be seen. The two girls in the boat reported that the victim had called for help on reaching the surface and after floundering he sank. The buddy then searched for the victim going down to 38m until his air was exhausted. The boat then returned to shore and picked up another diver and tank. They then returned to the dive area and the third diver searched to no avail. The buddy then put on a tank and searched to 60m until air was exhausted. The body was recovered the next day at a depth of 53m. No comment was made as to whether the victim was wearing a knife or buoyancy compensator or depth gauge or contents gauge. At the time the body was recovered, the weight belt was still present. 1200 psi of air remained in his tank. The postmortem showed air within the venae cavae and right heart. The lungs were voluminously inflated and microscopy showed alveolar rupture.

The reason for the rapid ascent and probable pulmonary barotrauma with air embolism is not known. The buddy certainly put himself at risk of getting decompression sickness in his attempts to find the body.

Case 21

This 42 year old was using scuba gear in order to inspect a boat mooring. He was diving alone but had his wife in a row boat accompanying him. He had a piece of chain around his body for a weight but it is not known how much this weighed, nor whether a wetsuit was worn. No details are available as to other articles of dive gear that he was wearing, if any. On the day of the fatality, water conditions were calm but the depth is not known. He dived for an unknown period of time and then surfaced beside the row boat. According to his wife he then let go and swam underwater. He then appeared to surface and shoot backwards at speed for about 30m and shout out "Jesus, Sweet Jesus". He then lay face upwards with one arm out of his diving harness. His wife then dived into the water and pushed him to shore where he was noted to be groaning. The rocky shore made attempts at resuscitation difficult. Examination of his equipment showed no remaining air and leaks from both first and second stages of the regulator. Rust was present within the tank. The postmortem showed signs of drowning.

The wife's description of the victim shooting backwards at speed for about 30m defies analysis. The victim undoubtedly ran out of air. Whether he then inhaled water or whether he suffered air embolism on surfacing cannot be ascertained. Although postmortem revealed changes of drowning, this may have occurred when being taken to shore. Since the mechanism of the fatality is not known, it cannot be ascertained whether EAR in the water would have altered the outcome. The cause of death

was certified as drowning from using faulty diving equipment which is probably incorrect, since he was able to continue diving until his air ran out.

The following factors contributed to the 21 fatalities:

1. Running out of air: 9 divers. In addition attempts at rescue were thwarted in three cases because the buddy had also run out of air.
2. No Contents Gauge: Only 3 divers were recorded as having a contents gauge. 10 were known not to have one. Presence or absence was unknown in 8.
3. No Buoyancy compensator: 6 divers were recorded as having a buoyancy compensator. 9 were known not to have used one. The situation was unknown in 6.
4. No Fins: 2 divers did not wear fins.
5. Faulty Equipment: In 6 cases, the tank or regulator were defective although in only one case did this lead to death.
6. Lack of Experience: 2 had nil, 8 had 0 - 1 year, 8 had 1 - 5 years and 1 had over 5 years. In two cases, experience was not known.
7. Lack of Fitness: This factor was inseparable from adverse weather conditions which contributed to 3 deaths.
8. Nitrogen Narcosis: contributed to 3 deaths.
9. Training: previous training was not recorded in 16 cases.
10. No Buddy: 7 had no diving buddy, 12 of the remaining 14 were separated from their buddy by at least 6 metres at the time of the mishap.
11. Air Embolism: only 1 confirmed case, although in 7 others there was a strong possibility.
12. Alcohol: 2 divers had blood alcohol levels of 25 mg/100 ml and 105 mg/100 ml respectively.

It is of interest that 14 deaths were in less than 15 metres and only one was greater than 45 metres.

DISCUSSION

It is apparent that greater information would have been available concerning the critical factors had the Coronial Investigation sought to obtain the following basic details.

1. Pre-Dive Data
 - a. Diving experience and whether the victim was suitably experienced for the type of dive that proved fatal.
 - b. The type of training and whether the diver was taught by a recognised diving school.
 - c. The events of the previous 24 hours, with specific reference to the amount of sleep, whether alcohol was consumed and any evidence of medical illness.

2. Diving Equipment

- a. A complete inventory of the equipment worn.
- b. Testing of the first and second stage regulators and of the tank with comment made as to whether any fault detected could have been contributory. Too often equipment has been described as faulty but its relationship, if any, to the fatality ignored.
- c. Gas analysis in every case. Even an "empty" tank contains air at ambient pressure that can be sampled and analysed.

3. Environment

Weather and sea conditions, visibility, water temperature, currents, all contributed to the fatalities recorded in this paper.

4. Dive Profile

A complete description is required with particular attention paid to the time at which various events happened. This is the most important piece of information that can be given to the coroner and the events of the dive must be described in detail. It is this information that needs critical appraisal by a skin-diving expert and preferably such an expert should have the opportunity to question appropriate witnesses to insure all the relevant facts are brought out.

OBITUARY

Ian Plant, UK Cave Diver

The tragic death of Ian Plant has been reported from the UK. This occurred in late March while he was attempting to plot the link between Bull Pot and Aygill Cavern, Cumbria, dye tests having shown the continuity of water filled passages.

He was a very experienced cave diver and had helped to save the lives of dozens of trapped potholers during his career. He was closely connected with Oliver Statham and Geoff Yeadon, who last year made the world record cave-dive at Keld Head.

Cave diving is a speciality of extreme risk, requiring the highest qualities of skill and self control.

Readers may like to re-read past articles on this subject. (*SPUMS Journal July-Dec 1977, Jan-Mar 1978*).