IN THE CORONERS COURT HELD AT WELLINGTON 21 October 2004
RESERVED FINDINGS OF THE CORONER
Lance Baker

Background
[1] The deposition of Constable Kelly reads that at about 1.00 pm on 10 March 2002 Police were advised by emergency services that Lance Baker, then aged 32 years, had died whilst diving off the northern end of Kapiti Island. Police went to the beach area near the Kapiti Boating Club rooms and began enquiries into his death. Those enquiries found that Mr Baker and three diving companions left the Boating Club by boat at about 9.00 am on 10 March. Mr Baker was a recognised ‘free dive’ exponent, which activity involves persons diving without the assistance of air tanks to the greatest depth possible, where they retrieve a tag or disc from a pre-set line. The production of this tag to the competition organisers indicates the diving depth achieved. Mr Baker was a North Island champion in the sport, had competed at national events where he was highly placed and had attended international coaching clinics. Mr Baker and his companions headed to the southern end of Kapiti Island where they made a number of individual free dives to depths of approximately 80-90 feet. They then travelled to the northern end of the island, anchoring about 500 metres off-shore. There were a number of boats around at the time and there was little swell or current. Water visibility was about 10 metres. The group used spearguns and were diving as individuals but in close proximity to each other. They were close to a large rock which was about 10 metres in diameter and lay 15 metres below the surface of the water. The water depth to the sea floor was about 50 metres. While one of the divers, Mr Paul Matthews, was ascending the face of the rock, he found Mr Baker lying face down among kelp on the top thereof. He immediately swam to him and noticed his mask was full of water. He hauled Mr Baker to the surface and attracted the attention of the boatman, who was some 20-30 metres away. Once he was on the boat his other companions immediately began CPR and broadcast a 'mayday' call on the radio. They were met on shore by an ambulance crew. Mr Baker was not able to be revived. Constable Kelly said

Police were satisfied that Mr Baker's death occurred as a result of shallow water blackout syndrome, described in a report compiled by Sergeant Bruce Adams of the Police National Dive Squad. She said Police found no evidence to suggest that any other person was involved in Mr Baker's death. The Court should comment that it is not a function of the Police to satisfy themselves as to the cause of deaths investigated by them on behalf of the Coroner. That is the function of the Coroner. The statutory function of the Police is to assist the Coroner in his or her investigations and inquiries into the causes and circumstances of deaths reported to him or her.

[2] Lying before the Court is a report from Dr K J Thomson of Wellington, Pathologist. Dr Thomson advises that the cause of Mr Baker's death was drowning. There was no evidence of any pre-existing disease which might have contributed to such drowning. Also before the Court is a report from ESR dated 27 June 2002. That report shows that no alcohol was detected in a sample of femoral venous blood taken from Mr Baker's body for analysis. The blood was analysed for the presence of the majority of medicinal drugs which affect the mind, alter mood or cause sleep. No such drugs were detected, other than indications of the possible presence of Atropine, which was not confirmed. The blood was screened for evidence of the recent use of Morphine/Heroin and Cannabis. No such evidence was found. Analysis of the blood for the presence of Amphetamine-type drugs showed the presence only of pseudoephedrine. That drug may be used as a nasal

decongestant and bronchodilator. It is found in "over the counter" cold and allergy formulations combined with antihistamines and analgesics such as Sinutab and Sudafed, in single doses that range from 5 to 60 mgs. Daily doses of up to 240 mg may taken. Pseudoephedrine may be subject to post-mortem redistribution. Toxic effects can result from a single 60 mg dose of pseudoephedrine. ESR says it does not know whether the increased pressure resulting from deep diving would exacerbate the adverse effects of pseudoephedrine. It advises that the level of pseudoephedrine in Mr Baker's blood specimen was at the top end, or marginally above the levels expected from the therapeutic use of such drug. Such level may have been increased by post-mortem redistribution. Because the blood taken from Mr Baker was taken from the femoral vein, there is not the same concern over the possibility of post-mortem redistribution as there would be if blood was taken centrally. Toxic effects from pseudoephedrine may include dizziness, convulsions, arrhythmias, hypotension and cardiovascular collapse.

[3] S.15 of the Coroners Act provides that a Coroner holds an Inquest for the purpose of establishing, so far as is possible, that a person has died; the identity of that person; when and where the person died; the causes of the death; and the circumstances of the death. The Court is satisfied that Lance Baker died on 10 March 2002 on a small boat at Paraparaumu Beach, Paraparaumu and that the direct (medical) cause of his death was drowning. It remains for the Court to establish the wider causes of his death and the circumstances surrounding it.

The Evidence

[4] Evidence was heard on 4 November 2003 from Mr G F Mackereth and Mr P A Matthews, who were diving with Mr Baker off Kapiti Island on the day that he died. In a statement made to Police on 10 March 2002 Mr Mackereth said he, Mr D Archbold, Mr Matthews and Mr Baker left Paraparaumu Beach on his small boat at about 9.00 am on 10 March. They went to the south end of Kapiti Island. Mr Archbold was the boatman. Messrs Mackereth, Matthews and Baker were diving. The three men went for a free dive at a reef near the Island. They were using only a snorkel. Divers can free dive to depths of up to 90 feet. Mr Mackereth says Mr Baker told him he was lying on the bottom at 90 feet at one stage. Mr Mackereth was diving to about 80 feet. When the boat was anchored there was a line off the back of it which the divers would hold onto when on the surface, as the current was quite strong. Mr Mackereth's statement continues:

"We would go down one at a time, as it is difficult going down together as you are using spearguns. Once the other person had come up, the next one would go. The visibility today wasn't good enough to see the diver going down, but you could see the line going down."

Mr Mackereth said that the divers then went to the north end of Kapiti and the boat was anchored in a cluster of boats. Conditions were calm and current was mild. The men were free diving for about 30 minutes. Mr Mackereth says he had shot a fish, gone to the boat and returned to the line, where he was recovering from his dive. Mr Baker and Mr Matthews had been diving near the aft-port quarter of the boat whilst he was behind the boat. The men were diving to a depth of about 20 metres. Mr Mackereth did three or more dives in the area referred to and then observed Mr Baker near him. He realised that Mr Baker had come back from the front of the boat towards him. There was a discussion between Mr Baker and Mr Mackereth concerning the location of fish. About 10 minutes later Mr Mackereth was on the surface and heard Mr Matthews shouting. He saw Mr

Matthews was holding Mr Baker and he swam over to help get Mr Baker back to the boat. Messrs Mackereth and Matthews had to swim against the current. Mr Mackereth observed that Mr Baker had blood and foam coming out of his nose and mouth whilst being held by Mr Matthews. Mr Matthews was telling Mr Baker to breath as Mr Mackereth drew near to assist in bringing Mr Baker back to the boat. Mr Mackereth says Mr Matthews was telling Mr Baker to breath because 'When you free dive there was what is called "shallow water blackout". This is when ascending after a dive, the expansion of the lung can draw oxygen out of the blood and cause the diver to blackout. They then start sinking." Mr Mackereth says that if the diver has his snorkel in, water rushes into the mouth. If the snorkel is out, the diver does not inhale oxygen. If a diver has blacked out whilst ascending, if someone shakes them or yells at them on the surface, "they take a breath". Mr Baker still had his weight belt on when Mr Mackereth got to him in the water. He and Mr Archbold started CPR when Mr Baker was returned to the boat. They released the weight belt and cut the wet suit. Mr Mackereth says that when he first saw Mr Baker he appeared very cyanosed. He appeared as though he was already dead. He did not try to take Mr Baker's pulse as one cannot take a pulse through a wet suit. CPR was continued all the way to the ambulance. Mr Mackereth says Mr Baker was a very experienced free diver. He knows he has dived to 50 metres and could hold his breath in the pool for 5 minutes. He was the most experienced free diver among the men. When he first saw Mr Matthews holding Mr Baker he was about 15 metres away; the boat was about 25 metres away from the men, easily within voice distance but hard to swim towards with Mr Baker because swimming was against the current.

[5] In oral evidence Mr Mackereth said he had no concern for Mr Baker's wellbeing in general on the day that he died. He said he was convinced that Mr Baker had died of shallow water blackout on ascent after a one and a half minute dive to 90 or nearly 90 feet. He said that condition was a known risk with spear fishing and free diving. Mr Baker told him that he had suffered an episode of shallow water blackout whilst diving overseas. This occurred whilst he was undertaking a course in free diving. The dive was deep and extended in time. Mr Mackereth said the deeper one dives the greater the risk of a blackout. 90 feet would be considered a deep dive. There are no recommendations as to how many deep free dives should be undertaken in a season. Mr Mackereth said that a diver who suffers shallow water blackout can be saved by being lifted into the air and told to breath. However, if water has entered the diver's lungs, as in this case, there are complications. He said it is recommended that free divers dive with a buddy. Free divers generally go with someone else when they go spear fishing. Asked whether Mr Baker had a buddy on the day he died, Mr Mackereth said 'the two of us were there, the degree of buddy supervision is often complicated by things like current and visibility and obviously the different objectives for the dive with the individuals concerned." Mr Mackereth said that by using the words 'the two of us were there", he meant he and Mr Baker were within the vicinity of each other, conceding that was "not effective in terms of immediate supervision." He was not diving with Mr Baker. He said "you don't actually dive down together, one stays on the surface." He said the practice in the National Spear Fishing Championship is to have two people using the same speargun: one remains on the surface at all times so that there is someone there when the other person dives. He said he and Mr Baker were using different guns and diving in the same vicinity. He said he had drifted back from Mr Baker and was behind the boat at the port stern. He said no mention was made by Mr Baker of his having a cold or having taken any medication for a cold. He said divers took cold or hayfever prescriptions if they were blocked up and that he had been told Mr Baker took pseudoephedrine "and that was a fairly routine thing when diving." He did not think there was anything wrong with

Mr Baker's last dive, when he shot a fish. He thought this would suggest Mr Baker was fully functional. He thought water had entered Mr Baker's mouth, leading to laryngeal spasm and that subsequently the muscles preventing the entry of water had relaxed, with the result that water flooded Mr Baker's lungs. Mr Mackereth is trained in the biological sciences and is a veterinary surgeon by profession.

[6] Mr Mackereth candidly conceded that had Mr Baker been "buddied" closely at all times whilst diving, he might have been assisted to the surface more quickly. He said Mr Baker was wearing a watch that logged every dive, its depth and the time spent below. He did reach the surface on his last dive and 'presumably at that point or just before ... he lost consciousness." If he or Mr Matthews "had been right there and then watching him and grabbed him ... presumably he may have survived." He added that he was making Assumptions as to the cause of Mr Baker's death. He accepted that because the three divers were not diving continuously in a buddy system, the opportunity to bring Mr Baker to the surface immediately was lost. Mr Mackereth said he did not agree with the view of Detective Bruce Adams that Mr Baker was excessively weighted and that this caused him to sink to the sea bed after losing consciousness. Mr Mackereth said 'the lungful of water would more than overcome - would change - the buoyancy." He said he did not know whether Mr Baker was negatively or positively buoyant during normal dives. He saw the weight belt he was wearing and did not think the weight was excessive. He said buoyancy for free diving is normally neutral at 10 metres "and then you are negative." He did not know whether Mr Baker was buoyant to 15, 10, 5 or 0 metres. He said the divers were wearing the same equipment, even the same-sized suit and that he was familiar with the amount of weight required for such suits. Mr Mackereth said he agreed with the advice given by Detective Adams in his report (to be referred to) that Mr Baker and his diving partners were free diving as individuals, although from the same boat, and that this is not recognised safe practice for the purposes of preventing or assisting a diver who suffers from shallow water blackout. Detective Adams said the three divers should have been alternating between diving and being in the water on the surface to supervise the person diving and to be ready to provide assistance if needed. Mr Mackereth said that was extremely good advice but that it was not common practice and was not being followed on the day that Mr Baker died. Asked what had been learned in retrospect from Mr Baker's sad death as to the need for buddying, Mr Mackereth said the circumstances reaffirmed the correctness of the advice just referred to from Detective Adams.

[7] Evidence was taken from Mr Matthews. Mr Matthews said it was common practice for divers to weight themselves as neutral at a depth of 10 metres, that is with a full "breath of air". This made for a safety factor in that once a diver had passed 10 metres on the way back up he would start rising with the natural buoyancy of the suit. On the way down a diver would only have to work to 10 metres or so and he could then relax and just start free falling. Mr Baker was in good shape on the day that he died. He had just come back from the National Competitions where he had done a lot of diving, six hours in the water a day for two days. Mr Matthews said he was about 10 metres away from Mr Baker on his last dive. Surface visibility was about 7 metres. It was a bit clearer further down. He agreed with Mr Mackereth's comments concerning the buddy system. He said that system was encouraged in the National Competitions. He said 'they've changed the way they are run due to the fact of shallow water blackouts." There are two ropes attached to the diver's buoy, at such competitions, a long one and a short one so that "you've always got someone above you

waiting for you when you surface." Sometimes it can be difficult to maintain that system. Mr Matthews said he accepted the principles laid down by Detective Adams. Mr Matthews said:

"It is a fact that if I was waiting for Lance to come up and providing he came up ... close enough for me to see him I would have seen him and would have been able to hold him up long enough for him to start breathing again."

Asked why he was not closer to Mr Baker, Mr Matthews said:
"For one, we were not in competition, so ... it wasn't enforced. Number two I guess the buddy system has been developed ... if you are diving in 30 metres of water and the water is crystal clear, it's going to work fine you are going to see your buddy to the bottom and to the top and you are going to be in contact with him 100%. We wee diving in dirty water with a bit of current. ... once your buddy leaves your side and dives down in the current he can be taken ... 10-15 metres behind you."

Mr Matthews said one would be able to see where the diver's rope went, 'there was obviously a rope attached to a speargun so you would see that disappearing into the meshing but you are not going to be too aware of what was happening at the end of that rope if he drops his gun which he appears to have done on his last dive." Mr Matthews said his guess is that Mr Baker knew he was running out of time, decided to drop his gun, leave the fish and swim to the surface and pull it up. He said that in this kind of situation the buddy system may fall over so it's not 100%.

[8] Mr Matthews accepted that had he been diving more closely with Mr Baker then he may have been able to assist him to the surface, in which case he may have been saved. The following question was then put to him by the Bench:

"Q. In retrospect do you accept that what Detective Adams says is correct, that is, that rather than free diving as individuals, the three divers should have been alternating between diving and being in the water on the surface supervising the person diving?

A. I accept that if we had been doing that there is a good chance Lance would still be with us."

[9] Mr Matthews accepted that free diving is a form of sport that is intrinsically risky. He said the problem is that 'there is currently no structure to the sport, so it's not like scuba diving where you need to go and get certified ... there are various free diving courses available which me and Lance had attended. We were fully aware of the danger." Asked whether he had any suggestions himself as to how risks, especially shallow water blackout, might be reduced, Mr Matthews said he reads international free diving literature, which lists 5-7 fatalities every year and that the same thing pops up at different times. He said a rescue device would be helpful. He said the cause of drowning is loss of consciousness, so:

"Some sort of safety mechanism in the form of an inflatable vest of some sort that would be armed when you dived and on the way back up you could arm ii so it would go off if you actually let go or something like that, something that timed how long you were down for and if you were down too long inflated to hold you on the surface."

Mr Matthews said blackouts occurred within two or three metres of the surface. He said Mr Baker had then sunk. He accepted that the sequence of events that had occurred in this case was the reason why Detective Adams had said it was important for the three divers to be together. Mr Matthews said it had to be understood that free diving was a competitive sport and that divers are trying to find the biggest fish, so that they are trying to put themselves in a position in which they can achieve that, including diving deeper and being quieter. The Court hardly needs to say that paramountcy must be accorded to divers' safety rather than to their aim to catch the largest fish.

[10] Evidence was heard from Detective Adams and the Court has before it his report. Detective Adams drew upon a variety of sources, reports and witness statements for his report, which records his examination of equipment and, in particular, of Mr Baker's dive computer. One such report drawn upon by him is from Dr Lynn Taylor, Incident and Accident Recorder New Zealand Underwater Association. It is convenient to deal with her report first. Her report is dated 30 May 2002 and is addressed to Detective Adams. Dr Taylor is a diving and oxygen provider instructor. She is an active scuba diver and holds a Doctoral degree in science. She says her report has been reviewed by Dr Simon Mitchell, a specialist diving physician working in Australia. She says the dive watch computer printouts for the 24 dives carried out by Mr Baker on the day that he died (consecutive numbers 149-172) can offer a clue as to the explanation for his death. Mr Baker started his 24th dive (dive number 172) at 12.17 pm, which was the time that his 23rd dive was completed, giving a surface interval of somewhere between 0-59 seconds. Descent on the 24th dive was much faster than (nearly) all the other dives on that day. The 24th dive was notable because descent was made at a constant rate with no plateauing near the bottom, as seen in other dives. Such facts are consistent with the possibility that Mr Baker may have suffered from shallow water blackout, (which is more correctly termed breath-hold hypoxia or apnoeic diving hypoxia) or some other illness or event, which caused him to become unconscious towards the end of the ascent on the 23rd dive, thus resulting in an uncontrolled, probably unconscious descent to the bottom on the 24th dive. Dr Taylor says it is also of relevance that the immediately preceding dives (170 and 171) were the deepest of the day and that Mr Baker's time at the deepest depth was of longer duration than the other dives of the day. Dr Taylor says that during a free dive oxygen is consumed from the gas in the lungs but that, at depth, such consumption is compensated for by the increasing partial pressure of oxygen (P02) caused by compression of the gas. The P02 at 30m/95 feet would be four times the P02 at the surface. During ascent, and as the ambient pressure falls, so does the P02 in the gas contained in the lungs. Hypoxia occurs when the arterial P02 falls below a P02 of 0.16. Below this threshold the brain starts to be deprived of oxygen. If sufficient oxygen has been consumed from the lungs during the dive then there may no longer be sufficient oxygen to maintain the arterial P02 at a level that will sustain consciousness. Since ascent takes place very rapidly, with a concomitant rapid fall in arterial P02, unconsciousness can occur without warning. Due to the rapid changes in pressure from 10m to the surface, this sudden loss of consciousness most commonly strikes around 5m from the surface. Dr Taylor says in the absence of any Findings from autopsy indicating any other reason for Mr Baker having lost consciousness whilst under water, 'the evidence provided from the dive profiles and the description of the circumstances are consistent with" the plausible explanation that the death of Mr Baker was due to "shallow water blackout"." Dr Taylor concludes her report thus:

'I note from your letter that 'they were not diving as one group or as buddies in the immediate presence of one another". An important safety recommendation is that free divers operate a "one

up, one down" buddy system. In cases such as this, where Mr Baker lost consciousness either at or very near to the surface, it is likely that he would have been rescued."

[11] In his report Detective Adams echoes the view advanced by Dr Taylor that Mr Baker may already have been dead during the descent of dive number 172 (24th dive). The Court comments that if this were so, it places a special premium on the detection of changes in consciousness of divers immediately upon onset and the taking of immediate remedial action. The wearing of an inflatable vest of the kind suggested by Mr Matthews, would have prevented Mr Baker from further descent through the operation of the triggering mechanism suggested by him. Close monitoring of ascent by a buddy, with appropriate intervention, would have served the same purpose.

[12] Detective Adams says in his report that if there were any surface interval between dives 23 and 24 it was extremely short compared to the time spent at the surface with other dives, ranging from two to eight minutes. The dive watch computer does not display seconds. It only records minutes. Echoes Dr Taylor's comments that the descent rate on dive number 172 (24th dive) was extremely fast when compared to almost all other previous dives on that day and was notable in that it was constant, with no plateauing near the sea bed as seen in other dives. It had a dive duration of some five minutes. This exceeded all previous dive times. Detective Adams says he believes Mr Baker suffered a diving illness during the ascent of dive number 171 (23rd dive) and was close to the surface. He then immediately sank to the sea bed until recovered by an associate, that last descent being recorded as dive 172.

[13] Detective Adams says Mr Baker's wet suit, weight belt, mask, fins and snorkel were not received by him for examination. The Court comments that such equipment should have been seized and sent to Detective Adams for examination and the Court expects that such practice will be followed with all future deaths of this kind. It should be added that either no statement was taken from Mr Matthews or that the statement taken from him was lost. If no statement was taken from Mr Matthews, there should have been, and that statement should have been produced to the Court. He is the most important witness as to the circumstances surrounding Mr Baker's death. Full statements from all material witnesses must be taken and produced to the Court in future cases. The statement of facts contained in Constable Kelly's deposition, in so far as it relates to the finding of Mr Baker's body under water by Mr Matthews, is dependent upon hearsay accounts contained in the Police report to Coroner. All statements contained in depositions must be verifiable in terms of signed witness statements as in other judicial proceedings. Detective Adams says enquiries by Paraparaumu Police showed that Mr Baker's speargun had a fish attached when recovered; he must have caught this fish prior to the end of the 171st dive. It is not known whether he had struggled with the fish or whether, if so, this caused him to remain at depth longer than expected. Mask, fins and snorkel are reported by Mr Baker's associates to have been functioning normally and securely attached to Mr Baker's body. Detective Adams says he does not believe these items to be contributors to Mr Baker's death. Mr Baker was wearing a 3-5mm thick Picasso wet suit constructed of neoprene which would have made him positively buoyant. To compensate for this and his own body's buoyancy, Mr Baker wore, as usual, a weight belt. Recognised free diving instruction indicates that a free diver should be neutrally buoyant at about 5 metres below the water's surface. This is done so that when free divers suffer "shallow water blackout" they will float to the surface and be rescued by others before drowning. Detective Adams says it is not known how buoyant Mr Baker was, but the information on his dive computer shows he ascended if not to the

surface then very close to it prior to his death at the conclusion of the 171st dive. This indicates that he was carrying an excessive amount of weight and was negatively buoyant. It is not known if the quick release buckle on the weight belt operated properly. As the onset of symptoms relating to shallow water blackout is rapid and can occur without warning, Mr Baker may not have had a chance to release the weight belt. The fact that Mr Baker was negatively buoyant ensured that he would sink to the sea bed and drown.

[14] Detective Adams goes on to comment in his report that Mr Baker and his dive partners were free diving as individuals, although from the same boat. He says this is not recognised safe practice for the reasons of preventing or assisting a diver who suffers from shallow water blackouts. Basically the three divers should have been alternating between diving and being in the water on the surface supervising the person diving, to be ready to provide assistance if needed. He concludes that Mr Baker may have lost consciousness whilst under water as a result of apnoeic diving hypoxia towards the end of his 171st dive and that an examination of the diving computer and information relating to the equipment being used by him suggests that he was excessively weighted and that this caused him to sink to the sea bed after losing consciousness. The detective says this is a diver error and prevented any chance of his being rescued. The deceased and his associates were not conducting their dives in direct supervision of each other. If they had done so, this may have prevented his death. The Court has already commented that Mr Baker's weight belt should have been seized by Police enquiring into his death and produced to Detective Adams. It accepts the Detective's view that it is likely Mr Baker was excessively weighted, he having come up close to the surface after his 171st dive and then having sunk, rather than having come to the surface as might reasonably have been expected.

[15] It should be recorded at this stage that the material in the originating Police report to the Coroner, which was not followed up by the taking of a statement from Mr Matthews (or such statement was lost) reads:

"The [three] divers were diving in close proximity to a large rock which is approximately 10 metres across, approximately 15 metres below the surface of the water and the water depth was approximately 50 metres from top to the bottom of the sea bed.

As the deceased's companion Paul Matthews was ascending up the rock face he located the deceased lying face up amongst kelp spread-eagled on top of the rock.

Matthews then swam to the deceased and noticed his mask was full of bloody water and grabbed him and swam to the surface. When he got to the surface he attracted the attention of the boat man. The boat man released the anchor and picked up both [men], who were approximately 20-30 metres away."

[16] It is clear on the evidence that the three divers were engaged individually at the same time in their own pursuits and were not following the buddy system, which was further described by Detective Adams in oral evidence as follows:

"The buddy system is described within the free diving fraternity as a one-up, one-down system, where one diver is down and completing the dive at a time when the second diver remains on the

surface watching for [the return of the diver who is down]. During the course of the day's activities the divers will alternate between roles. The importance of this is due to a phenomenon unique to free diving, shallow water black-out, which usually occurs close to the surface, anywhere from 10 metres towards the surface. The significance of the buddy system is that if this phenomenon takes place, the diver, whilst ascending, experiences a shallow water blackout and the diver on the surface is able to descend and effect a rescue to the surface."

The detective said that such practice is widely endorsed publicly and through training at clubs and events. He could not say to what extent it was being followed in practice. He said account May be taken of reduced visibility by limiting the amount of time spent beneath the surface and by limiting the depth to which one dives. Steps may be taken to reduce the hazards arising from reduced visibility. The amount of supervision or monitoring may be increased and a scuba diver may be employed. Detective Adams said he understood that this was common practice in National Competitions. He did not believe that there was a serious problem with visibility under water on this occasion.

[17] A statement taken from Mr Archbold is not helpful to the Court as he had no personal knowledge of the events that overtook Mr Baker until he was taken back on to the small boat, at which time he was "limp, lifeless and unconscious".

[18] Had the principles of the buddy system, as set out by Dr Taylor and Detective Adams, been followed in this case, Mr Baker might have been rescued and might not have died. Each of the three divers was effectively "doing their own thing" They were not acting in concert. Had Mr Matthews, or Mr Mackereth, been monitoring Mr Baker's progress it is likely that the change in consciousness that preceded his final and fatal dive would have been observed and remedial steps taken immediately.

The reports made references to the experience of the deceased "he was the most experienced free diver amongst us." Whilst experience may offer some protection from diving hazards, some of the SCUBA dive accident data shows that more experienced divers are more likely to suffer a dive accident. Experience in some situations may make the individual less concerned or fastidious with respect to basic dive safety.

There is evidence of laxity with respect to dive safety in the reports. For example in the Police National Dive Squad report, it is stated the deceased is likely to have been over weighted and negatively buoyant. In addition, there are multiple deep dives and long breath hold times - all known to predispose to shallow water blackout.

Furthermore, there was evidence that the deceased had speared a fish and may have struggled with this fish at depth using up more valuable oxygen.

The causation of shallow water blackout is multifactorial and may differ from dive to dive depending on the physiological condition of the diver; intercurrent illness or medication e.g. antihistamines, alcohol, dehydration; the degree of exertion during the dive; the degree of hyperventilation prior to the dive; the depth of the dive; the surface recovery times; the descent rate and buoyancy of the diver.

3. "Whether ... Pseudoephedrine has or might have relevance to the circumstances leading to Mr Baker's drowning."

Again, this question has two 'stems'.

One, that pseudoephedrine toxicity per se may have predisposed to the death of Mr Baker.

Medication, or for that matter any drug including alcohol, undergoes a complex pharmacological change under water that has largely not been studied. By analogy, we know that gases such as Nitrogen and Oxygen, harmless at sea level, become potent causes of dive related deaths at pressure.

Implicit in the assumption that a medication may predispose to a diving death is knowledge of its toxicity, the depth of the dive and the duration of the dive. Duration being at least equally important to toxicity and depth of the dive.

The ESR report from Dianna Kappatos, Forensic toxicologist, 27.06.2002 correctly identifies that a single dose of pseudoephedrine can cause toxic effects. These toxic effects include dizziness, convulsions, arrhythmias, hypotension and cardiovascular collapse.

Against pseudoephedrine toxicity is the short duration of the dive and insufficient time for a pressure gradient effect to occur. It is also likely that the deceased had used pseudoephedrine medication previously as it is commonly available over the counter. The deceased presumably would not have used the medication again if any serious event had occurred from normal usage.

Pseudoephedrine toxicity is unlikely to have contributed to an adverse outcome but may have lowered the seizure threshold for shallow water blackout to occur.

The other possibility of a cardiac arrhythmia would be more improbable unless there were a known history of arrhythmia (GP records may give some clues). Breath hold diving is not known to predispose to arrhythmia.

The second 'stem' relates to the reason for pseudoephedrine medication. Most commonly pseudoephedrine is used to combat cold or sinus congestion symptoms. Sometimes it is used a stimulant and forms the basis for manufacture of 'P'.

It is most likely that the deceased suffered from the effects of a cold or sinus congestion.
If the deceased were free diving with a cold or sinus inflammation, it is probable that that this would have predisposed to shallow water blackout (which is a hypoxic seizure).

Finally, I agree with the comments of Detective Bruce Adams with respect to accident causation and the absence of buddy system. There were significant deficiencies in the emergency care of the deceased due to an unspecified delay in recognition of the adverse event described.

There seems to be no nationally agreed standard to minimise shallow water blackout. In my opinion, this is a deficiency in the safety culture in the dive industry that allows safety standards to be defined in a recreational setting by the user. This ad hoc standard is at odds with legislation such as Maritime Safety Act that regulates recreational boating and maritime activities or the Civil Aviation Act that regulates private pilots in their recreational activities and defines in legislation a minimum safety standard.

One can argue proportionally more deaths occur in the recreational diving area than due to recreational flying and possibly maritime activities. Regulation is long overdue.

SUMMARY

Shallow Water Blackout and Drowning as a consequence is the most likely cause of death.
It is unknown if one shallow water blackout per se predispose to another as the condition is multifactorial. However, risk taking behaviour may be a common association.

Pseudoephedrine toxicity is unlikely to have contributed to an adverse outcome but may have lowered the seizure threshold for shallow water blackout to occur.

If the deceased were free diving with a cold or sinus inflammation, it is probable that this would have predisposed to shallow water blackout (which is a hypoxic seizure).

Yours sincerely

Dr Tony Hochberg
BHB MBChB AFOM MFOM (Ire) Dip Av Med NZCSM CHM Diving & Occupational Physician

References

1 OSH Guidelines for Occupational Diving 2004

"To Assist in Meeting the Requirements of the Health and Safety in Employment Act 1992 and the Health and Safety in Employment Regulations 1995"

Page 28: Part 6: Snorkel (Skin) Diving

The Health and Safety in Employment Regulations 1995 do not include snorkel diving in the definition of diving and as such there are no regulatory requirements to have a certificate of competence or dive medical clearance for this type of diving. Where persons are employed or engaged as snorkel divers however, the employer, principal, or self-employed snorkel diver will still be required to exercise an appropriate duty of care as required by the Health and Safety in Employment Act 1992. Snorkel diving deaths are usually due to drowning and most commonly occur at either the beginning or the end of a dive. These drowning accidents are contributed to by phenomena such as cardiorespiratory fitness, excess workload, and access to safety. In that context, breath hold divers are just as liable to die from these mechanisms as compressed gas divers.

An appropriate duty of care by persons involved in such diving activities would require an assessment of the divers competencies and an assessment of the divers medical fitness to carry out such diving activities in a safe manner.

2. The Physiology of Breath Hold Diving Undersea & Hyperbaric Medical Society workshop Edited by Lungren & Ferrigno. Buffalo New York October 1985.

3. The Physiology & Medicine of Diving Peter Bennett, David Elliott. 1993 Edition."

[21] By further letter dated 30 June, Dr Hochberg says he has discussed the second question put to him by the Coroner (as set out at the beginning of his letter) with diving medicine colleagues and that they are in agreement with his conception that such question falls into two 'stems' and with his views as to the risk-taking element described in the second stem. They believe that the occurrence of shallow water blackout per se would not predispose to another blackout. With regard to the use of pseudoephedrine medication, Dr Hochberg says its use is common among breathhold divers (to facilitate easier equalisation of air pressure). He says its use should actively be discouraged.

[22] The Court observes that there is now an Australian/New Zealand Standard governing occupational diving operations. Part III thereof lays down standards applicable to recreational industry diving and snorkelling operations. The Standard

"specifies requirements and offers practical guidance for the personnel, equipment and procedures involved in recreational diving operations using air or mixed gases as the compressed breathing gas supplied through self-contained underwater breathing apparatus (SCUBA), for recreational diving operations using rebreathers and for recreational snorkelling where these activities occur in a work place". The Standard does not apply to any recreational diving using compressed air, recreational snorkelling or recreational mixed gas diving performed by persons who are not at a work place. Nor does it apply to diving operations (including with surface - supplied breathing apparatus (SSBA) at a work place where the diving operations are not for the purpose of the training or supervision of recreational divers and snorkellers, for which other Standards may apply.

[23] There are no other such Standards; and the Standard referred to having no application to recreational free-diving activities, there is a lacuna in safety terms that requires to be addressed by those bodies and persons involved in and having responsibility for the proper development and safety of this recreational pursuit. It follows that recommendations may be made only in general terms and that they ought to be addressed to those bodies and persons named in para [26] below, with a view to the adoption of a common approach towards safety issues and the development of an education programme calculated to inform and remind organisers and participants in the sport of the risks of injury and death inherent in the manner in which free diving is carried out.

[24] Of particular concern is the fact that, as Dr Hochberg says, there is no nationally agreed standard to minimise shallow water blackout. As he also says, this is a deficiency in the "safety culture" of the dive industry, allowing safety standards to be defined subjectively by participants. Such deficiency, and the need to address it, is the subject of the first of the recommendations appearing below.

[25] These Findings should be read in conjunction with the Findings to be issued shortly by the Court in an Inquest into the death of Nathan Reginald Chapman (Decision No. 82/04)

Recommendations [26] To:
The Chief Executive Officer
New Zealand Underwater Association
PO Box 875
AUCKLAND

The Chief Executive Officer Water Safety New Zealand WELLINGTON

The Chief Executive Maritime Safety Authority WELLINGTON

The Chief Executive Officer
New Zealand Recreational Association WELLINGTON

The Chief Executive Officer Accident Compensation Corporation WELLINGTON

Mr G Cooper
National Diving Coordinator Department of Labour - OSH Private Bag MBE 433 HAMILTON

The Chief Executive Officer Dive New Zealand

The Editor
Viva Aqua New Zealand Underwater P O Box 875
AUCKLAND

1. That steps be taken immediately to establish a National Standard, supported by a Nation-wide safety programme, designed to eliminate, minimise or isolate the risks of injury and death inherent in free-diving, particularly apnoeic diving hypoxia (also known as breath-hold hypoxia or shallow water blackout) and other illnesses or events which may cause loss of or diminution of consciousness.

2. That consideration be given to recommending that all persons, before engaging in recreational diving (whether free-diving or with the use of SCUBA)' undergo medical examination and obtain a clearance to dive AND that such medical clearance be updated at regular intervals.

3. That consideration be given to the laying down on a nation-wide basis of the safety principles inherent in the "buddy" system', described as "a one-up, onedown system, involving the close monitoring of the activities and state of consciousness of one free diver by another."

4. That coordinated steps be taken to establish a nation-wide publicity campaign, aimed to educate those persons engaged in free diving (who may not be members of any established club or association) and those persons intending to take up the sport as to the risks inherent therein and those steps needing to be taken to ensure safety.

5. That consideration be given to the feasibility of the wearing by free divers of inflatable vests, inflation being triggered by the onset of loss or diminution of consciousness AND if thought desirable to recommend the wearing of such vests by free divers.

[28] The Court extends to Mr Baker's parents, to his partner and to all members of his family its sincere sympathy on their loss. It thanks Constable Kelly for her assistance. The Court greatly regrets the delay that has been occasioned in the delivery of these Findings, which delay has largely been beyond the control of the Coroner.

Verdict

Lance Baker late of 24 Hollis Road, Paraparaumu, Technician died on 10 March 2002 at Paraparaumu Beach, the cause of his death being drowning as a consequence of apnoeic diving hypoxia (also known as breath-hold hypoxia or shallow water blackout).

G L Evans
Wellington District Coroner
Lance Baker.doc(afw)