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NATURAL OBSERVATIONS OF DIVING INCIDENTS

Jeffrey Wilks and Lindsay Christie

Introduction

Safety has always been a concern for the recreational diving industry. While the major accident rate is very low compared to other sporting groups,[1,2] the consequences of an underwater accident can often be more serious than injuries on land. At a time when there is an increased willingness for the public to sue sports coaches and administrators for any alleged breach in their "duties of care", [3,4] the diving industry needs to look carefully at cost effective methods of improving safety. While formal legislation[5] or industry Codes of Practice[6] may provide frameworks for safety, other informal methods of preventing accidents should also be examined for their potential contribution.

The term "diving incident" has been used by Acott and his colleagues[7] to describe "An error by a diver, or a failure of his or her equipment to function properly. The error or failure could have led to more serious consequences, had it not been detected or corrected in time". An incident has the makings of an accident, where things actually do go wrong, but does not necessarily lead to an accident.

While the term "diving incident" is relatively new, scuba instructors have appreciated the importance of early recognition in accident prevention for some time.[8,9] Reviews of diving accidents consistently highlight some common factors contributing to the accident scenarios. These include medical and psychological factors, dangerous environmental conditions and equipment difficulties.[10-14]

Some of these problems may be difficult for a dive supervisor to overcome (e.g. undetected faulty personal equipment), whereas other problems might be prevented with detailed dive briefings and greater awareness of areas where accidents are likely to occur. For example, after reviewing 264 Japanese diver fatalities Mano and Shibayama[15] concluded that poor diving technique and reckless diving were the main causes of fatalities. They also noted that many accidents they investigated could be predicted on the basis of their non-existent or inadequate dive planning, and only a few accidents occurred that could not have been prevented.

The Diving Incidents approach to accident prevention suggested by Acott and his associates[7] focuses attention on those areas of activity where problems are likely to arise. In their pilot study they asked divers to record any incidents they had observed during a dive on a questionnaire report form. Of the total of 69 incidents reported, 36 occurred during the dive itself. A further 15 incidents occurred during preparation for the dive, and another five during entry.

The written report methodology presents several problems if this type of study is to be extended beyond a small group of interested divers. First, written reports require commitment and a large degree of organisation. Popularising reporting requires education of the reporters. Obtaining reports about serious accidents is a difficult process, only made possible through legal requirements and insistence by training agencies and government. Harmless incidents are likely to be overlooked entirely.

The second problem with written reports is the embarrassment factor.[16] Some divers feel embarrassed about asking others to spend time on a buddy check, especially if the buddy pair are strangers before the dive. In this situation, minor problems with setting up equipment and preparing to enter the water will either be not detected, or not commented upon by the buddies.

Lastly, new divers are most likely to experience difficulties, especially if they are using unfamiliar rented or borrowed equipment.[11] In Japan Mano and Shibayama[15] found that 30.8% of their 130 fatal cases involved novice divers on their first open-sea dive. While new divers are concentrating on not making mistakes themselves they would not be in any position to observe and report on the incidents occurring around them.

The limitations of a written record format for investigating diving incidents in no way detracts from the extremely valuable pilot work of Acott and his colleagues.[7] Recording patterns of incidents provides an excellent mechanism for identifying the early warning signs of diving accidents. An alternative method of gathering such data is to record observations of divers on a commercial dive boat, which was done in the present study.

Methods

PILOT STUDY

To identify focal areas of diver safety for the main study, a pilot project was conducted on the 35 metre M.V. Capricorn Reefseeker. The Reefseeker is a commercial vessel that runs between Great Keppel Island and North West Island on the outer Barrier Reef three times a week. Between October and December 1990, observations about 65 certified divers were recorded.

Data were collected unobtrusively at the time these divers completed their paperwork on the day of the dive. From their certification cards and log books the second author noted age, sex, date certified, certification level, total number of dives since certification, number of dives in the past 12 months, and city or country of origin. Where this information was not readily available from written records, friendly questions were asked in general conversation to elicit the missing data.

The pilot study included 38 men and 27 women; 58% of the sample were Australian and 42% were overseas visitors. Most divers held an open water certification (85%), though all levels of training and all major training agencies were represented. Just over half of the sample (54%) had been certified for 12 months or less, while 22% had been certified for more than five years. Diving frequency in the previous 12 months ranged from none to over 100 dives (a travelling instructor); 15% reported no dives in the past year, 54% less than 10 dives, 11% with 10-20 dives, and 20% with more than 20 dives. Overall, the pilot group seemed to represent a wide cross-section of recreational divers.

Comments on diving incidents were made next to each diver's identification on monitoring sheets disguised under briefing notes on the Divemaster's slate. The comments were unstructured during the pilot phase and included all observations that might later be useful in the design of the major study. On board the Reefseeker divers kit up on a 10 x 5 m rear deck, then descend six stairs to a 10 m platform just above the water. A Giant Stride entry is made from the platform. The Reefseeker moors stern in to the reef face, with the water depth under the rear platform about nine metres. Diving at North West Island is very easy, with no necessity to dive deep or to swim very far away from the vessel. Under these conditions it is not difficult for the Divemaster to observe accurately and record most behaviour on the surface.

THE MAIN STUDY

Drawing on the observations of the pilot project, and also previously identified problems associated with open water dives,[7,17] the Queensland Diving Incident Checklist was developed. This was pilot tested by two independent instructors and further refined to the final version presented in Figure 1.

The unobtrusive observational design of this study, and the use of a "dry" divemaster, restricted reporting to those events witnessed on the surface. The Incident Checklist therefore concentrates on diving incidents as they occur during pre-dive equipment assembly and dive preparation. Minor breaches of diving safety on the surface of the water and during the post-dive period were also recorded. Since several recent studies in Queensland had revealed a very similar demographic profile for certified recreational divers,[18-20] a decision was made not to alert subjects in the main sample to the research by collecting information about them or their diving history.

Subjects and procedures

A total of 192 certified scuba divers visiting North West Island on the M.V. Capricorn Reefseeker between December 1990 and May 1991 were included in the study.

FIGURE 1

QUEENSLAND DIVING INCIDENT CHECKLIST

D.M. No. in Group
Date TOTALS

Equipment and dive preparation
1 Faulty assembly
2 Forgotten/lost gear
3 Gear breakage
4 Not using octopus (O) watch (W)
5 Unsafe turning air on
6 Free-flowing regulator
7 Don tank over head
8 Mask on forehead
9 Snorkel wrong side (WS) /missing (X)
10 Carrying too much gear
11 No buddy assistance

Incomplete pre-dive check
12 Buoyancy
13 Weights (LH release = LH, missing = X)
14 Releases
15 Air (not turned on)
16 No pre-dive check

Other
17 Overheating
18 Clearly nervous

During and After Dive
19 Lost buddy
20 Equipment problems
21 Needed assistance (A) /rescue (R)
22 Exceed tables (T) /briefing (B)
23 Return with less than 50 bar
24 Not acknowledging boat from water

OTHER COMMENTS (WEATHER ETC)

The second author again recorded diving incidents in an unobtrusive manner, this time on the structured Incidents Checklist. Records were kept for 36 separate reef visits. Groups ranged in size from only one diver (buddied with a divemaster) to a total of 14 on one occasion. On only two of the 36 days were there no incidents observed.

Results

Table 1 presents the main diving incidents observed in this study.

TABLE 1

DIVING INCIDENTS OBSERVED

Area	Number of Divers	%
Equipment and dive preparation		
No buddy assistance	73	38
Faulty assembly	55	29
Unsafe turning air on	23	12
Not using octopus or watch	18	9
Forgotten/lost gear	16	8
Free-flowing regulator	10	5
Snorkel wrong side or missing	9	5
Mask on forehead	7	4
Donned tank over head	6	3
Clearly nervous	4	2
Gear breakage	2	1
Carrying too much gear	2	1
Incomplete pre-dive check		
No pre-dive check	109	57
Buoyancy	72	38
Releases	19	10
Weights (LH release or missing)	17	9
Air not turned on	13	7
During and after dive		
Not acknowledging boat from water	90	47
Exceeded tables or briefing	28	15
Returned with less than 50 bar	24	13
Lost buddy	23	12
Equipment problems	22	11
Needed assistance or rescue	14	7

Lack of buddy assistance was commonly observed during dive preparation. Divers often struggled into their gear while the buddy stood and talked to them. Just under one third of the sample (29%) had trouble assembling their equipment. This included buoyancy compensation devices (BCDs) facing the wrong way on the tank (or upside down), and attempts to attach the regulator first stage by screwing the yoke into the tank valve opening. Holding the contents gauge in front of one's face as the tank valve is turned on (and risking injury if the gauge explodes) was the next most common equipment incident.

Three divers kitted up without an octopus regulator on their personal gear. Following an explanation about Queensland regulations[5] they were given hire equipment. A total of 17 divers prepared to dive without a watch or timing device. Other common equipment incidents included forgotten or lost gear (8% of the sample), free-flowing regulators (5%), gear breakage (1%) and carrying too much gear (1%). While perhaps not serious, six divers prepared to dive

without a snorkel (another three wore theirs on the wrong side), six divers donned their BCDs (with tank) over their heads, and seven divers unknowingly signaled "distress" by wearing their masks on their foreheads. Two divers were observed to be clearly nervous during the process of dive preparation.

Lack of buddy assistance also emerged in the area of pre-dive equipment checks. In general, 57% of the sample made no attempt to run through a pre-dive check. This neglect was obvious in the area of buoyancy, where many divers did not connect their power inflator to the BCD. Weight belts were often observed to be twisted and the quick-release buckles not done up. Two divers prepared to enter the water without weightbelts, while a further 15 were recorded having the release flap on their weightbelts positioned so as to require the left-hand to be used to open it. Thirteen divers (7% of the sample) were prepared to enter the water without turning their air on!

Upon entering the water initially, or coming to the surface during the dive, 47% of the sample failed to signal the boat that they were OK. Directions given during the dive briefing (usually about time to return to the vessel) were disregarded by 15% of the sample. While the briefing contained a request for divers to return from their dive with at least 50 bar in reserve, 13% of the sample failed to comply. Buddy separation (12%) and equipment problems (11%) were also observed during and after the dive. Finally, one diver was rescued following a panic attack in the water, and 13 others needed assistance during the dive.

Discussion

Lack of buddy assistance emerged as the main diving incident observed in this study. This included little help by partners in setting up equipment and dive preparation, infrequent pre-dive safety checks, and 23 situations involving buddy separation in the water. The buddy system is a tried and proven method of promoting safety among divers, but it relies on the two partners staying together and being able to communicate effectively during the dive.[16] Supervisors should be aware that many divers may be shy and embarrassed when "buddied up" with a stranger for the first time. They will look to the Divemaster for assistance rather than their buddy, or alternatively struggle through pre-dive preparations by themselves, all the while becoming more nervous or distressed before even entering the water.[8]

Lack of familiarity with diving equipment, especially rental gear, may compound any discomfort a diver may feel about their readiness to dive. The Divemaster cannot always attend to minor trouble-shooting activities (e.g. free-flowing regulators) so the buddy pairs must be encouraged to assist each other.[21] This is particularly important with the pre-dive check. Fead[16] suggests emphasising to divers that the check is for rescue purposes, to save one's "own" life, and therefore the responsibility is for a person to insist that their partner be totally prepared to help them before entering the water. This includes physically checking that the BCD will inflate and deflate, releases are clear, the weightbelt has a right-hand release, and that the air is turned on prior to preparing to enter the water. These same types of incidents were reported in written form by divers in the Acott et al. study.[7]

Merriman and Conn[4] argue that providing a safe environment is the greatest step that one can take to avoid sport injury litigation. Effective use of the dive briefing will go a long way to ensuring that divers understand what is expected of them prior to entering the water. For example, a review of non-verbal safety signals (including how to signal OK to the boat after initial entry or upon surfacing during the dive) would clarify and standardise signals for buddy pairs who had not dived together before. As the present study shows, some divers will still disobey instructions given during the dive briefing, but safety will nevertheless be enhanced if emphasis is placed on local safety procedures to be followed during the dive.

Supervisors should also be aware that peer pressure and social evaluation are very strong factors that may detract from safety in a recreational diving setting. For example, Griffiths and Heyman[22] found that pre-dive anxiety was not caused by concern over potential danger, but rather by perceived social evaluation. In that study, females were more likely than males to be anxious about performing physical tasks in front of others. While the present study did not distinguish between male and female divers, many of the problems with faulty equipment assembly were clearly related to social nervousness.

Divemasters are trained to correct faults before they become a problem. One of the difficulties in this study, for the second author, was achieving a balance between the working role of a Divemaster and the role of an impartial observer. At times it was very busy on the back deck of the Reefseeker as divers assembled their equipment. Correcting faults as they happen, as well as providing friendly encouragement, definitely boosts the confidence of nervous divers. Unfortunately, there were times when the two roles were at odds. Ideally, in future studies the observer should have no other duties. This would also allow natural observations to be made underwater, where Acott and his associates report that most diving incidents are likely to occur.[7]

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