

and Dr Peter Sullivan, Australian Antarctic Division, for their valuable help with this manuscript.

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QUEENSLAND SCUBA DIVERS AND THEIR TABLES

Jeffrey Wilks and Vincent O'Hagan

Introduction

Increasing emphasis is being placed on scuba diver safety by the world's major certifying agencies.^{1,2} Though Australian statistics show recreational diving to be increasing in popularity³, and that safety is improving relative to the number of divers in the sport⁴, there are still many unnecessary accidents occurring. In particular, divers' inability to effectively plan dives using their tables^{5,6} may place them at risk for out-of-air emergencies and decompression sickness.⁷

Australian divers are not alone in having problems with their dive tables. In one American study 2,576 divers were asked to complete five decompression problems similar to situations that might arise on charter trips.⁸ Only 49% of the respondents successfully completed all five questions. In another study of 1,000 active certified divers only 20% could correctly answer a single repetitive dive problem.⁹

While there is growing evidence that many certified divers cannot use their tables to plan diving activities we still know very little about the type of mistakes that are being made in the use of tables. The present study examined divers' answers to two repetitive dive problems in an attempt to pin-point specific types of error.

Method

SAMPLING

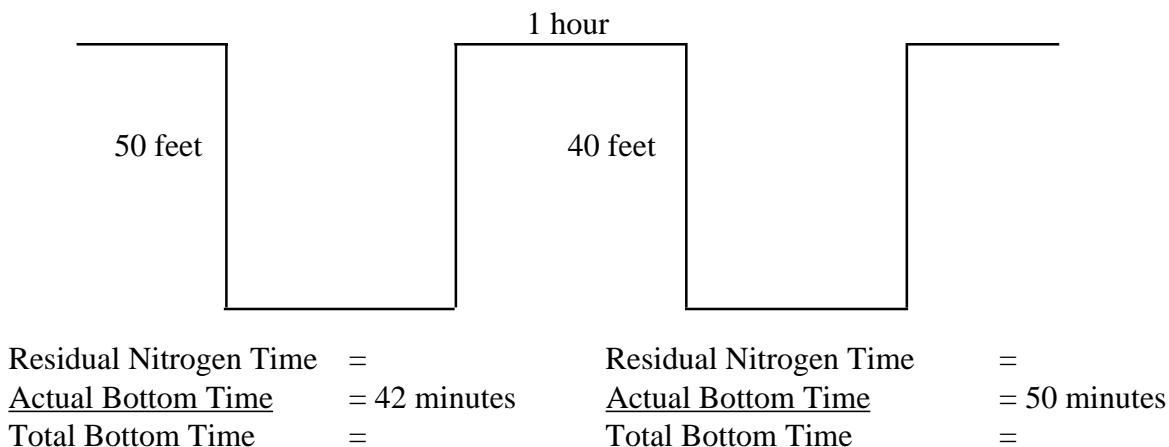
A random sample of 1500 certified divers in Queensland was drawn from the computer records of the National Association of Underwater Instructors (NAUI). After removing records where the address was incomplete, or "care of" a resort or dive shop, the first sample was reduced to 1373 divers. As the research project had a particular interest in the Great Barrier Reef, a second sample of 192 PADI (Professional Association of Diving Instructors) divers certified in Central Queensland, was also included in the study.

From a total of 1565 questionnaires mailed to divers throughout Queensland in September 1989, 291 were returned unopened as divers had left their previous address. Completed questionnaires were returned by 380 respondents.

SUBJECTS

Of the 380 completed returns, 285 (75%) were from active divers and 95 (25%) were from subjects who reported that they had not dived since gaining their open water certification. Active divers (who dive at least once a year), had an average age of 28 years, with a range from 14 to 60 years. There were 177 (62%) males and 108 (38%) females in the final sample. Based on scales of occupational status developed at the Australian National University¹⁰ the sample represents a full range of employment categories. Sixty-six percent of the sample were single and only 25% had children. Overall, the characteristics of this sample compare well to profiles of active divers in other studies.^{11,12} Most subjects (74%) had been certified for between one and four years. The majority of divers surveyed do most of their diving from commercial charter boats and are therefore subject to the requirements set out under Queensland's new Workplace Health and Safety Regulations.¹³ These include logging each dive in the same format as used in the present

FIGURE 1 TWO DIVE PROFILE



study and having the dive profile checked by a dive supervisor.

DIVE PROFILES

Subjects were asked to complete two dive profiles (Figures 1 and 2). A separate question asked which tables they used so that the marker could check answers with the same tables. In addition, if subjects could not complete the profiles they were asked to indicate their reasons for not doing so. Finally, a separate question asked subjects if they would be interested in a skills and theory refresher course if one was offered by a local instructor.

Results

Only 126 divers (44.2%) completed the first profile correctly. Sources of error for the remaining 159 divers included: adding a figure for Residual Nitrogen into the first dive (16 cases); incorrect calculation of Residual Nitrogen for the second dive (2 cases); incorrect calculation of Pressure Groups (12 cases) and what could be called “No Understanding” of the task. This last, and largest group (129 divers or 45.3% of the sample), included subjects who did not attempt the question, partial attempts, and those whose answers were totally incorrect but the rationale for the errors was not clear.

On the second profile, which asked divers to calculate a Minimum Surface Interval between repetitive dives, only 105 subjects (36.8% of the sample) obtained a correct answer. Main sources of error included: 18 divers misunderstanding the idea of Minimum Surface Interval (confusing it with the 10 minutes which is the minimum time between separate dives for repetitive dive calculations); providing a Maximum rather than a minimum surface interval (2 cases); confusing maximum no-decompression bottom times (especially with Residual Nitrogen time) and ending up in the wrong repetitive group columns (7 cases); adding a Residual

Nitrogen figure to the first dive (4 cases); trying to calculate the minimum surface interval between dives using Total Bottom Time from the second dive rather than the maximum no-decompression bottom time (6 cases); and finally, a large group who demonstrated no understanding of the task. Again, this group (143 divers or 50.2% of the sample), included subjects who did not attempt the question as well as those whose answers were totally incorrect.

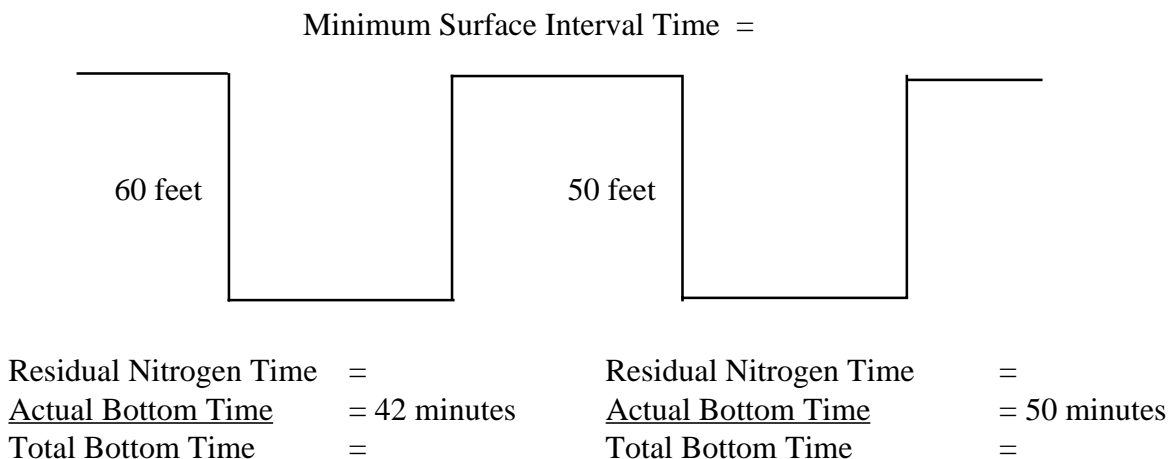
In addition to the specific sources of error described above, Table 1 presents an overview of correct responses according to divers’ gender and length of time certified, respectively. As can be seen, there were more female errors on both profiles, though the calculation of a minimum surface interval between dives (Profile 2) was poorly performed by both males and females. Table 1 also identifies divers certified for between 25 and 36 months as having the lowest proportion of correct responses, though statistical comparisons revealed no significant differences for dive table performance based on either gender or time since certification.

Asked why they could not complete the profiles, 74 divers (26% of the sample) replied that they could not remember how to use their tables, 46 divers (16%) said they did not have tables, and 14 divers (5%) indicated that they could not be bothered to do the exercise. On a more positive note, 197 divers (69% of the sample) reported that they would be interested to take a refresher course if one was offered by a local instructor. A larger proportion of women (77%) than men (64%) expressed interest in taking a refresher course.

Discussion

The effective use of dive tables is like knowledge of a second language: people become rusty and forgetful if the

FIGURE 2 MINIMUM SURFACE INTERVAL DIVE PROFILE



skill is not practised. All certified divers in this study were proficient with their tables at one time, or they would not have received certification. Moreover, subjects apparently do not consider that the problem lies in their initial training since 60.4% of respondents rated their open water course as excellent (38.2% rated it as adequate, and only 1.4% as poor). It remains for future studies to determine whether initial training with dive tables is indeed comprehensive enough.

Just over one quarter of the sample (26%) admitted that they could not remember how to use their tables. This figure is probably very conservative since conversations with divers who did not return their questionnaires revealed a high level of embarrassment in not being able to complete the two profiles. In an earlier Australian study, Knight⁵ commented on the extent to which divers rely on divemasters for their repetitive diving information. This reliance also emerged from written comments made by divers in the present study. For example, "We always dive with a dive club. The divemaster calculates for us." (Male, 35 years, certified 15 months, 100% of diving on charter vessels, both profiles incorrect). On the other hand, the fact that 69% of the sample are interested to do a refresher course suggests that many divers would like the opportunity to be independent. While certifying agencies do offer tailored refresher courses, these programs need to be actively marketed and more readily available to the diving public. The prices divers' say they are willing to pay for refresher courses are currently being investigated.

Most instructors are aware that the main source of confusion and error when using flat dive tables is accounting for Residual Nitrogen while calculating repetitive dives.¹⁴ Divers in the present study had many problems in this area. The recent introduction of circular tables such as the Dive Time Calculator II (NAUI) and The Wheel (PADI) automatically account for Residual Nitrogen. Instructors might consider teaching with these new instruments as a way of overcoming common dive table errors.

In Queensland, the recently legislated Workplace Health and Safety Regulations¹³ require divers to log all of their dives. This provision offers divers an opportunity ask the dive supervisor for assistance if they have difficulty with their tables and allows the supervisor, time permitting, to do some brief remedial teaching. Only a minority of divers have made the transition to using dive computers¹⁵, so improving divers' ability to use their tables is still critical. As mentioned above, encouraging refresher courses and the use of circular tables appear to be useful directions for overcoming common dive table problems.

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AUSTRALIA'S "DIVER EMERGENCY SERVICE" (DES) 008-088200

An analysis of recorded usage over a 35 month period during 1987-1990.

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Introduction

The Diver Emergency Service (DES) is Australia's (and its near neighbours') 24 hour, user-free emergency consultative telephone service for diving medical and diving safety information.

The service was born in 1984, and its origin and lively history to date have been described.¹ We present a detailed report of the activities of DES over a period of 35 months since April 1986, which follows two previous overviews in the Journal.^{1,2}

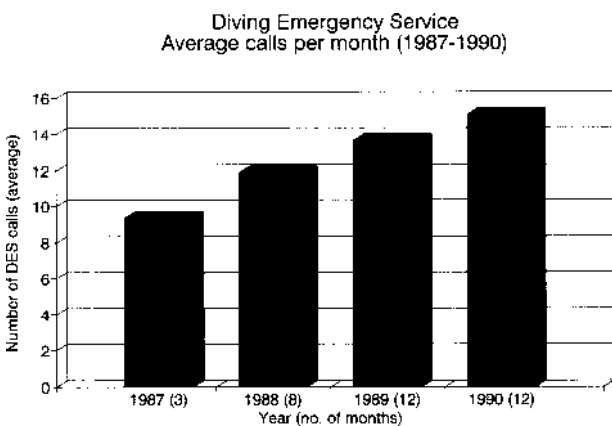


FIGURE 1. The average number of incoming DES calls per month, expressed on a yearly basis, over the 35 month period examined. The steadily increasing usage of the Service is shown. Note that records exist for only 3 months during 1987 and 8 months during 1988.

Method

We have analysed each written record of DES calls according to:-

- 1 Year, month, and time of day of call
- 2 Type of caller (diver, doctor, dive supervisor, etc.)
- 3 Location of caller, in Australia or beyond
- 4 Age of patient where recorded
- 5 Differential diagnoses over the 'phone'
- 6 Commonest presenting symptoms according to the provisional diagnoses
- 7 Medical referrals and aero-medivacs
- 8 Special features.

The advantages, disadvantages, lessons learned, trends usage characteristics, and future needs identified from this body of data are considered.

Results

The total of DES calls recorded in writing from 1987 to December 31, 1990 (35 months total) was 467. This approximates to 13 incoming calls a month.

USAGE TRENDS

Figure 1 shows the increasing recorded usage of the Service over the 35 month period.

Figure 2 shows that the busiest periods of usage during the year are the Australian warmer months of October to April.

The distribution of calls according to the time of day was:-

0800-1800	143	31%
1801-2300	58	12%
2301-0800	21	4%
Time not recorded	245	53%

OCCUPATION OF CALLER

Divers	223	48%
Medical Officers	107	23%
Dive Supervisors	40	9%
Friend or relative	17	4%
Rescue/First-Aid team	5	1%
Other	5	1%
Unidentified	70	14%

LOCATION OF CALLERS

WITHIN AUSTRALIA		
Queensland	111	24%