

Scuba tank fill survey in Victoria, Australia, 1 July 2024 to 30 June 2025

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Abstract

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Introduction: This study's aim was to determine the number of scuba tank fills done in Victoria, Australia from 1 July 2024 to 30 June 2025 to provide an estimate of the number of scuba dives conducted during that period and, from that, estimates of the fatality and decompression illness rates.

Methods: Suppliers of compressed gas for scuba diving in Victoria were identified through internet searches, industry liaison and the Australasian Diving Safety Foundation records. Those identified were emailed an invitation to participate in the tank fill survey and provided with dedicated spreadsheets. Email reminders were sent to collect monthly data on air, nitrox and 'other' fills. Data were compiled and, at the end of the survey period, non-regular participants were approached to provide actual numbers or estimates of the year's fills.

Results: Overall, 38/40 (95%) identified current suppliers participated in the survey, with 27 submitting regular monthly data and the remainder providing actual or estimated annual fills. There were 46,720 reported fills, including 39,386 air, 6,758 nitrox, and 576 others, with proportions of 84%, 15% and 1%, respectively. During that period, 11 scuba divers were treated for decompression illness (DCI) (eight of whom had dived locally) and there were two fatalities.

Conclusions: It is estimated that around 50,000 scuba tank fills were provided, equating to approximately 50,000 dives conducted in Victorian waters during from 1 July 2024 to 30 June 2025. During that period, there were eight open circuit divers who had dived in Victoria treated for DCI and two scuba diving fatalities, yielding estimates of 16 DCI cases and four deaths per 100,000 dives.

Introduction

Diving activity data provides valuable insights into the health of the dive industry and assists planning. Importantly, it also provides a denominator for determining the risk, indicating obvious problems to be identified and addressed, where necessary.

It is very difficult to obtain reliable estimates of scuba diving activity in most places. Entry-level certification numbers provide insights into industry growth but not the level of activity of divers overall. Sporting surveys can provide some insights, but the samples used may be too small to provide accurate data after extrapolation. Activity surveys are also subject to reporting bias.

Scuba tank fill data have been used to provide estimates in some places.^{1,2} Although a single tank fill may sometimes be used for several shallow, relatively short dives (e.g., in a pool) and multiple cylinders are used on technical dives, a tank fill most often represents a single dive. Therefore, the number of tank fills can provide a reasonable estimate of the number of dives.

A tank fill survey was conducted in Victoria, Australia in 1993 to gauge the level of activity and size of the Victorian dive industry.² Australian entry-level certification data has waned since the early 1990s,³ and anecdotal reports suggest a decline in diving in Victoria. To this end, it appeared timely to conduct another survey to assess the current level of activity and the accident rate.

The aim of this study was to determine the number of scuba tank fills done in Victoria from 1 July 2024 to 30 June 2025, to provide an estimate of the number of scuba dives conducted during that period and, from that, estimates of the fatality and decompression illness rates.

Methods

An internet search and discussions with industry sources were conducted to identify dive shops, charter operators, dive clubs and certain government agencies involved in diving throughout Victoria. The results were compared to the internal Australasian Diving Safety Foundation (ADSF) diving industry database and any discrepancies investigated. Separate email groups for dive shops, clubs and others were created and invitations to participate in the survey were

distributed, along with dedicated spreadsheets on which to record cylinder fills, if desired. Potential participants were assured by the investigator (who was known to most of them) that their individual data would be kept confidential with only totals reported. Participants were asked to record and report the number of air, nitrox and ‘other’ (i.e., other breathing gas mixtures). At the beginning of each month, emails were sent requesting participants to report their data for the preceding month. Late submitters were followed up by email and/or telephone and asked to provide actual, or a realistic estimate of their fills. In this way, data were collected from 1 July 2024 to 30 June 2025. At the end of the period, participants were asked to report whether the tank fills during the survey period were lower, similar or higher than recent years in order to gauge whether the survey data was typical, or otherwise.

Ninety-five percent confidence intervals (CI) were calculated based on an exact binomial method as implemented in the binomial test in the R statistical package.⁴

Results

Thirty-three shops (including dedicated dive shops, sports stores and other compressed gas suppliers), 11 dive clubs and three government agencies involved in diving were identified, and, of these, four shops and one club were no longer operating. Although two of the government agencies had their own compressors, these were not used, and tank fills were obtained from one of the other survey participants.

Of the 29 operating shops, 28 agreed to participate, as did ten of the dive clubs, the overall participation rate being 95%. Twenty-one shops and six clubs provided regular monthly data, and the remainder provided annual data, albeit sometimes an estimate. The total number of tank fills for the period is shown in Table 1. Monthly totals from 27 regular participants are shown in Figure 1.

During the period of this survey, were eight open circuit divers (all used air or nitrox) who had dived in Victoria and were treated for decompression illness (DCI) at The Alfred Hyperbaric Service, the sole local recompression facility treating divers in Victoria. In addition, there were two scuba

fatalities (both of whom were diving on air or nitrox).⁵ The two fatalities that occurred during the survey period are consistent with the long-term average of 1.6 scuba deaths per year in Victoria⁶ and, based on an estimate of 50,000 dives over the period (to allow for some missing data), this yields a fatality rate for the year of four deaths per 100,000 dives (95% CI 0.40–14.45). Similarly, based on an estimate of 50,000 dives over the period, the DCI rate for this survey period was 16/100,000 dives (95% CI 6.91–31.52).

Discussion

Keeping a good record of tank fills provides a variety of benefits to the dive operator or club, as well as enabling some industry-wide benefits. First, it can provide a measure against the running cost of the compressor on which to base the fill price, as well as an indication of when maintenance is likely to be required. It also provides an indicator of the level of activity of customers or club members.

Although fatalities in scuba divers from carbon monoxide toxicity are rare, they do occur,^{7,8} and anecdotal reports suggest that there are many more non-fatal incidents associated with breathing gas contamination in scuba divers. If cylinder filling dates and recipient details are recorded, these can provide a necessary record in the event of a mishap involving gas contamination. If a diver becomes incapacitated from contaminated gas, the date when their tank was filled can be found and, if other tanks were likely affected, the recipients can be tracked and notified of the potential for contamination. Workplace authorities in some jurisdictions, require this information to be available upon request.

On an industry level, periodic tank fill surveys help to track the health of the industry and can be used to guide individual business and local industry planning and marketing campaigns. For example, the 1993 Victorian tank fill survey² included 46 respondents (dive shops only) and yielded an estimate of 77,706 fills for that year, although

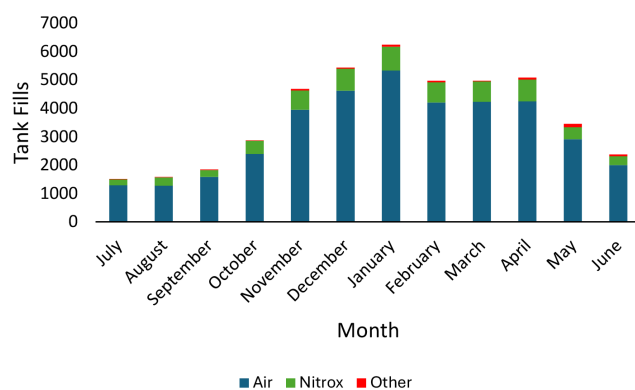
Table 1

Total air, nitrox and ‘other’ tank fills reported in Victoria from 1 July 2024 to 30 June 2025; note – the shops alone reported a total of 43,812 fills and clubs the balance of 2,908

Gas	n (%)
Air	39,386 (84)
Nitrox	6,758 (14)
Other	576 (1)
Total	46,720 (100)

Figure 1

Monthly air, nitrox and ‘other’ fills, 1 July 2024–30 June 2025



if dive clubs and other compressed gas suppliers had been included the number would have been higher (McDonald, personal communication, 2025). By comparison, this later and broader-based survey suggests a reduction of around 35%, confirming beliefs of lower diving activity.

An important benefit of obtaining a reasonable estimate of activity is to provide a denominator for accident risk estimates. Based on the 1993 survey data the fatality rate at that time was 2.5 deaths per 100,000 dives (95% CI 0.3–9.03).⁹ Although the current rate is higher, the two estimates lie within each other's 95% confidence intervals so there may be no significant difference in the underlying risk. In the year that the 1993 survey was conducted, 88 divers were treated for DCI in Victoria, although it is unknown how many of these dived locally so a meaningful DCI rate cannot be estimated. The DCI rate for this recent survey period was 16/100,000 dives (95% CI 6.91–31.52). The greatly reduced number of DCI cases treated is unsurprising given the substantial reduction in treated DCI Australia-wide over the past two decades.¹⁰ This is likely partly from reduced activity, but also a result of improved decompression management, including the introduction of slower ascents and routine safety stops, as well as some changes in diagnostic and treatment criteria. The latter is likely driven in part by changes in the management of mild and marginal DCI, especially in remote locations, which is largely focused on the appropriate delivery of oxygen first aid in consultation with diving medical expertise.^{11,12}

By way of comparison, some other DCI and fatality rate estimates based on hard numerator and denominator data include 4.1 DCI cases/100,000 dives (95% CI 1.12–10.50) for an operator in Tutukaka, New Zealand¹³ (based on charter dives from 2008 to 2014) and 9.6/100,000 dives (95% CI 5.23–16.05) in British Columbia, Canada (based on tank fills in 2000).¹ Compared to these estimates and despite the decrease over the years, the DCI rate in Victoria appears higher, suggesting closer scrutiny of potential preventative measures may be appropriate.

On the other hand, the fatality estimates for Tutukaka and British Columbia were 1.03 (95% CI 0.03–5.70) and 2.05 (95% CI 0.42–6.0) deaths/100,000 dives, respectively. In addition, hard data from a large Victorian dive operator from 2007–2014 gave an estimate of 1.64 deaths/100,000 dives (95% CI 0.20–5.93) for its customers.¹⁴ These estimates suggest that there may be no significant difference in the fatality risk between these and Victoria generally, when measured.

LIMITATIONS

Limitations to this study included the absence of data from an operator and a club and the likelihood that some individual compressor owners were not included, although an allowance was made for this. It also relies on the accuracy

of record keeping by participants, and in particular, the accuracy of estimates of annual fills offered by some who did not provide monthly data. The decompression illness rate is based on treated DCI and it is likely there were many more cases (especially mild cases) which remained untreated.¹⁵ The fatality estimates are based on very small numerators and can vary greatly with small changes in these.

Conclusions

Based on data provided by known Victorian compressed gas providers, it is estimated that around 50,000 scuba tank fills were provided, which equates to approximately 50,000 dives conducted in Victorian waters from 1 July 2024 to 30 June 2025. During that period, there were eight local divers treated for DCI and two scuba diving fatalities, yielding estimates of 16 DCI cases and four deaths per 100,000 open circuit dives.

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