



NITROX DIVING SAFETY

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INTRODUCTION

❖ Few data have been available from which to judge the safety of enriched air nitrox diving. The Divers Alert Network (DAN) conducted an observational study of recreational diving that found the DCS incidence for air dives to be: (a) greater than for 32% nitrox; and (b) less than for about 26% nitrox.

METHODS

❖ From 1995-2008, 122,554 dive profiles were prospectively recorded using dive computers by divers conducting basic recreational dives, Cozumel dive guides, and wreck divers in Scapa Flow, Scotland. 17,854 dives were on nitrox and 104,700 were on air. Air and nitrox dives were compared by depth, Equivalent Air Depth (EAD), time, and a measure of DCS stress for each dive. DCS stress was computed with a probabilistic model based on extravascular bubbles and calibrated with US Navy dive trial data (Gerth. UHM 24:275-92, 1997). Differences between continuous variables were tested by t-test and between categorical variables by Chi-square test with $p < 0.05$ considered significant.

RESULTS

❖ There were 7 DCS cases with nitrox, all of which occurred at Scapa Flow. The DCS incidence for air dives was 3.0 DCS cases per 10,000 dives (DCS/10K dives). Most nitrox dives were with 32% O₂ (Fig. 1). Nitrox dives with a mean of 32.5% oxygen had a non-significantly lower incidence of 2.0 DCS/10K dives with EADs less than for the air dives and lower DCS stresses. Nitrox dives with a mean of 26.1% oxygen had the highest incidence of 12.6 DCS/10K dives, were deeper (by depth and EAD) than air dives, and had the highest DCS stresses. The maximum depth and Equivalent Air Depth decreased with the O₂% in nitrox as did the DCS stress (Fig. 2). DCS stresses were highest in Scapa Flow. DCS cases who breathed 24, 32, and 34% O₂ experienced omitted decompression.

Mean %O ₂	SD %O ₂	Range %O ₂	#DCS	#Dives	DCS per 10K Dives	Mean Stress	Mean Depth	Mean EAD	Mean Time
Air	---	---	31	104,700	3.0*	0.48	66	66	47.2
26.1	2.03	22-29	4	3,167	12.6	0.70	91	83	43.3
32.5	2.03	30-47	3	14,687	2.0*	0.29	76	60	46.5

* not significant

CONCLUSIONS

❖ Divers used nitrox to dive deeper rather than to extend bottom time. Nonetheless, DCS stress was lower for 32.5% nitrox than for air dives. Nitrox was effective for oxygen percentages near 32% but not for oxygen percentages near 26%. The higher DCS incidence for the 26% nitrox dives may reflect their greater severity as indicated by higher DCS stress suggesting that the dive procedures, not nitrox was the causative agent.

ACKNOWLEDGMENT

Supported by NAVSEA Contract # N0463A-08-C-0005.

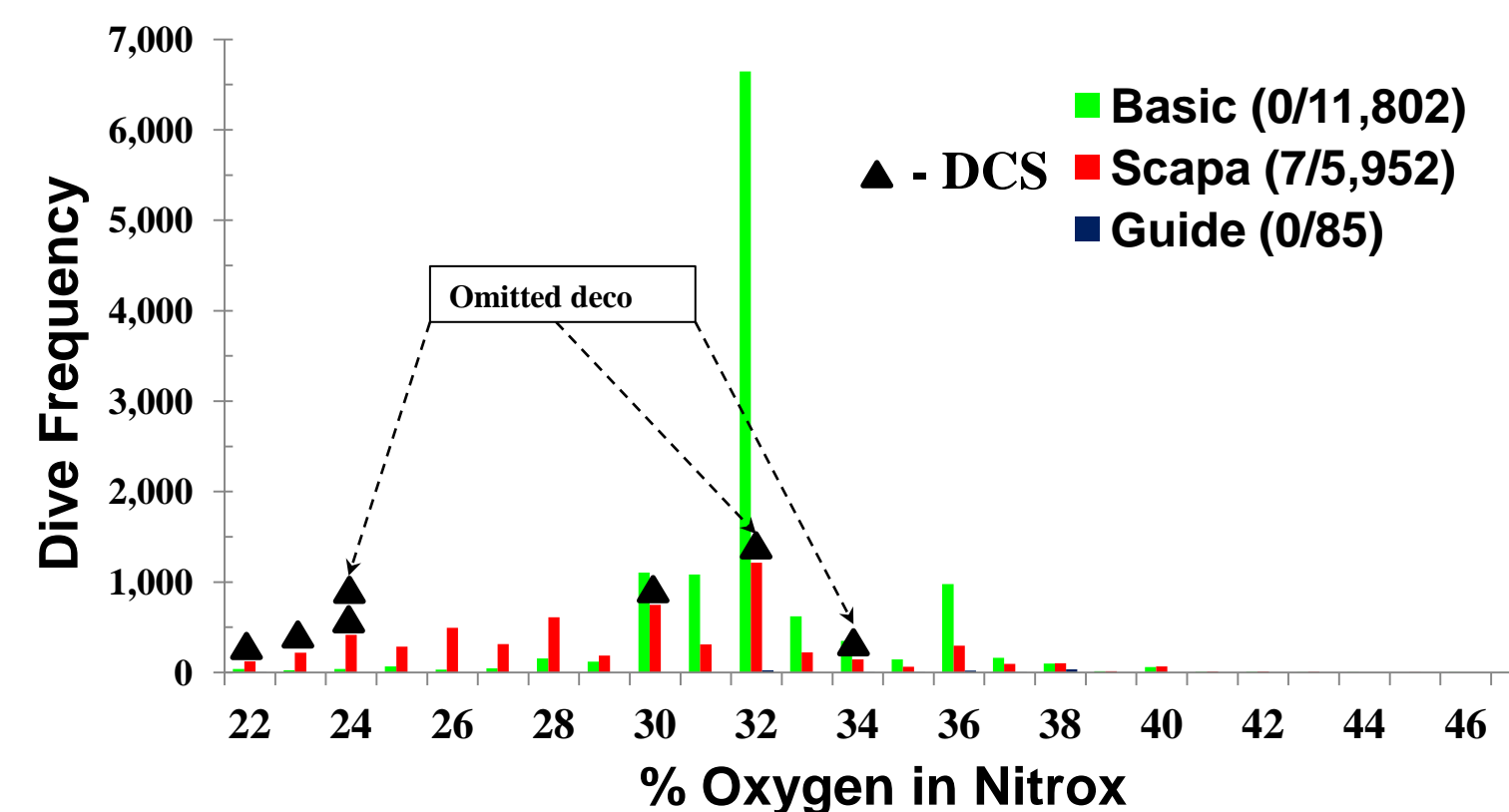


Figure 1. Distribution of O₂ in nitrox.

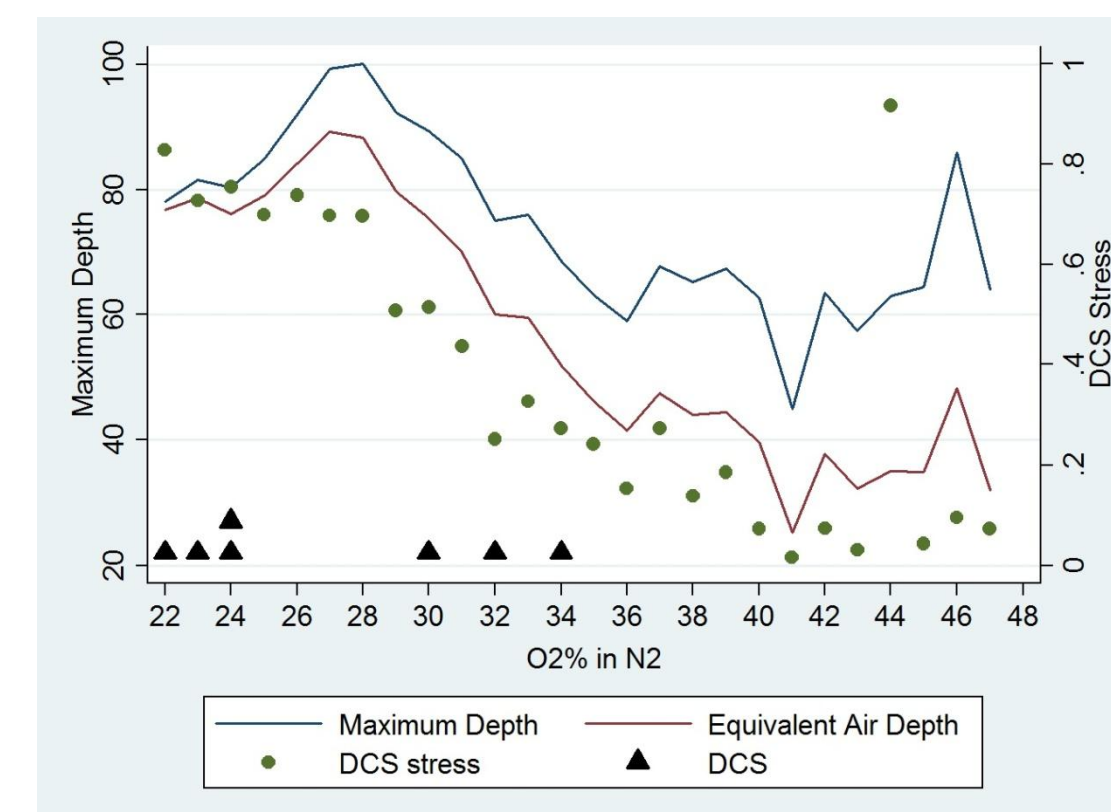


Figure 2. % O₂ vs. Depth, EAD, and DCS stress.