Nitrox Diving

Should Read as Follows:

100

Should Read as Follows:

30

15.1 NITROGEN-OXYGEN BREATHING MIXTURES

Divers have used air as a breathing gas since the beginning of diving. Its principal advantage is that it is readily available and inexpensive to compress into cylinders or use directly from compressors with surface-supplied diving equipment. Air is not the "ideal" breathing mixture for diving because of the effects of nitrogen narcosis at deeper depths and the decompression liability it imposes. Since decompression obligation is dependent on exposure to inspired nitrogen partial pressure, this obligation can be reduced by replacing a portion of the nitrogen content of divers' breathing gas with oxygen, which is metabolized by the body. This is the fundamental benefit of nitrogen-oxygen diving (Wells 1989).

The two most commonly used nitrogen-oxygen mixtures in NOAA are 32% and 36% oxygen, called NOAA Nitrox 32 (NN32) and NOAA Nitrox 36 (NN36). The remainder, the other gas in nitrox mixes, is nitrogen. Other mixes can be used with permission from the NOAA Diving Office. "Nitrox" is a generic term that can be used for any gaseous mixture of nitrogen and oxygen, but in the context of this chapter, the implication is that nitrox is a mixture with more oxygen than that in air. Using NN32 or NN36 versus air can significantly increase the amount of time a diver can spend at depth without incurring additional decompression.

Table 15.1, which is a comparison of air and the NOAA nitrox mixes for no-stop dive times measured in minutes, clearly indicates why oxygen-rich mixtures are a preferred choice for diving in the 50–130 fsw (15–40 msw) depth range.

A diver making a 90 fsw (28 msw) dive using one of these mixtures can increase the air no-stop dive time from 30 minutes to as much as 50 minutes. Assuming a diver uses a 30-foot-per-minute rate of descent, a diver using air will have only 27 minutes on the bottom, whereas the diver breathing NN36 will have 47 minutes. This is a 74 percent increase in bottom time.

But the increased bottom time does not come without an operational price tag. Nitrox diving comes with limits and safety procedures. This chapter explains why nitrox works and describes how NOAA divers take advantage of this principle for their scientific underwater work.

TABLE 15.1
No-Stop Dive Times

Depth (fsw)	*(msw)*	USN Air 21%	NN32 32%	NN36 36%
50	*15*	100	200	310
60	*18*	60	100	100
70	*22*	50	60	60
80	*25*	40	50	60
90	*28*	30	40	50
100	*31*	25	30	40
110	*34*	20	25	30
120	*37*	15	25	
130	*40*	10	20	

15.1.1 Early Use of Nitrogen-Oxygen Breathing Mixtures

The use of oxygen-rich breathing gases for diving is not a new concept. References to such gas mixes go back to the 19th century. The eminent American physicist and chemist, Elihu Thompson (1853–1936), first proposed the breathing of hydrogen and oxygen (Davis 1962). The U.S. Navy has used nitrox effectively with semiclosed rebreathers since the 1950s when it was studied intensively by Dr. Edward H. Lanphier, and also by Dr. Christian J. Lambertsen.

Commercial application of nitrogen-oxygen mixtures was practiced from the late 1950s, particularly by André Galerne at International Underwater Contractors (IUC) of New York (Galerne 1989). These techniques were used to a limited extent by IUC and other commercial companies. When equipment for on-line mixing of oxygen and air was developed, nitrox techniques became more popular and were used more extensively by a few commercial diving companies.