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RISK OF DECOMPRESSION SICKNESS IN SHALLOW NO-STOP AIR DIVING:

AN ANALYSIS OF NAVAL SAFETY CENTER DATA 1990-1994

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The experiments reported herein were conducted according to the principles set forth in the current edition of the "Guide for the Care and Use of Laboratory Animals," Institute of Laboratory Animals Resources, National Research Council.

This technical report has been reviewed by the NMRI scientific and public affairs staff and is approved for publication. It is releasable to the National Technical Information Service where it will be available to the general public, including foreign nations.

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13. ABSTRACT *(Maximum 200 words)*

Naval Safety Center (NSC) dive and incident reports for calendar years 1990-1994 were analyzed to determine the risk of decompression sickness (DCS) in shallow no-stop air diving using current U.S. Navy no-decompression limits (USN57). Navy and Marine Corp divers performed 163,400 no-decompression dives between 21and 55 feet of sea water (fsw) during this period and reported 48 incidents that could be interpreted as DCS. The overall DCS rate was 0.29 cases/1000 dives. There was a clear pattern of increasing DCS risk with increasing bottom time. The DCS rate in the 4th quartile of USN57 no-decompression time (1.28 cases/1000 dives) was nearly six times the rate in the 1st quartile (0.22 cases/1000 dives). Nevertheless, the DCS rate even in the 4th quartile of USN57 no-decompression time was still quite low in absolute terms.

The majority of the 48 incidents reported to NSC were labelled Type II DCS. This is in marked contrast to previous reports of military diving operations where Type I cases predominate.

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The potential impact of adopting new and more restrictive no-decompression limits (USN93) was examined. If the new limits were adopted in the context of single-level dive tables similar to the current Standard Air Tables, and if the pattern of Navy diving remained unchanged, approximately 2.9% of the no-decompression dives conducted between 21 and 55 fsw would be converted to decompression-requiring dives. Approximately 954 dives would be affected annually, adding 419 hours of decompression time to operations each year assuming the decompression was computed using the proposed new USN93 tables. This is an average of 26.3 minutes of decompression for each dive over the new limit. The observed DCS case rate for dives over the proposed USN93 limit is 1.26 cases/1000 dives, a rate very similar to the USN57 4th quartile rate. With the institution of decompression for these dives, the DCS case rate could be expected to fall from 1.26 cases/1000 dives to 1.07 cases/1000 dives, a 15% reduction. In absolute terms, this is an expected reduction of 0.18 case/year.

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This work was supported by Naval Medical Research and Development Command Work Unit No. 63713N M0099.01A-1510 . The opinions and assertions contained herein are the private ones of the authors and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

BACKGROUND

During the 1980s, surveys of operational diving practice (1-4) as well as experimental work at NEDU (5) demonstrated that decompression was inadequate for long, deep air dives. When performed with either in-water decompression or surface decompression techniques, these dives were associated with an unacceptable bends rate (5). Experimentally, Thalmann demonstrated that a 150 feet of sea water (fsw) for 40 min dive or a 190 fsw for 30 min dive required 1.6 times the decompression time called for in the U.S. Naby Standard Air Decompression Table (USN57). Similarly, a 60 fsw/180 min dive required 2.7 times as much decompression (5). In the mid 1980's, concern about the safety of air decompression was so great that the U.K. Department of Energy issued two Diving Safety Memoranda (6) that severely restricted the depth-time envelope for air diving in the North Sea.

In response to these concerns, and to restore the operational envelope for air diving, new decompression models and procedures were developed by several groups including the U.S. Navy, the French Navy, COMEX S.A. (subsequently adopted by the French Ministry of Health), the Canadian Forces, the University of Pennsylvania (for the U.K. Health and Safety Executive and SubSea International, Inc.), and Duke University (for its support of Turkish archaeologic expeditions). Some of these new decompression models continued with the traditional Haldanian (17) approach while others incorporated probabilistic features and risk based on computed bubble dynamics.

The U.S. Navy developed and extensively tested a new probabilistic decompression model in 1993 (7-9). This model, referred to as USN93, produced a new set of air decompression procedures that corrected perceived deficiencies in the decompression from long, deep dives. However, this model also shortened the allowed no-decompression bottom times for shallow dives when compared to USN57. At 40 fsw, for example, USN93 shortened the no-decompression limit from 200 minutes to 144 minutes. At 35 fsw, the no-decompression limit was shortened from 310 to 185 minutes. Table 1 summarizes the changes.

The USN93 model recommendations for shortening the shallow no-decompression limits were consistent with the recommendations of others. The new COMEX tables set a no-

decompression limit of 165 minutes at 40 fsw, while the new University of Pennsylvania tables allowed only 120 minutes. Nevertheless, the need for shorter no-decompression limits was seriously questioned by the Fleet (10). The Fleet maintained that no-decompression diving in the U.S. Navy had an excellent safety record and that shorter no-decompression limits were both mission-compromising and unnecessary.

As a part of its review of USN93-based decompression procedures for Fleet introduction, the Naval Sea Systems Command (NAVSEA) (11) requested that the Naval Medical Research Institute (NMRI) assess the historical DCS rate for shallow, no-decompression air diving in the U.S. Navy using the USN57 procedures. This paper reports the results of that assessment and estimates the potential impact of adopting the USN93 no-decompression limits.

Table 1
Comparison of USN57 and USN93 No-Decompression Limits
for Shallow Water Air Diving

Depth Range (fsw)	**USN57 (min)**	**USN93 (min)**
21-25	Unlimited	338
26-30	Unlimited	245
31-35	310	185
36-40	200	144
41-45	100	114
46-50	100	93
51-55	60	77
56-60	60	64

METHODS

The assessment was performed using data archived in the Naval Safety Center (NSC). The NSC was asked to identify all air dives in its database that met the following criteria:

a. Were performed in the five-year period between 01 January 1990 and 31 December 1994.
b. Were performed by Navy, Marine, Reserve, or Civilian divers as coded in Box A-10 of DD Form 2544.
c. Were performed in open water as coded in Box B-16.
d. Were to a maximum depth of 21-55 fsw as coded in Box B-29.
e. Were labelled as "Air Diving, No-decompression", code "A" in Box C-34.

Dives reported to NSC by other Department of Defense components (e.g. Army, Coast Guard) were not included because incident reporting for these components was felt to be incomplete (M. Bonnin, NSC; personal communication).

Once received from NSC, the data set was scanned for possible errors including duplicate entries, dives with a breathing apparatus not compatible with air diving (LAR V, Mark 15, Mark 16), dives not on 21% oxygen or showing helium in Box B-26, and dives with bottom times exceeding the air no-decompression limits. Dives failing to pass these additional screens were deleted and the remaining dives were aggregated into a spreadsheet in depth increments of 5 fsw from 21-55 fsw and in time increments of both 1 and 10 minutes from 0-360 min. For dives in the 21-25 fsw and 26-30 fsw depth ranges, additional time categories of 6-8 h, 8-10 h, 10-12 h and >12 h were added to accommodate dives longer than 360 min. From this spreadsheet, frequency distributions of dives by depth, bottom time and performer were created.

The NSC was also asked to provide copies of all incident reports bearing a diagnosis of either decompression sickness or arterial gas embolism for the period 01 January 1990 to 31 December 1994. These reports were examined to select those incidents that occurred on open-water, air, no-decompression dives between 21and 55 fsw. These incidents were then reviewed by a panel of five NMRI undersea medical officers who segregated them by consensus vote into one of three categories: (1) Definitely Decompression Illness (DCI), (2) Definitely not DCI, and (3) Uncertain whether it is DCI or not. Category 1, Definitely DCI, was further divided into three subclasses: (a) Decompression Sickness (DCS), (b) Arterial Gas

Embolism (AGE), and (c) DCS or AGE. This categorization scheme recognizes the fact that it is frequently impossible to tell whether an illness observed following decompression represents DCS or AGE (12). The selected incidents were also checked against the dive database to ascertain that the causative dive was included in the database and the depths and bottom times of the dive and the accident reports matched.

Prior to any analyses, all incidents categorized as Definitely not DCI by the panel of undersea medical officers were eliminated from the data set. Also, those incidents where both NSC and the panel of undersea medical officers agreed that the case was a definite AGE were eliminated. This left only those cases where the diagnosis was either (1) Definite Decompression Sickness or (2) Possible Decompression Sickness. All equivocal cases that might have been decompression sickness were thus retained in the analysis.

The DCS rate was computed by dividing the number of cases observed by the number of dives performed, then multiplying the quotient by 1000 to express the rate in cases/1000 dives. The DCS rate was computed by depth band alone (*e.g.,* 21-25 fsw), by depth band and whether the dive was shorter or longer than the USN93 no-decompression limit, and by depth band and whether this dive was in the first, second, third, or fourth quartile of the USN57 no-decompression time. Rates across depth bands were also computed. The relative risk of one condition compared with another was computed by dividing the rate in that condition by the rate in the reference condition. Tests of statistical significance were not conducted because of the small number of DCS cases in the data set.

RESULTS

The NSC identified 166,443 dives based on the criteria (a - e) outlined above. Of these dives, 863 were found to be duplicate entries, 223 to have bottom times exceeding the current no-decompression limit, and 1,957 that were not entirely air dives. These invalid entries represented approximately 2% of the data received from NSC and when they were eliminated from the data set, 163,400 dives remained for analysis. The refinement of the NSC data set is summarized in Table 2.

Table 2
Refinement of the Naval Safety Center Data set

Initial NSC Total		**166,443**
Eliminate Non-Air Dives		
	LAR V 1154	
	Mark 15 414	-1,957
	Mark 16 287	
	SL-17, 100% O_2 90	
	HeO_2 12	
Eliminate Dives Longer than No-D Limit		-223
Eliminate Duplicate Entries		-863
Final NSC Total		163,400

Duplicate entries represented one-half of one percent of the data set. Usually two entries were made, one with the diver's full name and one with his initials. In one instance, two dives with the same diver had an identical date and surfacing time, but the time recorded for leaving the surface differed by 2 minutes.

A number of dives (n=223; 31-55 fsw) listed as "no-decompression" actually exceeded the USN57 no-decompression limit. In some instances, the reported bottom time was just over the limit. Some reported dives, however, were well over the limit. At 36-40 fsw, for example, 16 dives were reported with bottom times of 271-290 minutes (No-decompression limit = 200 min). Across the depth range of 31-55 fsw, 28 "no-decompression" dives were reported with bottom times in excess of 6 hours!

A unique situation was discovered in 32 records. In these records, the day of the month the dive was performed was entered into the day column of the bottom time field, resulting, for example, in a no-decompression dive to 32 fsw for 23 days, 0 hours, and 13 minutes. Such errors were corrected and these dives were retained in the database. They are not part of the 223 dives over the limit described above.

Dives performed with the LAR V, Mark 15, and Mark 16 and listed as air no-decompression may have been SPECWAR dives in which these rigs were used for part of the time in what otherwise was an air dive. Alternatively, they may have been no-decompression dives no those respective rigs in which code "A" in Box C-34 of DD 2544 was checked in error. No attempt was made to verify the nature of these dives. They were eliminated from the dataset.

Table 3 shows the distribution of the 163,400 dives by depth range and performer. More detailed information is given in Appendix A. The greatest number of dives occurred in the 26-30 fsw depth range. Eighty-two percent of the dives were between 21and 40 fsw. Active duty and civilian Navy divers performed more than 90% of the dives. Within Navy, the ratio of active duty dives to civilian dives was approximately 3 to 1.

Table 3

Distribution of Dives by Depth Range and Performer

Depth Range (fsw)	Total Dives	Navy	Civilian	Marine	Reserve
		(% within depth range)			
21-25	29,325	75.8	13.4	4.7	6.2
26-30	43,455	68.0	24.7	2.4	4.9
31-35	28,621	72.4	22.2	1.8	3.5
36-40	33,198	64.1	29.8	1.7	4.4
41-45	11,415	75.6	18.0	1.8	4.6
46-50	13,302	65.2	28.5	2.0	4.2
51-55	4,084	78.5	12.2	3.6	5.7
Total	163,400	70.0	22.8	2.5	4.7

Figure 1 shows the frequency distribution of dives across all performers as a function of bottom time. For all depth ranges under study, the frequency rises rapidly with increasing bottom time, reaching a peak at 21-30 minutes. Frequency then declines with a long tail until the no-decompression time is reached. A secondary peak in dive frequency is not seen as the no-decompression limit is approached. This suggests that divers are not pushing the no-decompression limit. Appendix A gives a further breakdown of these time distributions by category of performer.

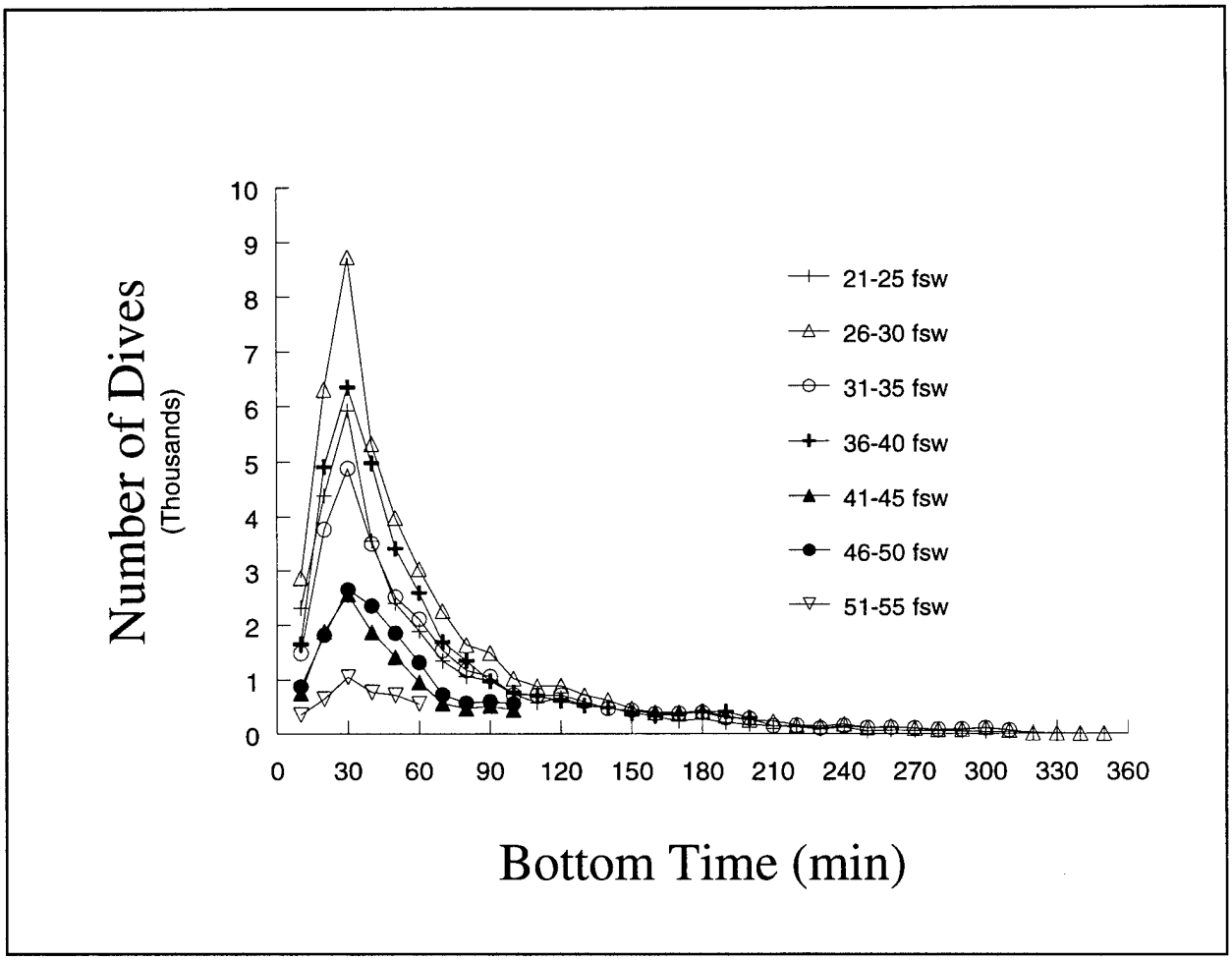

Figure 1. Frequency Distribution of No-Decompression Dives as a Function of Bottom Time. The number of dives performed in each 10 minute increment of bottom time from zero to the USN57 limit is shown for all 7 depth ranges studied. Numbers are the sum of values for Navy, Civilian, Marine, and Reserve divers. At all depths the highest frequency is observed between 21and 30 min of bottom time.

Figure 2 shows the frequency distribution of dives by the maximum reported depth (Box B-29, DD 2544). Substantial spikes in dive frequency are observed at increments of 5 and 10 fsw, suggesting rounding up of the actual maximum depth of the dive to the next deeper 5- or 10-fsw depth. Spikes at the 10-fsw mark consistently exceed those at the 5-fsw mark, suggesting further that rounding up to the next deeper 10-fsw depth is the more common practice.

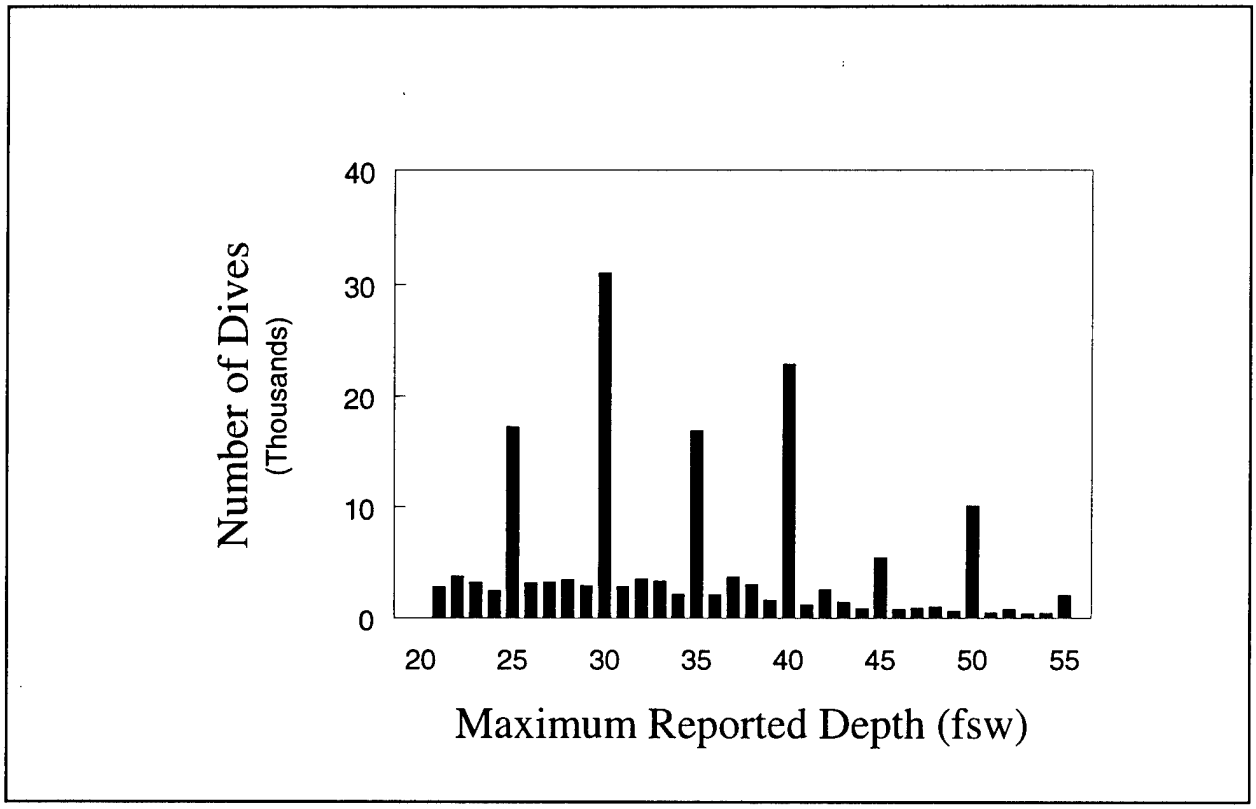

Figure 2. Frequency Distribution of Dives by Maximum Reported Depth. Pronounced peaks are observed at 5- and 10-fsw intervals indicating rounding up of maximum depth to the next 5- or 10-fsw mark.

Figure 3 shows the frequency distribution of dives by the last digit of the reported bottom time (Box B-30, DD 2544). Zero represents dives of 10, 20, 30 min, etc, while 5 represents dives of 5, 15, 25 min, etc. A substantial spike is present at 0, suggesting rounding up the bottom time to the next 10-minute mark. There also appears to be some rounding up to the next 5 minutes as well, although the evidence for this is less strong.

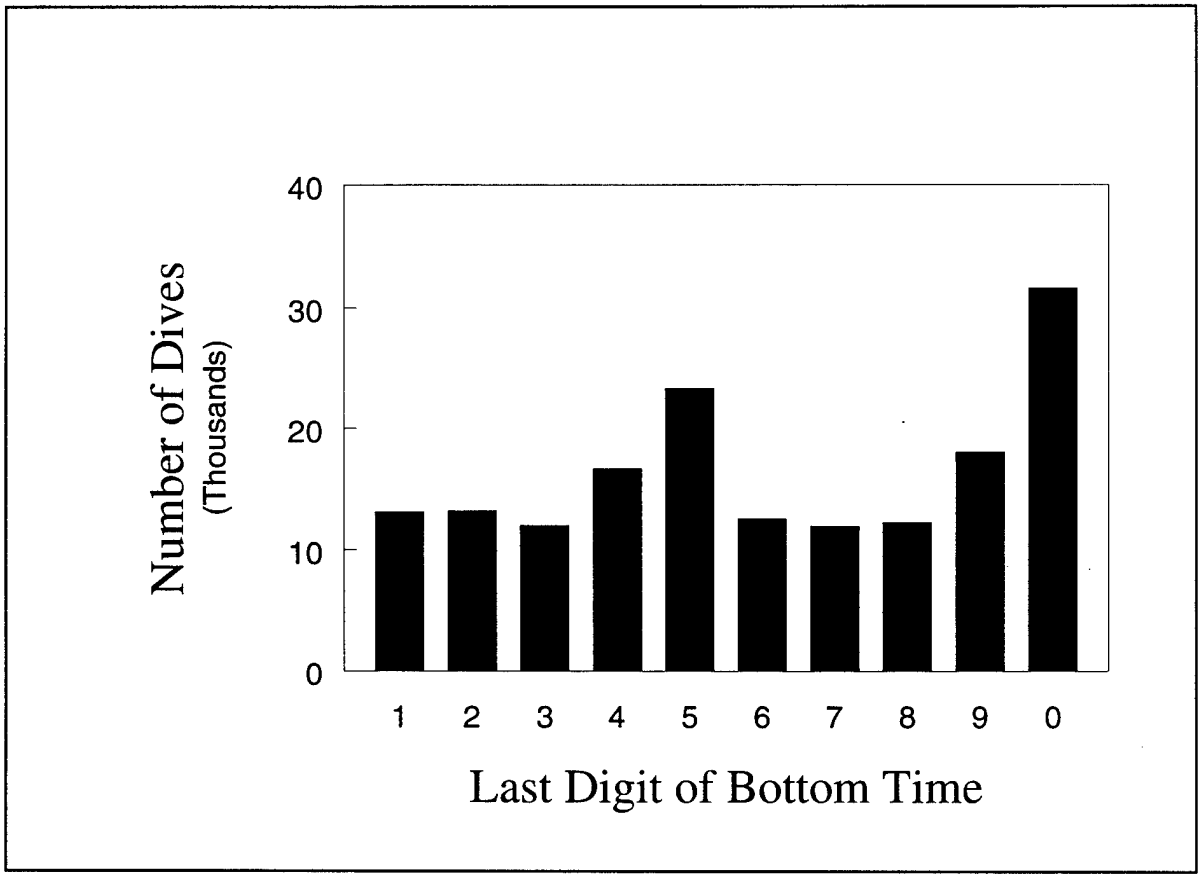

Figure 3. Frequency Distribution of Dives by Last Digit of Reported Bottom Time. The highest frequencies are observed at 5 and 0 suggesting some rounding up of bottom time to the next 5 or 10 minute mark.

For dives to 30 fsw and shallower, the USN57 no-decompression limit is infinite. Table 4 shows the number of dives between 21and 30 fsw that were reported to be greater than 6-hours duration. Fifty-eight dives were identified in this category; 11 of these dives had reported durations greater than 12 hours.

Table 5 shows the number of dives reported between the USN93 no-decompression

limit and the USN57 limit for the depth range indicated. The blank entries for 41-45 and 51-55 fsw reflect the fact that the USN93 limit is more permissive than the USN57 limit in these ranges. All dives conducted between the USN93 limit and the USN57 limits in these two ranges therefore would have been labelled decompression dives under current rules and as such were not captured for this analysis.

Table 4
Air No-Decompression Dives Longer than Six Hours

Depth Range (fsw)	Duration (hours)				Total
	6-8	8-10	10-12	>12	
21-25	16	3	2	5	26
26-30	13*	7	6	6	32
Total	29	10	8	11	58

*Two incidents reported (see Table 7 below)

Table 5
Number of Dives Between USN93 and USN57 No-Decompression Limits

Depth Range (fsw)	≤ USN93	≤USN57	Between
21-25	29,291	29,325	34
26-30	42,791	43,455	664
31-35	26,970	28,621	1651
36-40	31,143	33,198	2055
41-45	--	--	--
46-50	12,976	13,302	366
51-55	--	--	--
Total			4770

Approximately 4,770 dives between 21and 55 fsw would be converted from no-decompression dives to decompression dives in a 5 year period by adopting the USN93 limit in a single level dive format (Table 5). This represents 2.9% of the total dives conducted in this depth range. The word "approximately" is used because the dives falling between the USN93 and USN57 limits in the depth ranges of 41-45 and 51-55 fsw would actually be converted in the opposite direction, from decompression dives to no-decompression dives, making the total number of dives converted to decompression dives over the full depth range of 21-55 fsw less than 4,770. The precise reduction from 4,770 cannot be determined.

A total of 60 DCS/AGE incidents on open-water, air no-decompression dives were identified from the material provided by NSC. Of these, NSC considered 31 cases to represent DCS while 29 were considered AGE. Of the 31 DCS cases, 27 (87%) were reported by NSC as Type II DCS.

The NMRI panel of undersea medical officers felt that 36 of the 60 cases were definitely decompression-related (Definitely DCI), 7 were definitely not decompression-related (Definitely not DCI), and 17 were equivocal (*i.e.*, they may or may not have been decompression-related). For the cases labelled Definitely not DCI, symptoms were already present during the bottom phase of the dive or the diver failed to show any response to recompression therapy. Of those cases labelled Definitely DCI by the panel, 18 were felt to be DCS, 5 to be AGE, and 13 to be either DCS or AGE. After eliminating 7 cases considered Definitely Not DCI and 5 cases where both NMRI and NSC agreed on the diagnosis of AGE, 48 cases remained for analysis. One of the 7 cases eliminated as definitely not DCI had a bottom time longer than the USN93 limit (265 min at 28 fsw). The remaining 6 definitely not DCI cases and the 5 AGE cases all had bottom times shorter than the USN93 limit.

There was generally very good agreement between the depth/bottom time information provided on the incident report and the information contained in the dive database for the causative dive. There were some instances, however, where there were discrepancies. In one instance, the dive was reported as 90 minutes; the incident report indicated 91 minutes. In another instance, the dive record and the incident report numerical data both indicated a depth of 22 fsw, but the incident report narrative indicated a depth of 29 fsw. In a third instance, the dive record and incident report numerical data indicated a bottom time of 52 minutes, but the incident report narrative indicated 51 minutes. In a fourth instance, the dive record and

incident report numerical data indicated a depth of 26 fsw, while the incident report narrative indicated a depth of 30 fsw. Since there was agreement between the dive record and the incident report numerical data in the latter three instances, these values were used in the analysis. In the first instance, the 90-minute bottom time from the dive record was used.

Table 6 shows the distribution of incidents by bottom time within each depth range. Cases indicated by bold print lie beyond the USN93 limit. The shortest bottom time for a case was 13 minutes, the longest was 397 minutes. Within each depth range, cases appeared across the range of bottom times, with no evidence of clustering near the no-decompression limits.

Table 6
Distribution of Incidents by Bottom Time

Depth Range (fsw)	Bottom Time (min)
21-25	29,40,40,44,44,63,90,140
26-30	17,22,25,30,45,50,61,73,74,135,**397,397**
31-35	43,52,52,76,115,143,**191,278**
36-40	20,30,50,74,91,113,121,134,**176,189**
41-45	15,46,97
46-50	40,52,52,57
51-55	13,46,58

Figure 4 shows the percentage of total cases observed in the 26-30, 31-35, and 36-40 fsw depth ranges as a function of the bottom time expressed as percentage of the USN57 no-decompression limit. These are the depth ranges where implementation of the USN93 limit would have the greatest impact (see Table 5). For purposes of this analysis the USN57 no-decompression limit at 26-30 fsw was considered to be 400 minutes; in fact, it is infinite. For all three depth ranges, 70% or more of the cases are observed in the first 60% of the no-decompression time. For the 26-30 fsw range, nearly 80% of the cases are observed in the first 20% of the no-decompression time. (Note: This result would be even more striking if a no-decompression limit greater than 400 min had been selected for this depth range.) The

unexpectedly large number of cases at bottom times well short of the no-decompression limit is a reflection of the very large number of dives performed at these short times (see also the discussion below).

Six of the 48 cases (12.5%) occurred at bottom times between the USN93 limit and the USN57 limit. Table 7 summarizes the essential features of these cases. Appendix B gives greater detail. Three of the cases were from ship husbandry operations; three from special-warfare operations. All but one case demonstrated some form of neurological involvement. The NSC labelled two of the cases AGE, the remaining four DCS. The NMRI review panel felt one of the cases labelled AGE by NSC was in fact DCS; the other case labelled AGE by NSC was considered equivocal (*i.e.*, could have represented either DCS, AGE, or was not-decompression related). The first two cases occurred on the same dive.

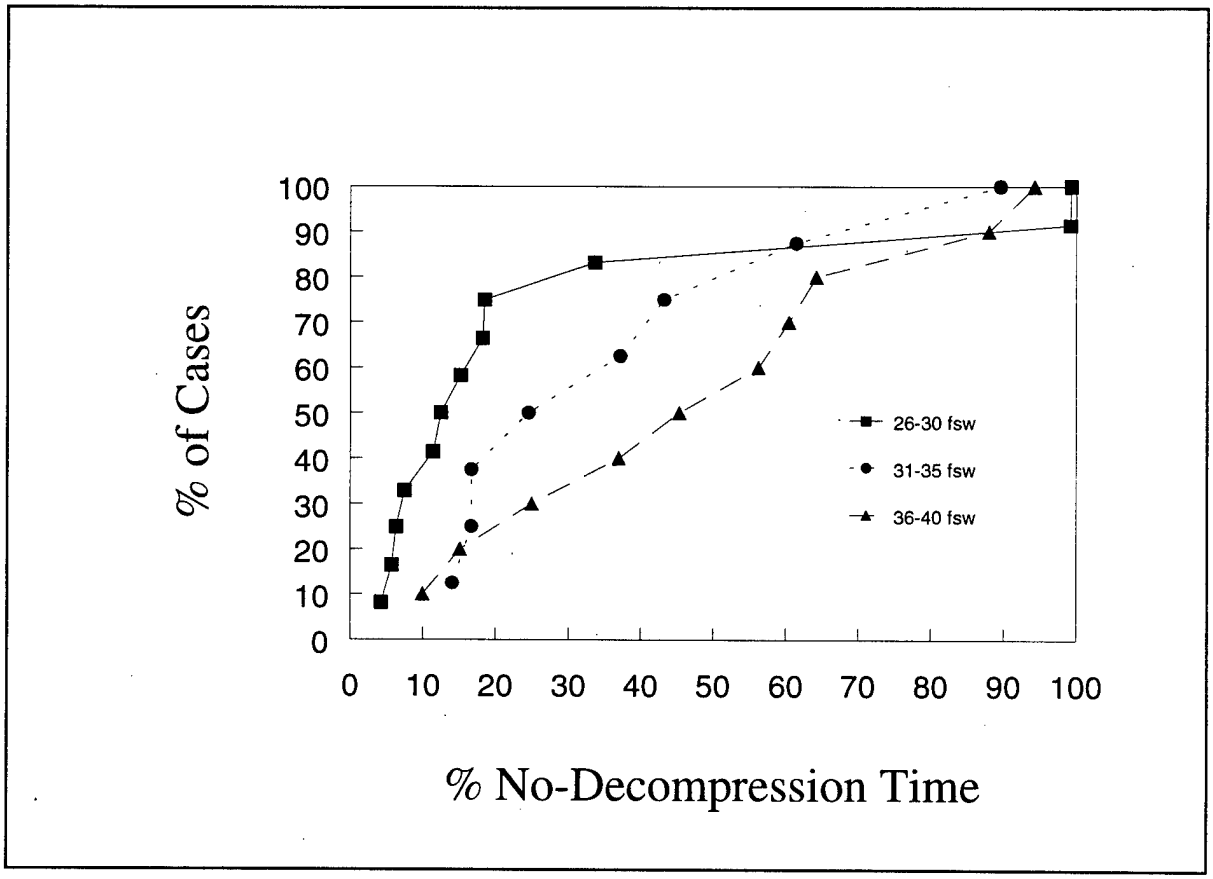

Figure 4. Percentage of Cases Observed as a Function of the Fraction of USN57 No-Decompression Time. Most of the reported cases are observed well before the no-decompression limit is neared.

Table 7
Cases Occurring Beyond the USN93 No-Decompression Limit

Dive (fsw/min)	Purpose	Symptoms	Diagnosis	
			NSC	NMRI
30/397	SW/SDV	Neuropsychiatric	DCS TYPE 2	EQV
30/397	SW/SDV	Numbness	DCS TYPE 2	DCS
33/278	SW/DDS	Back Pain	DCS TYPE 1	DCS
34/191	SH	Hearing Loss	AGE	EQV
37/176	SH	Pain/Weakness	AGE	DCS
40/189	SH	Pain/Numbness	DCS TYPE 2	DCS

SW-special warfare; SDV-swimmer diver vehicle; DDS-dry deck shelter;
EQV-equivocal case, may or may not have been decompression-related.

Table 8 shows the DCS rate (cases/1000 dives) by depth interval without regard to bottom time. The rate is remarkably constant, ranging between 0.26 and 0.30 cases/1000 dives (2.6-3.0 cases/10,000 dives) across the entire range of 21 to 50 fsw. Only between 51 and 55 fsw does the rate increase to 0.73 cases/1000 dives.

Table 8
DCS Rate as a Function of Depth Range

Depth Range (fsw)	Bottom Time (min)	Total Dives (#)	Total Cases (#)	Rate (cases/1000)
21-25	0-INF	29,325	8	0.27
26-30	0-INF	43,455	12	0.28
31-35	0-310	28,621	8	0.28
36-40	0-200	33,198	10	0.30
41-45	0-100	11,415	3	0.26
46-50	0-100	13,302	4	0.30
51-55	0-60	4,084	3	0.73
Total		163,400	48	0.29

Table 9 shows the DCS rate further segregated into quartiles of USN57 no-decompression time. At 21-30 fsw, where the USN57 limit is infinite, four quartiles of 100 minutes each were arbitrarily chosen, allowing the analysis to cover 400 minutes of bottom time and to encompass all of the observed cases of DCS. This process excluded 43 dives beyond the 400-minute mark from the analysis.

Overall, the quartile analysis shows a steadily increasing DCS rate from quartile to quartile, ranging from 0.22 cases/1000 dives in the first quartile to 1.28 cases/1000 dives in the fourth quartile. The DCS rate in the fourth quartile is 2.2 times the rate in the 3rd quartile and 5.8 times the rate in the first quartile.

Figure 5 plots the cumulative number of DCS cases at 26-30, 31-35, and 36-40 fsw as a function of the cumulative number of dives undertaken beginning at a bottom time of 1-10 minutes and then proceeding to progressively longer bottom times. If the DCS rate was a constant value independent of bottom time, these plots would be expected to be straight lines with a y-intercept of zero and a slope equal to the DCS rate. At each depth, the curves bow upward indicating a rising DCS rate with increasing bottom time. The information plotted in Figure 5 is from Appendix A and Table 6.

Table 10 shows the DCS rate within each depth range when the dives are segregated into those equal to or shorter than the USN93 limit and those longer than the USN93 limit. The latter are the dives that would be converted to decompression dives by adopting the USN93 limit. The depth ranges 41-45 and 51-55 fsw are not shown since the USN93 limit exceeds the USN57 limit in these ranges. For dives equal to or shorter than the USN93 limit, the mean DCS rate is 0.26 cases/1000 dives (range 0.22-0.31). Longer than the USN93 limit, the mean DCS rate is 1.26 cases/1000 dives (range 0-3.01), a 4.8-fold increase over those dives equal to or shorter than the limit.

Table 9

DCS Rate as a Function of Quartile of No-Decompression Time

Depth Range (fsw)	Bottom Time (min)	Total Dives (#)	Total Cases (#)	Rate (#/1000)
21-25	0-100	24,584	7	0.28
	101-200	3,867	1	0.26
	201-300	775	0	0.00
	301-400	80	0	0.00
26-30	0-100	36,641	9	0.25
	101-200	5,370	1	0.19
	201-300	1,330	0	0.00
	301-400	90	2	22.22
31-35	0-78	20,701	4	0.19
	79-155	5,175	2	0.39
	156-233	1,981	1	0.50
	234-310	764	1	1.31
36-40	0-50	21,300	3	0.14
	51-100	7,374	2	0.27
	101-150	2,704	3	1.11
	151-200	1,820	2	1.10
41-45	0-25	3,826	1	0.26
	26-50	4,646	1	0.22
	51-75	1,743	0	0.00
	76-100	1,200	1	0.83
46-50	0-25	3,862	0	0.00
	26-50	5,679	1	0.18
	51-75	2,347	3	1.28
	76-100	1,414	0	0.00
51-55	0-15	651	1	1.54
	16-30	1,394	0	0.00
	31-45	1,139	0	0.00
	46-60	900	2	2.22
Summary	1st Quartile	111,565	25	0.22
	2nd Quartile	33,505	8	0.24
	3rd Quartile	12,019	7	0.58
	4th Quartile	6,268	8	1.28
TOTAL		163,357	48	0.29

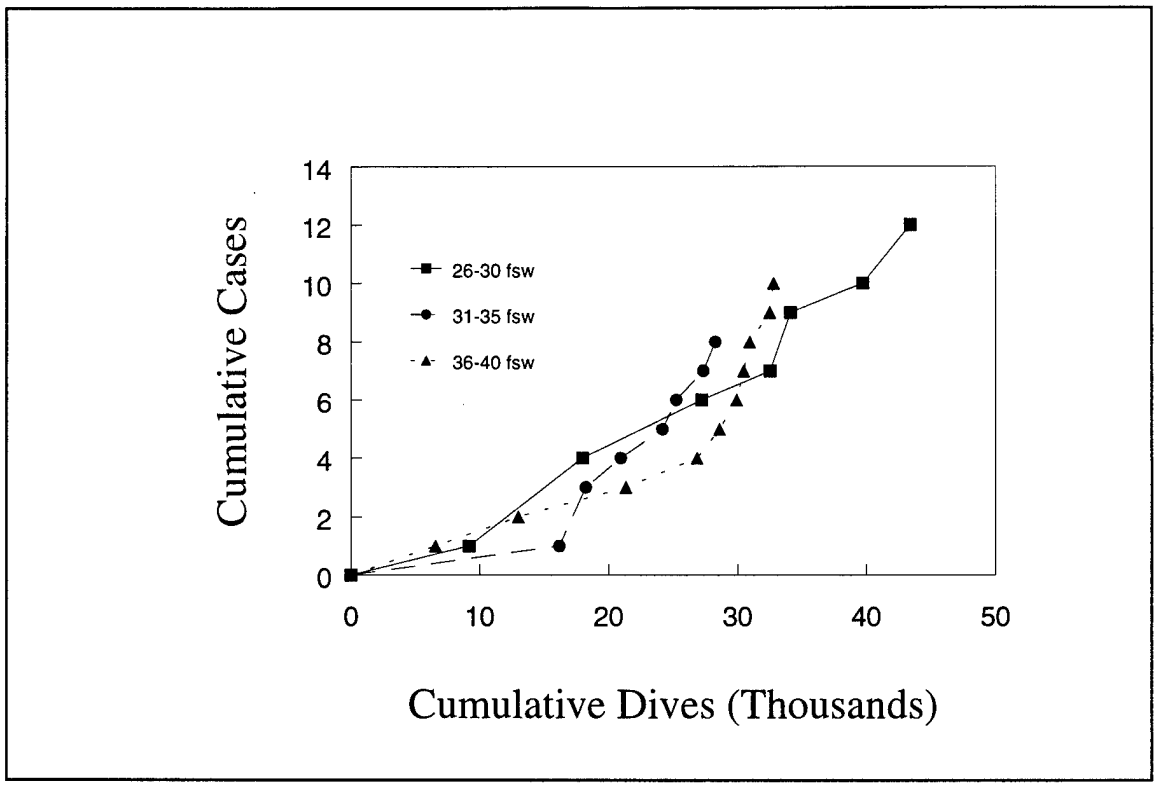

Figure 5. Cumulative Number of Cases versus Cumulative Number of Dives Undertaken. At the three depths shown, the curves tend to bow upward suggesting the DCS rate is rising with increasing bottom time.

Table 10
DCS Rate for Dives Shorter or Longer than the USN93 Limit

Depth Range (fsw)	Shorter than USN93 Limit			Longer than USN93 Limit		
	Dives (#)	Cases (#)	Rate (#/1000)	Dives (#)	Cases (#)	Rate (#/1000)
21-25	29,291	8	0.27	34	0	0.00
26-30	42,791	10	0.23	664	2	3.01
31-35	26,970	6	0.22	1651	2	1.21
36-40	31,143	8	0.26	2055	2	0.97
41-45	11,415	3	0.26	--	-	--
46-50	12,936	4	0.31	366	0	0.00
51-55	4,084	3	0.73	--	-	--
Total	158,630	42	0.26	4770	6	1.26

DISCUSSION

The epidemiologic data that the NSC collects on U.S. military diving operations is among the best in the world today. Nevertheless, we found that these data sets were not error-free. Approximately 2% of the diving records we examined had to be excluded from the study because they represented duplicate entries, had listed bottom times in excess of the air no-decompression limits, or listed a breathing apparatus inconsistent with air diving (*e.g.*, LAR V). We observed that reported maximum depth was usually rounded up to the next even increment of 5 or 10 fsw. Reported bottom time appeared to be rounded up as well.

Incident reports occasionally contained conflicting depth and time information. By far the more limiting feature of the incident report, however, was the quantity and quality of the information contained in the narrative section. These narratives, containing 100-200 words, provided scant information on the clinical presentation of the cases (see Appendix B for examples). The information was so brief that the panel of undersea medical officers in seven cases could not conclude whether the case was related to decompression or not. The narratives appeared to be written largely by non-medical personnel, and in the cases where two divers from the same dive were treated, the narratives were nearly identical for both divers (see Appendix B). A different categorization may have been reached by the panel if full narrative summaries of the incidents written by the attending physician or corpsman had been available for examination.

Eighty-seven percent of the cases reported to NSC as DCS were labelled Type II. The prominence of Type II symptoms was surprising given previous reports of the experimental and operational experience of professional divers (13,14,15) in which Type I symptoms are the dominant manifestation of DCS. The finding of a high prevalence of Type II symptoms is consistent, however, with recently reported observations in recreational divers (15,16) for whom, as a class, medical monitoring and incident reporting are highly variable.

For all depth ranges, the incidents of definite and possible DCS were distributed broadly over the range of bottom times up to the USN57 no-decompression limit. The cases were not clustered near the no-decompression limit as might be expected. In fact, most cases were observed in the first quartile of the no-decompression time, and can be attributed to the

high frequency of diving at these short bottom times (see Figure 1 and Table 9), not to a higher risk level. Experience has shown that DCS can occur after almost any hyperbaric exposure, even very short and shallow ones. Although the probability of DCS on these dives is very low, the sheer number of dives makes the observance of some cases inevitable.

The data show a clear pattern of increasing risk of DCS with increasing bottom time. The DCS rate for the 4th quartile of no-decompression time is 2.2 times the 3rd quartile rate and nearly 6 times the 1st quartile rate. The DCS rate for dives longer than the USN93 limit is 4.8 times the rate for dives shorter than the limit.

Despite the pattern of increasing risk with increasing bottom time, the absolute risk of DCS during no-decompression diving as currently practiced is quite low. For dives falling between the USN93 limit and the USN57 limit, the mean DCS rate is only 1.26 cases/1000 dives. The highest rate observed in this interval is 3.01 cases/1000 dives.

It would have been highly desirable to make point estimates of the DCS rate <u>at</u> the USN93 and USN57 limit times for each depth range rather than estimates for the preceding interval. The DCS rate for dives conducted <u>at</u> the longer USN57 limit, for example, will be clearly greater than the rate for all the dives between the USN93 and the USN57 limit. Unfortunately, the low number of reported cases would not sustain such an analysis.

IMPACT OF ADOPTING THE USN93 NO-DECOMPRESSION LIMITS

The foregoing analysis allows assessment of the likely operational impact of adopting the USN93 no-decompression limits. If the new limits were adopted in the context of single-level dive tables similar to USN57 and the pattern of diving in the Fleet remained unchanged, approximately 954 dives per year (4,770 dives/5 years, see Table 5) would be converted from no-decompression dives to dives requiring decompression. This number is a slight overestimate since a small number of dives in the 41-45 and 51-55 fsw range now requiring decompression would be converted to no-decompression dives. The 954 dives would add approximately 419 hours of decompression time to operations annually assuming that these dives were all square dives to the maximum depth and bottom time indicated in the NSC data and that decompression was computed using the new USN93 tables. This is an average of 26.3 minutes of decompression per dive for this subset of dives.

The institution of decompression for the 954 dives between the USN93 and USN57 limits would reduce the DCS risk below the current risk with no-decompression, but would not eliminate risk altogether. The decompression tables themselves are associated with a finite level of risk. Using the USN93 algorithm, the risk of performing these 954 dives with and without decompression was computed. For this calculation, the 4,770 dives over the USN93 limit for the five-year period were aggregated into a spreadsheet in depth intervals of 5 fsw (*e.g.*, 26 to 30 fsw) and time intervals of 10 minutes (*e.g.*, 251 to 260 minutes). For all dives in the spreadsheet cell, the depth for the calculation was taken as the upper limit of the cell (*e.g.*, 30 fsw for 26-30 fsw) and the bottom time was taken as the mid point of the cell (*e.g.*, 255 min for 251-260 min). For the 4,770 dives in question, the DCS risk with decompression was estimated by the algorithm to be 85% of the risk of performing them without decompression. In other words, the DCS risk is approximately 15% lower with USN93 decompression than without.

Six cases of DCS were observed in 5 years on the 4770 dives performed over the USN93 limit. This gives a baseline risk of 1.26 cases/1000 dives when these dives are performed without decompression. Based on the analysis outlined above, the risk on these dives with the institution of decompression would be expected to fall to 1.07 cases/1000 dives (1.26 x 0.85). For the 954 dives over the USN93 limit annually, this would result in a rate of 1.02 cases/year with decompression vice 1.20 cases/year without decompression, or the avoidance of 0.18 case/year. This number is a slight overestimate of the benefit since the dives in the 41-45 fsw and 51-55 fsw ranges converted from decompression dives to no-decompression dives would add back in a small risk.

Thus, the best estimate of the cost/benefit of adopting the USN93 limits in the context of single level dive tables is the addition of approximately 419 hours of decompression time annually to operations for the avoidance of 0.18 cases of DCS.

CONCLUSIONS

1. The overall DCS rate for shallow water, air, no-stop diving in the U.S. Navy is very low, approximately 0.29 cases/1000 dives. This overall rate remains nearly constant over the depth range of 21-50 fsw.

2. The observed probability of DCS with shallow no-decompression diving increases with increasing bottom time. The DCS rate during the 4th quartile of USN57 no-decompression time (1.28 cases/1000 dives) is approximately six times the rate in the 1st quartile (0.22 cases/1000 dives). For bottom times longer than the proposed USN93 limit, the DCS rate is 1.26 cases/1000 dives, which is substantially greater than the DCS rate of 0.26 cases/1000 dives for dives shorter than the limit, but still quite low in absolute terms.

3. There is no evidence that divers are currently pushing the no-decompression limits in shallow water. In fact, the vast majority of dives are conducted at less than 25% of the current no-decompression limits for the depth ranges studied here.

4. The proportion of DCS cases reported as Type II in shallow no-stop diving is significantly higher than has been previously reported in military divers.

5. If the USN93 limits were adopted and used in the context of single-level diving tables, approximately 0.18 cases of DCS would be avoided per year at a cost of approximately 419 hours of additional decompression time.

6. These data do not support shortening the USN57 no-decompression limits in shallow water.

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APPENDIX A

FREQUENCY OF SHALLOW AIR NO-DECOMPRESSION DIVING

1990 - 1994

Table A1

Distribution of Dives by Depth and Bottom Time

All Dives

Scuba

B.T. ---> Depth	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	100-110	111-120	121-130	131-140	141-150	151-160	161-170	171-180	181-190	191-200	201-210	211-220	221-230	231-240	241-250	251-260	261-270	271-280	281-290	291-300	301-310	311-320	321-330	331-340	341-350	351-360	Totals	# Beyo No-D Li
21 - 25	1488	2684	3848	2261	1391	1049	682	442	405	280	224	273	182	166	134	96	58	80	48	47	34	22	19	34	5	18	15	8	13	4	2	8	3	2	0	3	16228	
26 - 30	1617	3659	5018	2916	2085	1541	966	674	613	347	319	332	250	200	142	114	112	136	60	52	76	29	30	54	15	37	19	8	7	10	8	3	9	0	1	3	21463	
31 - 35	815	2329	2840	1971	1339	1082	589	451	319	187	156	172	129	85	76	70	64	43	33	35	30	19	10	37	26	21	19	27	13	24	6	0	6	7	1	0	13031	14
36 - 40	1072	3352	4175	3180	2013	1563	839	562	387	245	197	173	124	103	88	45	61	69	34	60	3	8	2	5	6	0	2	6	4	0	0	2	0	1	0	0	18381	39
41 - 45	419	1192	1718	1400	1025	643	304	207	190	120	7	0	3	4	1	0	0	6	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	7241	23
46 - 50	591	1266	1983	1813	1387	966	444	314	291	264	10	0	7	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	9361	22
51 - 55	218	466	736	613	544	376	3	0	3	8	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2968	15
Totals	6220	15148	20318	14154	9784	7220	3827	2650	2208	1471	913	950	695	559	442	326	295	335	175	194	143	78	61	130	52	76	55	49	37	38	19	13	18	12	2	6	98673	113

Cumulative Sums: Scuba

21 - 25	1488	4372	8220	10481	11872	12921	13603	14045	14450	14730	14954	15227	15409	15575	15709	15805	15863	15943	15991	16038	16072	16094	16113	16147	16152	16170	16185	16193	16206	16210	16212	16220	16223	16225	16225	16228		
26 - 30	1617	5276	10294	13210	15295	16836	17802	18476	19089	19436	19755	20087	20337	20537	20679	20793	20905	21041	21101	21153	21229	21258	21288	21342	21357	21394	21413	21421	21428	21438	21447	21450	21459	21459	21460	21463		
31 - 35	815	3144	5984	7955	9294	10376	10965	11416	11735	11922	12078	12250	12379	12464	12540	12610	12674	12717	12750	12785	12815	12834	12844	12881	12907	12928	12947	12974	12987	13011	13017	13017	13023	13030	13031	13031		
36 - 40	1072	4424	8599	11779	13792	15355	16194	16756	17143	17388	17585	17758	17882	17985	18073	18118	18179	18248	18282	18342	18345	18353	18355	18360	18366	18366	18368	18374	18378	18378	18378	18380	18380	18381	18381	18381		
41 - 45	419	1611	3329	4729	5754	6397	6701	6908	7098	7218	7225	7225	7228	7232	7233	7233	7233	7239	7239	7239	7239	7239	7239	7239	7239	7239	7239	7239	7239	7239	7241	7241	7241	7241	7241	7241		
46 - 50	591	1857	3840	5653	7040	8006	8450	8764	9055	9319	9349	9349	9356	9357	9358	9358	9358	9359	9359	9359	9359	9359	9359	9359	9359	9359	9359	9359	9359	9359	9359	9359	9359	9359	9361	9361		
51 - 55	218	684	1420	2033	2577	2953	2956	2956	2959	2967	2967	2967	2967	2967	2967	2968	2968	2968	2968	2968	2968	2968	2968	2968	2968	2968	2968	2968	2968	2968	2968	2968	2968	2968	2968	2968		

Surface Supplied

B.T. ---> Depth	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	100-110	111-120	121-130	131-140	141-150	151-160	161-170	171-180	181-190	191-200	201-210	211-220	221-230	231-240	241-250	251-260	261-270	271-280	281-290	291-300	301-310	311-320	321-330	331-340	341-350	351-360	Totals	# Beyo No-D Li
21 - 25	821	1500	2081	1296	1008	838	659	621	574	458	350	390	345	313	274	223	178	198	160	128	112	102	68	82	46	45	44	40	31	33	35	16	1	0	0	3	13071	
26 - 30	1254	2648	3708	2408	1894	1489	1291	961	881	671	557	558	465	423	328	287	280	282	268	205	155	136	111	125	99	98	81	68	73	101	52	3	0	0	1	1	21960	
31 - 35	671	1435	2043	1532	1178	1027	949	722	735	534	560	542	472	383	361	304	313	355	260	249	118	136	98	111	85	89	83	53	68	82	58	0	0	1	0	5	15410	6
36 - 40	579	1555	2177	1800	1397	1032	852	784	585	525	505	435	399	382	298	295	301	344	376	235	5	5	0	4	0	0	1	0	3	0	0	0	1	0	0	0	14875	19
41 - 45	328	689	845	467	389	310	262	260	327	320	12	5	4	4	3	3	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4232	35
46 - 50	279	548	672	539	463	351	276	255	308	272	3	3	3	2	0	5	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	3962	19
51 - 55	134	179	312	156	168	182	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1134	3
Totals	4066	8554	11836	8198	6497	5229	4290	3603	3411	2778	1988	1933	1688	1507	1264	1117	1073	1182	1064	817	390	379	275	323	230	230	209	162	175	217	145	19	2	1	1	9	74864	82

Cumulative Sums: Surface Supplied

21 - 25	821	2321	4402	5698	6706	7544	8203	8824	9398	9854	10204	10594	10939	11252	11526	11749	11927	12125	12285	12413	12525	12627	12695	12777	12823	12868	12912	12952	12983	13016	13051	13067	13068	13068	13068	13071		
26 - 30	1254	3902	7610	10018	11912	13401	14692	15653	16534	17205	17762	18320	18785	19208	19536	19823	20103	20385	20653	20858	21013	21149	21260	21385	21484	21580	21661	21729	21802	21903	21955	21958	21958	21958	21959	21960		
31 - 35	671	2106	4149	5681	6859	7886	8835	9557	10292	10826	11386	11928	12400	12783	13144	13448	13761	14116	14376	14625	14743	14879	14975	15086	15171	15260	15343	15396	15464	15546	15604	15604	15604	15605	15605	15610		
36 - 40	579	2134	4311	6111	7508	8540	9392	10176	10761	11286	11791	12226	12625	13007	13305	13600	13901	14245	14621	14856	14861	14866	14866	14870	14870	14870	14871	14871	14874	14874	14874	14874	14875	14875	14875	14875		
41 - 45	328	1017	1862	2329	2718	3028	3290	3550	3877	4197	4209	4214	4218	4222	4225	4228	4229	4232	4232	4232	4232	4232	4232	4232	4232	4232	4232	4232	4232	4232	4232	4232	4232	4232	4232	4232		
46 - 50	279	827	1499	2038	2501	2852	3128	3383	3691	3963	3966	3969	3972	3974	3974	3979	3979	3979	3979	3979	3979	3979	3979	3980	3980	3980	3980	3981	3981	3982	3982	3982	3982	3982	3982	3982		
51 - 55	134	313	625	781	949	1131	1132	1132	1133	1133	1134	1134	1134	1134	1134	1134	1134	1134	1134	1134	1134	1134	1134	1134	1134	1134	1134	1134	1134	1134	1134	1134	1134	1134	1134		

Total

B.T. --> Depth	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	100-110	111-120	121-130	131-140	141-150	151-160	161-170	171-180	181-190	191-200	201-210	211-220	221-230	231-240	241-250	251-260	261-270	271-280	281-290	291-300	301-310	311-320	321-330	331-340	341-350	351-360	Totals	# Beyo No-D Li
21 - 25	2309	4384	5929	3557	2399	1887	1341	1063	979	736	574	663	527	479	408	319	236	278	208	175	146	124	87	116	51	63	59	48	44	37	37	24	4	2	0	6	29299	
26 - 30	2871	6307	8726	5324	3979	3030	2257	1635	1494	1018	876	890	715	623	470	401	392	418	328	257	231	165	141	179	114	133	100	76	80	111	61	6	9	0	2	4	43423	
31 - 35	1486	3764	4883	3503	2517	2109	1538	1173	1054	721	716	714	601	468	437	374	377	398	293	284	148	155	106	148	111	110	102	80	81	106	64	0	6	5	1	5	28641	20
36 - 40	1651	4907	6352	4980	3410	2595	1691	1346	972	770	702	608	523	485	386	340	362	413	410	295	8	13	2	9	6	0	3	6	7	0	0	2	1	1	0	0	33256	58
41 - 45	747	1881	2563	1867	1414	953	566	467	517	440	19	5	7	8	4	3	1	9	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	11473	58
46 - 50	870	1814	2655	2352	1850	1317	720	569	599	556	13	3	10	3	1	5	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2	0	0	13343	41
51 - 55	352	645	1048	769	712	558	4	0	4	8	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4102	18
Totals	10286	23702	32156	22352	16281	12449	8117	6253	5619	4249	2901	2883	2383	2056	1706	1443	1368	1517	1239	1011	533	457	336	453	282	306	264	211	212	255	164	32	20	13	3	15	163537	195

Cumulative Sums: Total

21 - 25	2309	6693	12622	16179	18578	20465	21806	22869	23848	24584	25158	25821	26348	26827	27235	27554	27790	28068	28276	28451	28597	28721	28808	28924	28975	29038	29097	29145	29189	29226	29263	29287	29291	29293	29293	29299		
26 - 30	2871	9178	17904	23228	27207	30237	32494	34129	35623	36641	37517	38407	39122	39745	40215	40616	41008	41426	41754	42011	42242	42407	42548	42727	42841	42974	43074	43150	43230	43341	43402	43408	43417	43417	43419	43423		
31 - 35	1486	5250	10133	13636	16153	18262	19800	20973	22027	22748	23464	24178	24779	25247	25684	26058	26435	26833	27126	27410	27558	27713	27819	27967	28078	28188	28290	28370	28451	28557	28621	28621	28627	28635	28636	28641		
36 - 40	1651	6558	12910	17890	21300	23895	25586	26932	27904	28674	29376	29984	30507	30992	31378	31718	32080	32493	32903	33198	33206	33219	33221	33230	33236	33236	33239	33245	33252	33252	33252	33254	33255	33256	33256	33256		
41 - 45	747	2628	5191	7058	8472	9425	9991	10458	10975	11415	11434	11439	11446	11454	11458	11461	11462	11471	11471	11471	11471	11471	11471	11471	11471	11471	11471	11471	11471	11471	11473	11473	11473	11473	11473	11473		
46 - 50	870	2684	5339	7691	9541	10858	11578	12147	12746	13302	13315	13318	13328	13331	13332	13337	13337	13338	13338	13338	13338	13338	13338	13339	13339	13339	13339	13340	13340	13341	13341	13341	13341	13343	13343	13343		
51 - 55	352	997	2045	2814	3526	4084	4088	4088	4092	4100	4101	4101	4101	4101	4101	4102	4102	4102	4102	4102	4102	4102	4102	4102	4102	4102	4102	4102	4102	4102	4102	4102	4102	4102	4102	4102		

Figure A1

All Dives

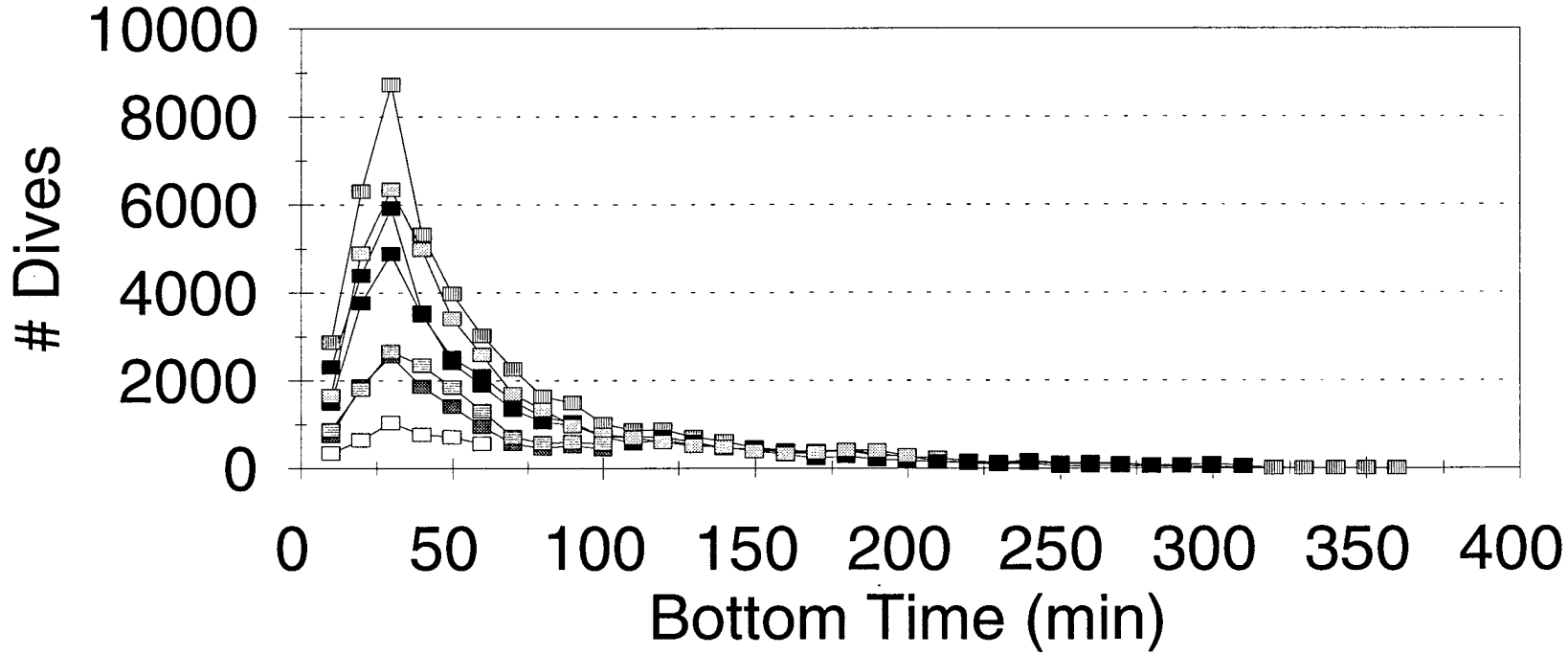


Table A2

Distribution of Dives by Depth and Bottom Time

Navy Dives

Scuba

B.T. ----> / Depth	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	100-110	111-120	121-130	131-140	141-150	151-160	161-170	171-180	181-190	191-200	201-210	211-220	221-230	231-240	241-250	251-260	261-270	271-280	281-290	291-300	301-310	311-320	321-330	331-340	341-350	351-360	Totals	# Beyo No-D Li
21 - 25	1262	2275	2825	1602	924	748	480	337	303	219	196	233	160	136	105	85	52	70	46	42	33	22	14	25	5	11	15	8	13	4	2	7	3	2	0	3	12267	
26 - 30	1339	2794	3900	2160	1464	1119	613	414	416	274	247	258	186	163	126	91	99	121	51	43	62	29	24	43	12	24	19	8	7	10	9	3	9	0	1	3	16141	
31 - 35	725	1902	2334	1572	1055	824	470	356	220	140	134	117	98	71	68	58	50	34	25	28	30	19	10	36	26	21	19	27	13	24	6	0	6	7	1	0	10526	14
36 - 40	930	2790	3246	2465	1560	1236	612	402	273	178	142	134	80	65	63	40	49	63	28	46	3	8	2	5	6	0	2	6	4	0	0	2	0	1	0	0	14441	39
41 - 45	359	960	1406	1151	813	521	235	155	152	72	6	0	2	4	1	0	0	6	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	5845	21
46 - 50	555	1066	1590	1427	1074	734	231	129	80	77	2	0	7	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	6977	14
51 - 55	198	358	569	486	446	264	3	0	3	8	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2336	15
Totals	5368	12145	15870	10863	7336	5446	2644	1793	1447	968	727	742	533	440	364	275	250	295	150	159	128	78	50	109	49	56	55	49	37	38	19	12	18	12	2	6	68533	103

Cumulative Sums: Scuba

21 - 25	1262	3537	6362	7964	8888	9636	10116	10453	10756	10975	11171	11404	11564	11700	11805	11890	11942	12012	12058	12100	12133	12155	12169	12194	12199	12210	12225	12233	12246	12250	12252	12259	12262	12264	12264	12267		
26 - 30	1339	4133	8033	10193	11657	12776	13389	13803	14219	14493	14740	14998	15184	15347	15473	15564	15663	15784	15835	15878	15940	15969	15993	16036	16048	16072	16091	16099	16106	16116	16125	16128	16137	16137	16138	16141		
31 - 35	725	2627	4961	6533	7588	8412	8882	9238	9458	9598	9732	9849	9947	10018	10086	10144	10194	10228	10253	10281	10311	10330	10340	10376	10402	10423	10442	10469	10482	10506	10512	10512	10518	10525	10526	10526		
36 - 40	930	3720	6966	9431	10991	12227	12839	13241	13514	13692	13834	13968	14048	14113	14176	14216	14265	14328	14356	14402	14405	14413	14415	14420	14426	14426	14428	14434	14438	14438	14438	14440	14440	14441	14441	14441		
41 - 45	359	1319	2725	3876	4689	5210	5445	5600	5752	5824	5830	5830	5832	5836	5837	5837	5837	5843	5843	5843	5843	5843	5843	5843	5843	5843	5843	5843	5843	5843	5845	5845	5845	5845	5845	5845		
46 - 50	555	1621	3211	4638	5712	6446	6677	6806	6886	6963	6965	6965	6972	6973	6974	6974	6974	6975	6975	6975	6975	6975	6975	6975	6975	6975	6975	6975	6975	6975	6975	6975	6975	6977	6977	6977		
51 - 55	198	556	1125	1611	2057	2321	2324	2324	2327	2335	2335	2335	2335	2335	2335	2336	2336	2336	2336	2336	2336	2336	2336	2336	2336	2336	2336	2336	2336	2336	2336	2336	2336	2336	2336	2336		

Surface Supplied

B.T. ----> / Depth	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	100-110	111-120	121-130	131-140	141-150	151-160	161-170	171-180	181-190	191-200	201-210	211-220	221-230	231-240	241-250	251-260	261-270	271-280	281-290	291-300	301-310	311-320	321-330	331-340	341-350	351-360	Totals	# Beyo No-D Li
21 - 25	702	1191	1577	919	732	596	453	442	387	310	250	293	256	244	228	190	158	169	132	116	102	93	66	79	33	44	39	37	29	33	30	14	1	0	0	3	9948	
26 - 30	1003	1613	2112	1120	872	796	637	528	513	411	372	370	333	329	261	223	234	247	239	175	140	126	105	117	96	89	76	63	73	99	48	0	0	0	1	1	13422	
31 - 35	574	971	1358	877	680	624	540	444	461	322	371	351	298	250	224	204	203	222	157	185	92	127	82	102	79	76	80	51	65	75	51	0	0	1	0	5	10200	6
36 - 40	463	931	1032	648	486	410	343	346	271	250	233	193	165	158	131	137	133	173	196	148	3	2	0	2	0	0	0	0	2	0	0	0	0	0	0	0	6856	9
41 - 45	263	491	591	262	214	196	160	176	223	236	4	4	4	3	2	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2824	22
46 - 50	235	371	347	164	125	107	63	70	107	107	0	2	3	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1704	8
51 - 55	124	141	277	124	114	99	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	882	3
Totals	3364	5709	7294	4114	3223	2818	2197	2006	1963	1636	1231	1213	1057	984	846	758	728	814	724	624	337	348	253	301	208	209	195	151	169	207	129	14	1	1	1	9	45836	48

Cumulative Sums: Surface Supplied

21 - 25	702	1893	3470	4389	5121	5717	6170	6612	6999	7309	7559	7852	8108	8352	8580	8770	8928	9097	9229	9345	9447	9540	9606	9685	9718	9762	9801	9838	9867	9900	9930	9944	9945	9945	9945	9948		
26 - 30	1003	2616	4728	5848	6720	7516	8153	8681	9194	9605	9977	10347	10680	11009	11270	11493	11727	11974	12213	12388	12528	12654	12759	12876	12972	13061	13137	13200	13273	13372	13420	13420	13420	13420	13421	13422		
31 - 35	574	1545	2903	3780	4460	5084	5624	6068	6529	6851	7222	7573	7869	8119	8343	8547	8750	8972	9129	9314	9406	9533	9615	9717	9796	9872	9952	10003	10068	10143	10194	10194	10194	10195	10195	10200		
36 - 40	463	1394	2426	3074	3560	3970	4313	4659	4930	5180	5413	5606	5771	5929	6060	6197	6330	6503	6699	6847	6850	6852	6852	6854	6854	6854	6854	6854	6854	6856	6856	6856	6856	6856	6856	6856		
41 - 45	263	754	1345	1607	1821	2007	2167	2343	2566	2802	2806	2810	2814	2817	2819	2821	2821	2824	2824	2824	2824	2824	2824	2824	2824	2824	2824	2824	2824	2824	2824	2824	2824	2824	2824	2824		
46 - 50	235	606	953	1117	1242	1349	1412	1482	1589	1696	1696	1698	1701	1701	1701	1703	1703	1703	1703	1703	1703	1703	1703	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704	1704		
51 - 55	124	265	542	666	780	879	880	880	881	881	882	882	882	882	882	882	882	882	882	882	882	882	882	882	882	882	882	882	882	882	882	882	882	882	882	882		

Total

B.T. --> / Depth	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	100-110	111-120	121-130	131-140	141-150	151-160	161-170	171-180	181-190	191-200	201-210	211-220	221-230	231-240	241-250	251-260	261-270	271-280	281-290	291-300	301-310	311-320	321-330	331-340	341-350	351-360	Totals	# Beyo No-D Li
21 - 25	1964	3466	4402	2521	1656	1344	933	779	690	529	446	526	416	380	333	275	210	239	178	158	135	115	80	104	38	55	54	45	42	37	32	21	4	2	0	6	22215	
26 - 30	2342	4407	6012	3280	2336	1915	1250	942	929	685	619	628	519	492	387	314	333	368	290	218	202	155	129	160	108	113	95	71	80	109	57	3	9	0	2	4	29563	
31 - 35	1299	2873	3692	2449	1735	1448	1010	800	681	462	505	468	394	321	292	262	253	256	182	213	122	146	92	138	105	97	99	78	78	99	57	0	6	8	1	5	20726	20
36 - 40	1393	3721	4278	3113	2046	1646	955	748	544	428	375	327	245	223	194	177	182	236	224	194	6	10	2	7	6	0	2	6	6	0	0	2	0	1	0	0	21297	48
41 - 45	622	1451	1997	1413	1027	707	395	331	375	308	10	4	6	7	3	2	0	9	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	8669	43
46 - 50	790	1437	1937	1591	1199	841	294	199	187	184	2	2	10	1	1	2	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	8681	22
51 - 55	322	499	846	610	560	363	4	0	4	8	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3218	18
Totals	8732	17854	23164	14977	10559	8264	4841	3799	3410	2604	1958	1955	1590	1424	1210	1033	978	1109	874	783	465	426	303	410	257	265	250	200	206	245	148	26	19	13	3	15	114369	151

Cumulative Sums: Total

21 - 25	1964	5430	9832	12353	14009	15353	16286	17065	17755	18284	18730	19256	19672	20052	20385	20660	20870	21109	21287	21445	21580	21695	21775	21879	21917	21972	22026	22071	22113	22150	22182	22203	22207	22209	22209	22215		
26 - 30	2342	6749	12761	16041	18377	20292	21542	22484	23413	24098	24717	25345	25864	26356	26743	27057	27390	27758	28048	28266	28468	28623	28752	28912	29020	29133	29228	29299	29379	29488	29545	29548	29557	29557	29559	29563		
31 - 35	1299	4172	7864	10313	12048	13496	14506	15306	15987	16449	16954	17422	17816	18137	18429	18691	18944	19200	19382	19595	19717	19863	19955	20093	20198	20295	20394	20472	20550	20649	20706	20706	20712	20720	20721	20726		
36 - 40	1393	5114	9392	12505	14551	16197	17152	17900	18444	18872	19247	19574	19819	20042	20236	20413	20595	20831	21055	21249	21255	21265	21267	21274	21280	21280	21282	21288	21294	21294	21294	21296	21296	21297	21297	21297		
41 - 45	622	2073	4070	5483	6510	7217	7612	7943	8318	8626	8636	8640	8646	8653	8656	8658	8658	8667	8667	8667	8667	8667	8667	8667	8667	8667	8667	8667	8667	8669	8669	8669	8669	8669	8669	8669		
46 - 50	790	2227	4164	5755	6954	7795	8089	8288	8475	8659	8661	8663	8673	8674	8675	8677	8677	8678	8678	8678	8678	8678	8678	8679	8679	8679	8679	8679	8679	8679	8679	8679	8679	8681	8681	8681		
51 - 55	322	821	1667	2277	2837	3200	3204	3204	3208	3216	3217	3217	3217	3217	3217	3218	3218	3218	3218	3218	3218	3218	3218	3218	3218	3218	3218	3218	3218	3218	3218	3218	3218	3218	3218	3218		

Figure A2

Navy Dives

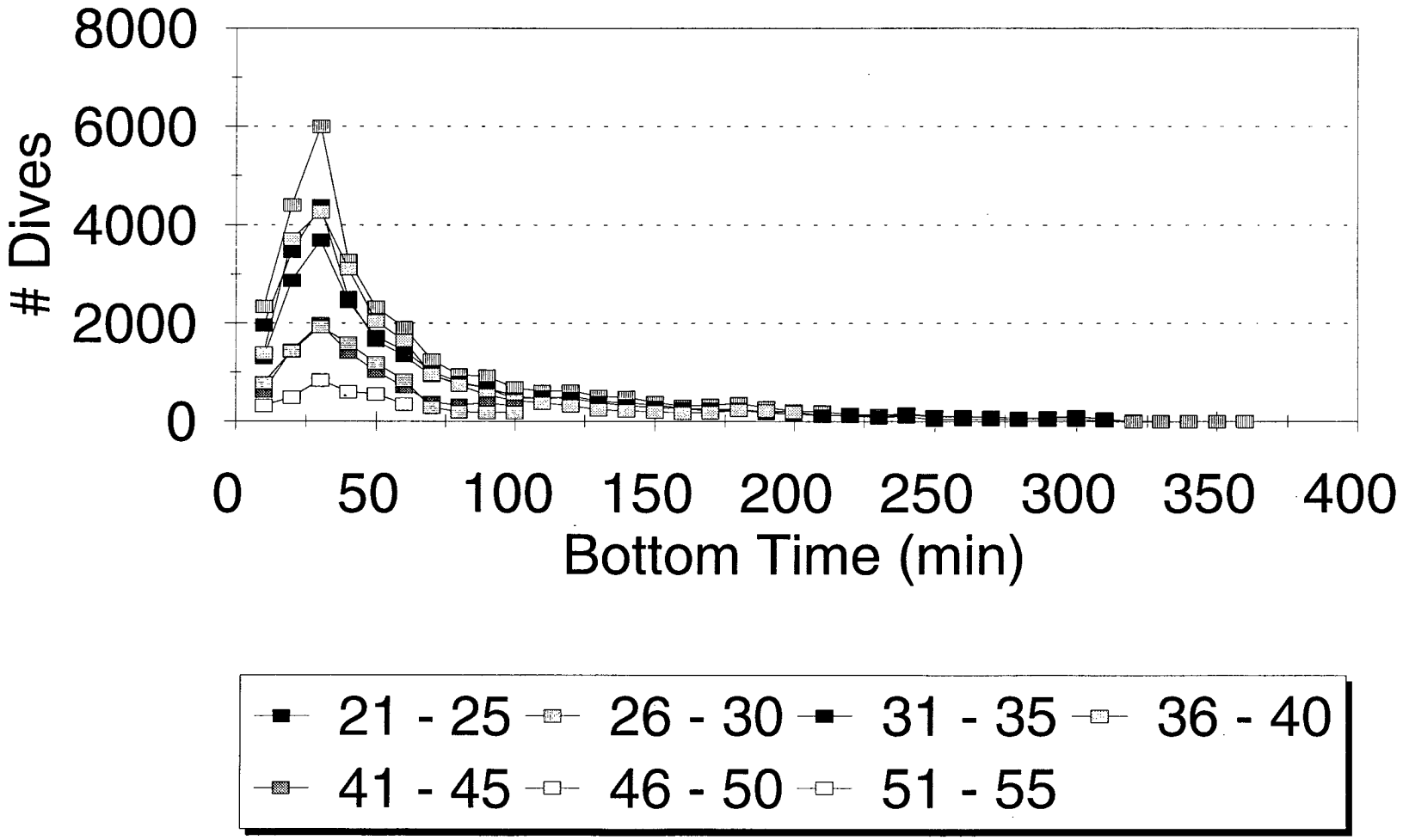


Table A3

Distribution of Dives by Depth and Bottom Time

Civilian Dives

Scuba

B.T. ---> Depth	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	100-110	111-120	121-130	131-140	141-150	151-160	161-170	171-180	181-190	191-200	201-210	211-220	221-230	231-240	241-250	251-260	261-270	271-280	281-290	291-300	301-310	311-320	321-330	331-340	341-350	351-360	Totals	# Beyo No-D Li
21 - 25	51	148	192	155	147	90	108	66	56	45	23	34	19	23	16	8	4	8	2	1	1	0	5	9	0	3	0	0	0	0	0	1	0	0	0	0	1213	
26 - 30	103	354	395	330	320	266	279	212	156	54	58	65	60	34	13	23	13	15	9	9	14	0	6	9	3	13	0	0	0	0	0	0	0	0	0	0	2813	
31 - 35	28	147	175	142	134	160	101	86	90	45	19	49	30	14	7	12	14	9	7	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2813	
36 - 40	64	224	345	345	271	198	187	133	102	62	48	37	43	33	23	4	9	5	6	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2153	0
41 - 45	27	115	128	106	108	80	58	40	28	41	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2153	0
46 - 50	14	91	151	167	197	192	200	174	211	203	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1608	8
51 - 55	10	64	48	45	62	76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	305	0
Totals	297	1143	1434	1290	1239	1062	933	711	643	450	156	185	153	104	59	45	40	37	24	31	15	0	11	18	3	16	0	0	0	0	0	1	0	0	0	0	10100	9

Cumulative Sums: Scuba

21 - 25	51	199	391	546	693	783	891	957	1013	1058	1081	1115	1134	1157	1173	1179	1183	1191	1193	1194	1195	1195	1200	1209	1209	1212	1212	1212	1212	1212	1212	1213	1213	1213	1213	1213		
26 - 30	103	457	852	1182	1502	1768	2047	2259	2415	2469	2527	2592	2652	2686	2699	2722	2735	2750	2759	2768	2782	2782	2788	2797	2800	2813	2813	2813	2813	2813	2813	2813	2813	2813	2813	2813		
31 - 35	28	175	350	492	626	786	887	973	1063	1108	1127	1176	1206	1220	1227	1239	1253	1262	1269	1276	1276	1276	1276	1276	1276	1276	1276	1276	1276	1276	1276	1276	1276	1276	1276	1276		
36 - 40	64	288	633	978	1249	1447	1634	1767	1869	1931	1979	2016	2059	2092	2115	2119	2128	2133	2139	2153	2153	2153	2153	2153	2153	2153	2153	2153	2153	2153	2153	2153	2153	2153	2153	2153		
41 - 45	27	142	270	376	484	564	622	662	690	731	731	731	732	732	732	732	732	732	732	732	732	732	732	732	732	732	732	732	732	732	732	732	732	732	732	732		
46 - 50	14	105	256	423	620	812	1012	1186	1397	1600	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608	1608		
51 - 55	10	74	122	167	229	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305		

Surface Supplied

B.T. ---> Depth	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	100-110	111-120	121-130	131-140	141-150	151-160	161-170	171-180	181-190	191-200	201-210	211-220	221-230	231-240	241-250	251-260	261-270	271-280	281-290	291-300	301-310	311-320	321-330	331-340	341-350	351-360	Totals	# Beyo No-D Li
21 - 25	88	219	341	330	261	228	190	170	184	144	97	95	86	68	45	32	20	28	28	12	9	9	2	3	13	1	4	3	2	0	5	2	0	0	0	0	2719	
26 - 30	207	891	1425	1221	995	680	641	429	359	255	180	185	130	93	67	63	44	34	29	29	14	10	6	7	3	6	5	5	0	2	4	3	0	0	0	0	8022	
31 - 35	83	380	577	638	476	397	400	274	271	206	182	185	170	128	136	99	110	132	102	64	26	9	14	9	6	13	3	2	3	7	7	0	0	0	0	0	5109	0
36 - 40	97	548	1080	1136	901	609	503	435	313	274	271	241	233	224	167	157	168	171	180	87	2	3	0	1	0	0	1	0	0	0	0	0	1	0	0	0	7804	9
41 - 45	58	171	232	196	174	123	101	83	101	84	7	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1335	12
46 - 50	26	158	312	368	336	241	212	185	201	164	3	1	0	2	0	3	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	2214	11
51 - 55	4	22	18	28	45	81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	198	0
Totals	563	2389	3985	3917	3188	2359	2047	1576	1429	1127	740	708	619	516	416	355	343	365	339	192	51	31	22	20	22	20	13	11	8	10	16	5	1	0	0	0	27401	32

Cumulative Sums: Surface Supplied

21 - 25	88	307	648	978	1239	1467	1657	1827	2011	2155	2252	2347	2433	2501	2546	2578	2598	2626	2654	2666	2675	2684	2686	2689	2702	2703	2707	2710	2712	2712	2717	2719	2719	2719	2719	2719		
26 - 30	207	1098	2523	3744	4739	5419	6060	6489	6848	7103	7283	7468	7598	7691	7758	7821	7865	7899	7928	7957	7971	7981	7987	7994	7997	8003	8008	8013	8013	8015	8019	8022	8022	8022	8022	8022		
31 - 35	83	463	1040	1678	2154	2551	2951	3225	3496	3702	3884	4069	4239	4367	4503	4602	4712	4844	4946	5010	5036	5045	5059	5068	5074	5087	5090	5092	5095	5102	5109	5109	5109	5109	5109	5109		
36 - 40	97	645	1725	2861	3762	4371	4874	5309	5622	5896	6167	6408	6641	6865	7032	7189	7357	7528	7708	7795	7797	7800	7800	7801	7801	7801	7802	7802	7803	7803	7803	7803	7804	7804	7804	7804		
41 - 45	58	229	461	657	831	954	1055	1138	1239	1323	1330	1331	1331	1332	1333	1334	1335	1335	1335	1335	1335	1335	1335	1335	1335	1335	1335	1335	1335	1335	1335	1335	1335	1335	1335	1335		
46 - 50	26	184	496	864	1200	1441	1653	1838	2039	2203	2206	2207	2207	2209	2209	2212	2212	2212	2212	2212	2212	2212	2212	2212	2212	2212	2212	2213	2213	2214	2214	2214	2214	2214	2214	2214		
51 - 55	4	26	44	72	117	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198	198		

Total

B.T. --> Depth	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	100-110	111-120	121-130	131-140	141-150	151-160	161-170	171-180	181-190	191-200	201-210	211-220	221-230	231-240	241-250	251-260	261-270	271-280	281-290	291-300	301-310	311-320	321-330	331-340	341-350	351-360	Totals	# Beyo No-D Li
21 - 25	139	367	533	485	408	318	298	236	240	189	120	129	105	91	61	38	24	36	30	13	10	9	7	12	13	4	4	3	2	0	5	3	0	0	0	0	3932	
26 - 30	310	1245	1820	1551	1315	946	920	641	515	309	238	250	190	127	80	86	57	49	38	38	28	10	12	16	6	19	5	5	0	2	4	3	0	0	0	0	10835	
31 - 35	111	527	752	780	610	557	501	360	361	251	201	234	200	142	143	111	124	141	109	71	26	9	14	9	6	13	3	2	3	7	7	0	0	0	0	0	6385	0
36 - 40	161	772	1425	1481	1172	807	690	568	415	336	319	278	276	257	190	161	177	176	186	101	2	3	0	1	0	0	1	0	1	0	0	0	1	0	0	0	9957	9
41 - 45	85	286	360	302	282	203	159	123	129	125	7	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2067	13
46 - 50	40	249	463	535	533	433	412	359	412	367	11	1	0	2	0	3	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	3822	19
51 - 55	14	86	66	73	107	157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	503	0
Totals	860	3532	5419	5207	4427	3421	2980	2287	2072	1577	896	893	772	620	475	400	383	402	363	223	66	31	33	38	25	36	13	11	6	10	16	6	1	0	0	0	37501	41

Cumulative Sums: Total

21 - 25	139	506	1039	1524	1932	2250	2548	2784	3024	3213	3333	3462	3567	3658	3719	3757	3781	3817	3847	3860	3870	3879	3886	3898	3911	3915	3919	3922	3924	3924	3929	3932	3932	3932	3932	3932		
26 - 30	310	1555	3375	4926	6241	7187	8107	8748	9263	9572	9810	10060	10250	10377	10457	10543	10600	10649	10687	10725	10753	10763	10775	10791	10797	10816	10821	10826	10826	10828	10832	10835	10835	10835	10835	10835		
31 - 35	111	638	1390	2170	2780	3337	3838	4198	4559	4810	5011	5245	5445	5587	5730	5841	5965	6106	6215	6286	6312	6321	6335	6344	6350	6363	6366	6368	6371	6378	6385	6385	6385	6385	6385	6385		
36 - 40	161	933	2358	3839	5011	5818	6508	7076	7491	7827	8146	8424	8700	8957	9147	9308	9485	9661	9847	9948	9950	9953	9953	9954	9954	9954	9955	9955	9956	9956	9956	9956	9957	9957	9957	9957		
41 - 45	85	371	731	1033	1315	1518	1677	1800	1929	2054	2061	2062	2063	2064	2065	2066	2067	2067	2067	2067	2067	2067	2067	2067	2067	2067	2067	2067	2067	2067	2067	2067	2067	2067	2067	2067		
46 - 50	40	289	752	1287	1820	2253	2665	3024	3436	3803	3814	3815	3815	3817	3817	3820	3820	3820	3820	3820	3820	3820	3820	3820	3820	3820	3820	3821	3821	3822	3822	3822	3822	3822	3822	3822		
51 - 55	14	100	166	239	346	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503	503		

Figure A3

Civilian Dives

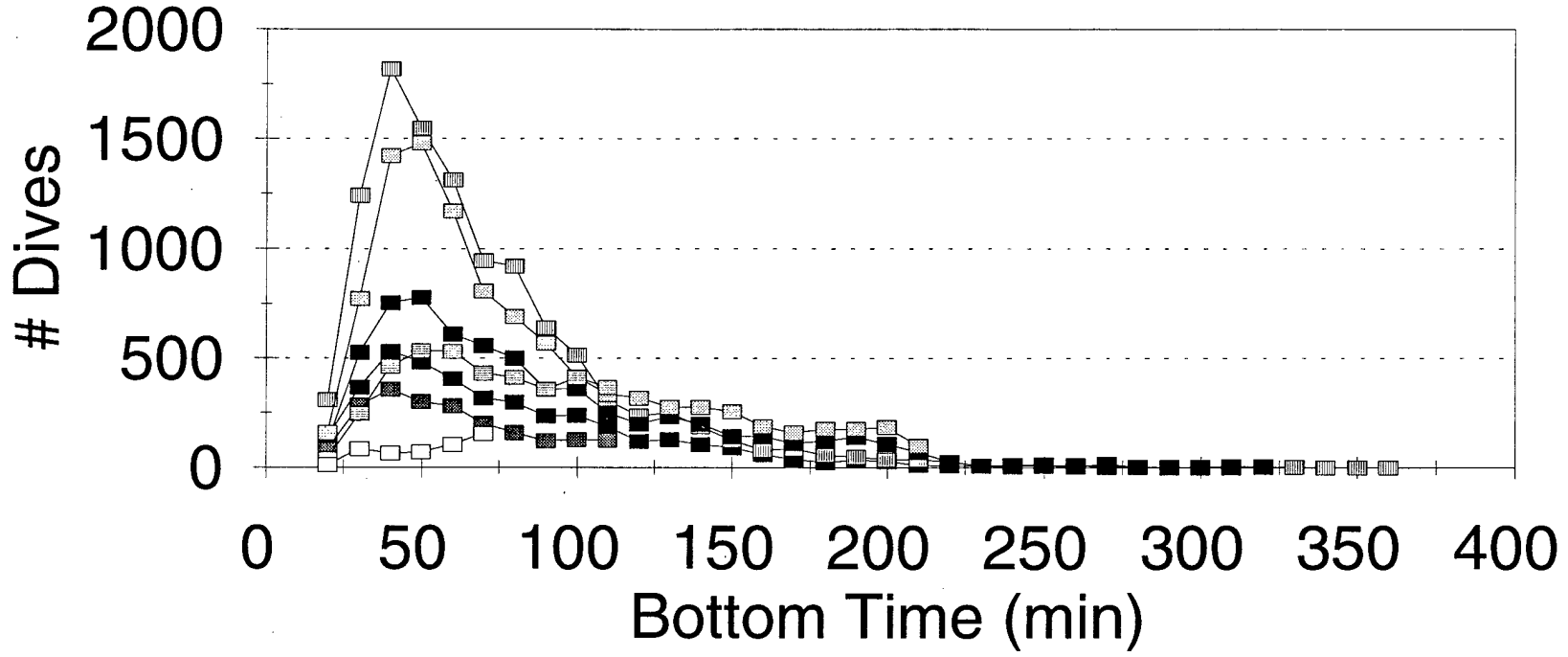


Table A4

Distribution of Dives by Depth and Bottom Time

Marine Dives

Scuba

B.T. ----> Depth	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	100-110	111-120	121-130	131-140	141-150	151-160	161-170	171-180	181-190	191-200	201-210	211-220	221-230	231-240	241-250	251-260	261-270	271-280	281-290	291-300	301-310	311-320	321-330	331-340	341-350	351-360	Totals	# Beyo No-D Li
21 - 25	76	189	359	247	220	155	55	22	28	2	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1356	
26 - 30	37	186	237	178	161	112	36	22	25	12	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1008	
31 - 35	12	125	108	107	74	46	5	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	482	0
36 - 40	17	79	168	130	55	66	5	6	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	527	0
41 - 45	8	20	58	43	40	27	7	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	205	1
46 - 50	2	32	74	91	57	10	0	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	271	0
51 - 55	0	13	58	38	19	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	146	0
Totals	152	644	1062	834	626	434	108	52	54	17	2	5	1	1	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3995	1

Cumulative Sums: Scuba

21 - 25	76	265	624	871	1091	1246	1301	1323	1351	1353	1353	1353	1353	1354	1354	1355	1356	1356	1356	1356	1356	1356	1356	1356	1356	1356	1356	1356	1356	1356	1356	1356	1356	1356	1356	1356	
26 - 30	37	223	460	638	799	911	947	969	994	1006	1007	1007	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	1008	
31 - 35	12	137	245	352	426	472	477	477	477	477	477	482	482	482	482	482	482	482	482	482	482	482	482	482	482	482	482	482	482	482	482	482	482	482	482	482		
36 - 40	17	96	264	394	449	515	520	526	526	526	526	526	526	526	526	527	527	527	527	527	527	527	527	527	527	527	527	527	527	527	527	527	527	527	527	527		
41 - 45	8	28	86	129	169	196	203	203	204	204	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205		
46 - 50	2	34	108	199	256	266	266	268	268	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271		
51 - 55	0	13	71	109	128	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146		

Surface Supplied

B.T. ----> Depth	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	100-110	111-120	121-130	131-140	141-150	151-160	161-170	171-180	181-190	191-200	201-210	211-220	221-230	231-240	241-250	251-260	261-270	271-280	281-290	291-300	301-310	311-320	321-330	331-340	341-350	351-360	Totals	# Beyo No-D Li
21 - 25	0	6	1	0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	
26 - 30	4	2	1	2	0	1	3	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	
31 - 35	1	4	2	0	4	0	5	4	2	5	7	3	4	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46	0
36 - 40	1	4	9	1	0	8	3	2	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	32	1
41 - 45	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1
46 - 50	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
51 - 55	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Totals	7	17	13	4	7	10	12	6	3	6	9	4	5	5	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	109	2

Cumulative Sums: Surface Supplied

21 - 25	0	6	7	7	9	10	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11		
26 - 30	4	6	7	9	9	10	13	13	14	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15		
31 - 35	1	5	7	7	11	11	16	20	22	27	34	37	41	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46		
36 - 40	1	5	14	15	15	23	26	28	28	28	29	30	31	31	31	31	31	31	31	31	31	31	31	32	32	32	32	32	32	32	32	32	32	32	32	32		
41 - 45	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		
46 - 50	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
51 - 55	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		

Total

B.T. --> Depth	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	100-110	111-120	121-130	131-140	141-150	151-160	161-170	171-180	181-190	191-200	201-210	211-220	221-230	231-240	241-250	251-260	261-270	271-280	281-290	291-300	301-310	311-320	321-330	331-340	341-350	351-360	Totals	# Beyo No-D Li
21 - 25	76	195	360	247	222	156	56	22	28	2	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1367	
26 - 30	41	188	238	180	161	113	39	22	26	13	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1023	
31 - 35	13	129	110	107	78	46	10	4	2	5	7	8	4	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	528	0
36 - 40	18	83	177	131	55	74	8	8	0	0	1	1	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	559	1
41 - 45	9	20	58	44	40	27	7	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	206	2
46 - 50	2	33	74	91	57	10	0	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	272	0
51 - 55	0	13	58	38	20	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	147	0
Totals	159	661	1075	838	633	444	120	58	57	23	11	9	6	6	0	2	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	4104	3

Cumulative Sums: Total

21 - 25	76	271	631	878	1100	1256	1312	1334	1362	1364	1364	1364	1364	1365	1365	1366	1367	1367	1367	1367	1367	1367	1367	1367	1367	1367	1367	1367	1367	1367	1367	1367	1367	1367	1367	1367	
26 - 30	41	229	467	647	808	921	960	982	1008	1021	1022	1022	1023	1023	1023	1023	1023	1023	1023	1023	1023	1023	1023	1023	1023	1023	1023	1023	1023	1023	1023	1023	1023	1023	1023	1023	
31 - 35	13	142	252	359	437	483	493	497	499	504	511	519	523	528	528	528	528	528	528	528	528	528	528	528	528	528	528	528	528	528	528	528	528	528	528	528		
36 - 40	18	101	278	409	464	538	546	554	554	554	555	556	557	557	557	558	558	558	558	558	558	558	558	559	559	559	559	559	559	559	559	559	559	559	559	559		
41 - 45	9	29	87	131	171	198	205	205	206	206	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208		
46 - 50	2	35	109	200	257	267	267	269	269	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272		
51 - 55	0	13	71	109	129	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147		

Figure A4

Marine Dives

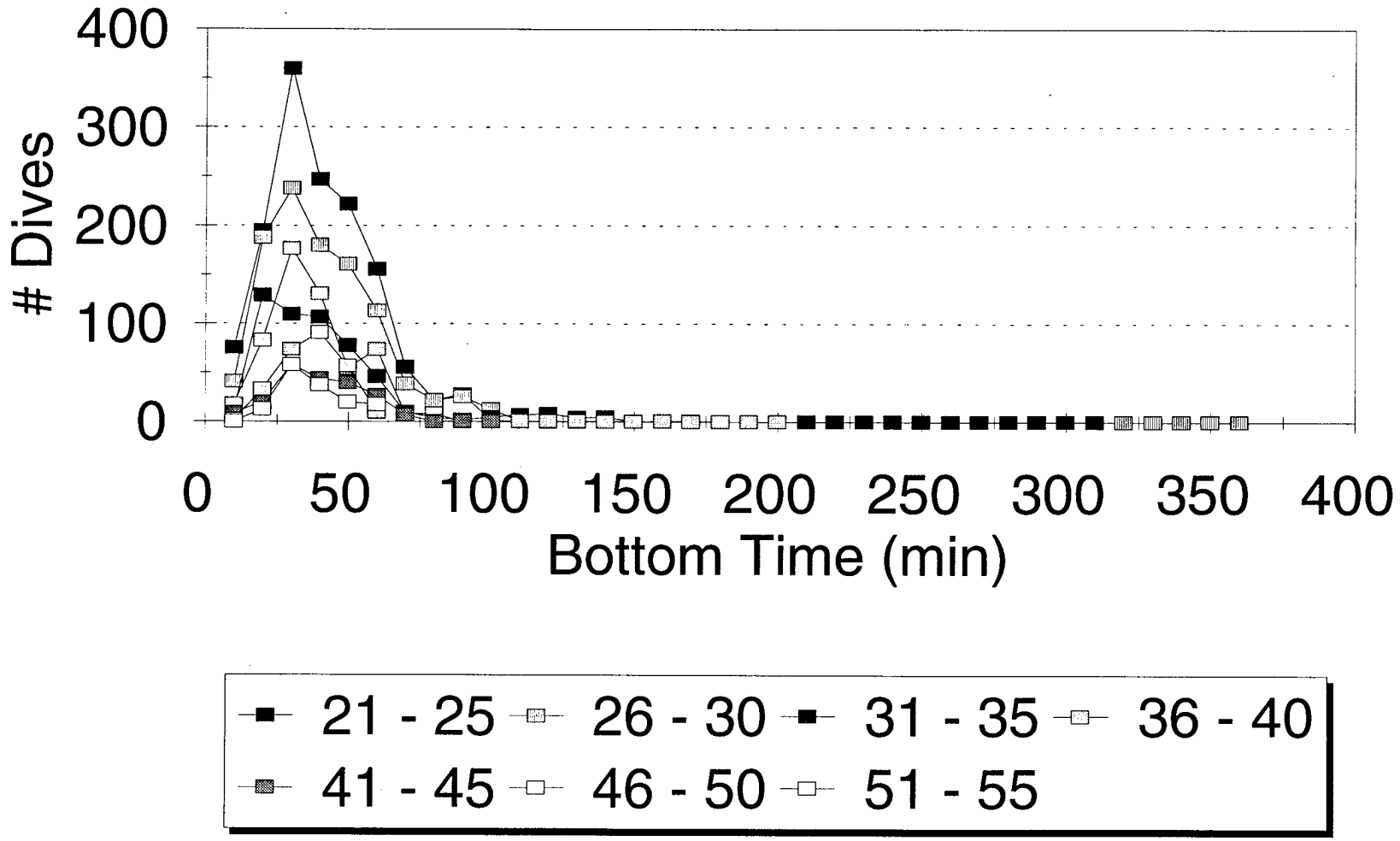


Table A5

Distribution of Dives by Depth and Bottom Time

Reserves Dives

Scuba

B.T. ---> / Depth	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	100-110	111-120	121-130	131-140	141-150	151-160	161-170	171-180	181-190	191-200	201-210	211-220	221-230	231-240	241-250	251-260	261-270	271-280	281-290	291-300	301-310	311-320	321-330	331-340	341-350	351-360	Totals	# Bey No-D
21 - 25	99	272	472	257	100	56	39	17	18	14	5	6	3	6	13	4	1	2	0	4	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	1392	
26 - 30	138	325	486	248	140	44	38	26	16	7	13	9	3	3	3	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1501	
31 - 35	50	155	223	150	76	52	13	9	9	2	3	1	1	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	747	0
36 - 40	61	259	416	240	127	63	35	21	12	5	7	2	1	5	2	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1260	0
41 - 45	25	97	126	100	64	15	4	12	9	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	459	0
46 - 50	20	77	168	128	59	30	13	9	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	505	0
51 - 55	10	31	61	44	17	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	181	0
Totals	403	1216	1952	1167	583	278	142	94	64	36	28	18	8	14	19	4	4	3	1	4	0	0	0	3	0	4	0	0	0	0	0	0	0	0	0	0	6045	0

Cumulative Sums: Scuba

21 - 25	99	371	843	1100	1200	1256	1295	1312	1330	1344	1349	1355	1358	1364	1377	1381	1382	1384	1384	1388	1388	1388	1388	1388	1388	1392	1392	1392	1392	1392	1392	1392	1392	1392	1392	1392
26 - 30	138	463	949	1197	1337	1381	1419	1445	1461	1468	1481	1490	1493	1496	1499	1499	1499	1499	1499	1499	1499	1499	1499	1501	1501	1501	1501	1501	1501	1501	1501	1501	1501	1501	1501	1501
31 - 35	50	205	428	578	654	706	719	728	737	739	742	743	744	744	745	745	745	745	748	746	746	746	746	747	747	747	747	747	747	747	747	747	747	747	747	747	747	747
36 - 40	61	320	736	976	1103	1166	1201	1222	1234	1239	1246	1248	1249	1254	1256	1256	1259	1260	1260	1260	1260	1260	1260	1260	1260	1260	1260	1260	1260	1260	1260	1260	1260	1260	1260	1260	1260	1260
41 - 45	25	122	248	348	412	427	431	443	452	459	459	459	459	459	459	459	459	459	459	459	459	459	459	459	459	459	459	459	459	459	459	459	459	459	459	459	459	459
46 - 50	20	97	265	393	452	482	495	504	504	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505
51 - 55	10	41	102	146	163	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181

Surface Supplied

B.T. ---> / Depth	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	100-110	111-120	121-130	131-140	141-150	151-160	161-170	171-180	181-190	191-200	201-210	211-220	221-230	231-240	241-250	251-260	261-270	271-280	281-290	291-300	301-310	311-320	321-330	331-340	341-350	351-360	Totals	# Bey No-D
21 - 25	31	84	162	47	13	13	15	9	3	2	3	2	3	1	1	1	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	393	
26 - 30	40	142	170	65	27	12	10	4	8	4	5	3	2	1	0	1	2	1	0	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	501	
31 - 35	13	80	106	17	18	6	4	0	1	1	0	3	2	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	255	0
36 - 40	18	72	56	15	10	5	3	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	183	0
41 - 45	6	27	22	8	1	1	1	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	70	0
46 - 50	18	18	13	7	2	3	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	63	0
51 - 55	6	16	17	4	8	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	53	0
Totals	132	439	546	163	79	42	34	15	16	9	8	5	7	2	2	4	2	3	1	1	2	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	1518	0

Cumulative Sums: Surface Supplied

21 - 25	31	115	277	324	337	350	365	374	377	379	382	384	387	388	389	390	390	391	391	391	392	392	392	392	392	392	393	393	393	393	393	393	393	393	393	393		
26 - 30	40	182	352	417	444	456	466	470	478	482	487	490	492	493	493	494	496	497	497	498	499	499	499	500	500	501	501	501	501	501	501	501	501	501	501	501		
31 - 35	13	93	199	216	234	240	244	244	245	246	246	249	251	251	252	253	253	254	255	255	255	255	255	255	255	255	255	255	255	255	255	255	255	255	255	255		
36 - 40	18	90	146	161	171	176	179	180	181	182	182	182	182	182	182	183	183	183	183	183	183	183	183	183	183	183	183	183	183	183	183	183	183	183	183	183		
41 - 45	6	33	55	63	64	65	66	67	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70		
46 - 50	18	36	49	56	58	61	62	62	62	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63		
51 - 55	6	22	39	43	51	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53		

Total

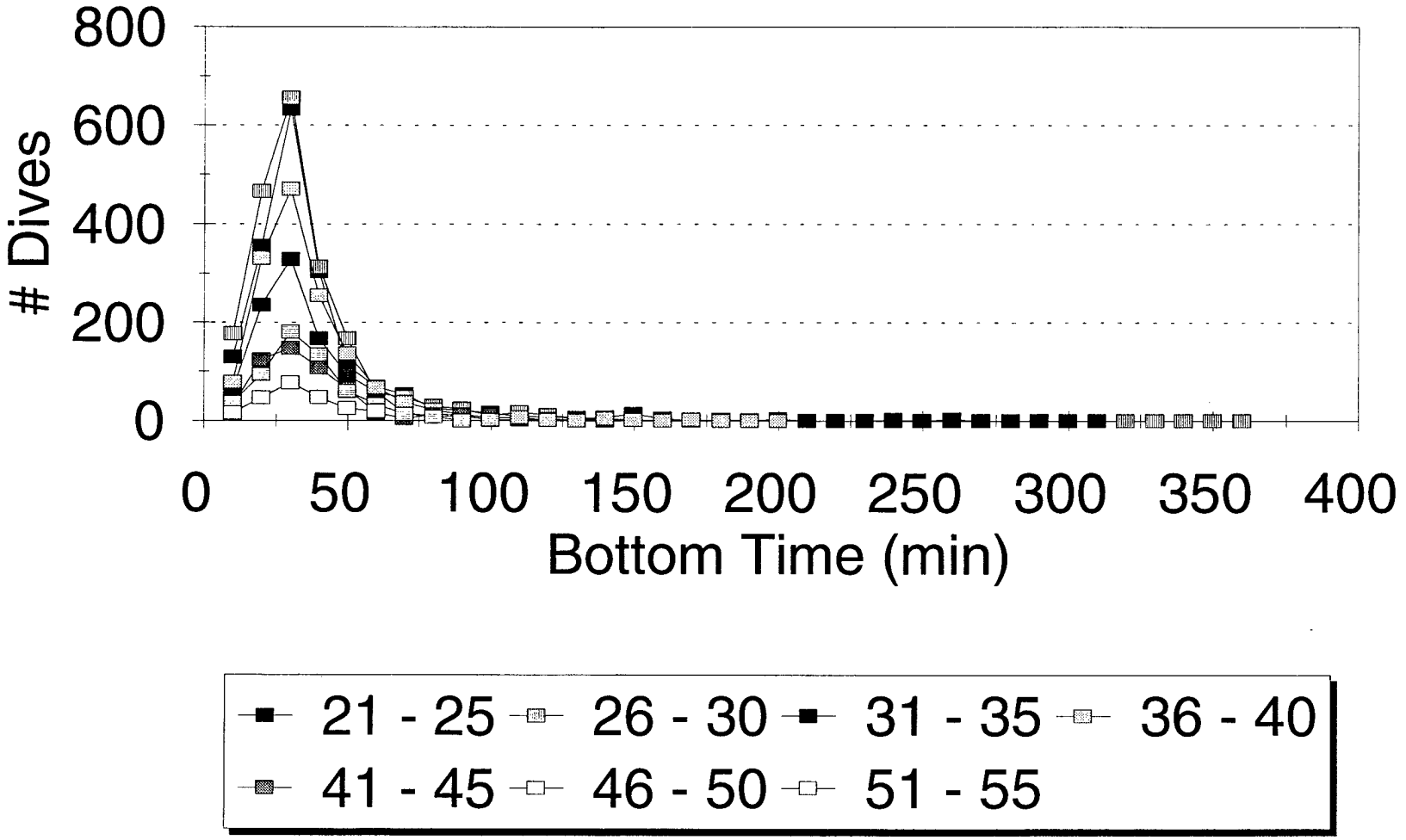
B.T. ---> / Depth	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	100-110	111-120	121-130	131-140	141-150	151-160	161-170	171-180	181-190	191-200	201-210	211-220	221-230	231-240	241-250	251-260	261-270	271-280	281-290	291-300	301-310	311-320	321-330	331-340	341-350	351-360	Totals	# Bey No-D
21 - 25	130	356	634	304	113	69	54	26	21	16	8	8	6	7	14	5	1	3	0	4	1	0	0	0	0	4	1	0	0	0	0	0	0	0	0	0	1785	
26 - 30	178	467	656	313	167	56	48	30	24	11	18	12	5	4	3	1	2	1	0	1	1	0	0	3	0	1	0	0	0	0	0	0	0	0	0	0	2002	
31 - 35	63	235	329	167	94	58	17	9	10	3	3	4	3	0	2	1	0	1	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1002	0
36 - 40	79	331	472	255	137	68	38	22	13	6	7	2	1	5	2	1	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1443	0
41 - 45	31	124	148	108	65	16	5	13	12	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	529	0
46 - 50	38	95	181	135	61	33	14	9	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	568	0
51 - 55	16	47	78	48	25	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	234	0
Totals	535	1655	2498	1330	662	320	176	109	80	45	36	26	15	16	21	8	6	6	2	5	2	0	0	4	0	5	1	0	0	0	0	0	0	0	0	0	7563	0

Cumulative Sums: Total

21 - 25	130	486	1120	1424	1537	1606	1660	1686	1707	1723	1731	1739	1745	1752	1766	1771	1772	1775	1775	1779	1780	1780	1780	1780	1780	1784	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785		
26 - 30	178	645	1301	1614	1781	1837	1885	1915	1939	1950	1968	1980	1985	1989	1992	1993	1995	1996	1996	1997	1998	1998	1998	2001	2001	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002		
31 - 35	63	298	627	794	888	946	963	972	982	985	988	992	995	995	997	998	998	999	1001	1001	1001	1001	1001	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002		
36 - 40	79	410	882	1137	1274	1342	1380	1402	1415	1421	1428	1430	1431	1436	1438	1439	1442	1443	1443	1443	1443	1443	1443	1443	1443	1443	1443	1443	1443	1443	1443	1443	1443	1443	1443	1443		
41 - 45	31	155	303	411	476	492	497	510	522	529	529	529	529	529	529	529	529	529	529	529	529	529	529	529	529	529	529	529	529	529	529	529	529	529	529	529		
46 - 50	38	133	314	449	510	543	557	566	566	568	568	568	568	568	568	568	568	568	568	568	568	568	568	568	568	568	568	568	568	568	568	568	568	568	568	568		
51 - 55	16	63	141	189	214	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234	234		

Figure A5

Reserves Dives



APPENDIX B

Part I. Summary of Cases

Code
Purpose of Dive
- SW = SPECWAR
- SH = Ship Husbandry
- TN = Training
- UC = Underwater Construction
- SR = Search
- SS = Security Swim
- EO = EOD
- SV = Salvage
- RQ = Requal
- IS = Inspection

Rig
- SO = Open circuit SCUBA
- SS = Surface-supplied

NMRI Diagnosis
Class
- 1 = Definitely Decompression Illness
- 2 = Definitely not Decompression Illness
- 3 = Uncertain if Decompression Illness or not

SubClass
- A = Decompression Sickness
- B = Arterial Gas Embolism
- C = Decompression Sickness or Arterial Gas Embolism
- N = Not applicable

Naval Safety Center Diagnosis (SAFE Dx)
- 1 = Type I Decompression Sickness
- 2 = Type II Decompression Sickness
- 3 = Arterial Gas Embolism

Service
- N = Navy
- M = Marine
- C = Civilian

Part II. Case Descriptions

Narratives exactly as received from NSC; "(*sic*)" used to denote obvious and/or distracting errors
Cases with bottom times longer than the USN93 limit are indicated with an asterisk.

Part I. Summary of Cases

Case #	Day	Month	Year	Purpose	Rig	Depth	Bottom Time	NMRI Diagnosis Class	NMRI Diagnosis Subclass	SAFE Dx	Service
1	3	2	90	SW	SO	50	52	3	N	2	N
2	3	2	90	SW	SO	50	52	3	N	2	N
3*	2	3	90	SW	SO	30	397	3	N	2	N
4*	16	3	90	SW	SO	30	397	1	A	2	N
5	21	3	90	TN	SS	52	13	1	A	2	N
6	18	4	90	TN	SO	45	46	1	A	1	M
7	9	6	90	UC	SS	52	46	1	A	1	N
8	7	8	90	SH	SO	40	74	1	A	2	C
9	29	8	90	SW	SO	29	135	1	A	2	N
10	23	10	90	SS	SO	36	30	3	N	2	N
11*	6	11	90	SH	SS	40	189	1	A	2	N
12	5	12	90	SH	SS	26	50	3	N	2	N
13	15	1	91	SR	SS	55	29	2	N	2	N
14	27	1	91	SH	SS	27	17	1	C	2	N
15	1	2	91	SH	SS	30	30	1	C	2	N
16	11	2	91	SH	SS	37	134	1	A	1	N
17	5	4	91	SH	SO	35	76	1	C	2	N
18	16	2	93	SH	SS	31	87	2	N	2	N
19	23	3	93	SH	SS	41	99	2	N	2	N
20	29	3	93	SH	SS	42	97	3	N	2	N
21*	21	7	93	SW	SO	33	278	1	A	1	N
22	9	8	93	SH	SS	25	140	3	N	2	N
23	16	3	94	RC	SO	30	45	1	A	2	N
24	21	4	94	SH	SS	22	91	3	N	2	N
25	27	5	94	SH	SS	38	91	1	C	2	C
26	12	7	94	SW	SO	28	265	2	N	2	N
27	8	8	94	SH	SO	45	15	3	N	2	N
28	8	8	94	SH	SS	36	113	1	A	2	N
29	17	8	94	SR	SO	27	73	3	N	2	N
30	29	1	90	TN	SO	22	29	1	C	3	N
31	14	2	90	SW	SO	40	121	1	C	3	N
32	24	4	90	TN	SO	24	40	1	A	3	N
33	21	5	90	SW	SO	36	50	2	N	3	N
34	21	5	90	SW	SO	36	50	3	N	3	N
35	19	7	90	SR	SS	26	61	1	C	3	N
36*	21	8	90	SH	SS	37	176	1	A	3	N
37	29	10	90	SH	SS	25	44	1	C	3	N
38	12	11	90	SV	SS	33	134	3	N	3	N
39*	9	1	91	SH	SS	34	191	3	N	3	N
40	4	4	91	SR	SO	40	3	2	N	3	N
41	30	5	91	SV	SO	35	52	1	C	3	N
42	30	5	91	SV	SO	35	52	3	N	3	N
43	11	6	91	EO	SO	50	40	1	A	2	N
44	16	7	91	SH	SS	26	25	1	C	3	N
45	1	8	91	TN	SS	29	22	3	N	3	N
46	5	9	91	SW	SO	29	74	1	C	3	N
47	7	10	91	SH	SS	35	115	3	N	3	N
48	6	11	91	EO	SO	45	23	1	B	3	N
49	16	2	93	IS	SO	47	57	1	C	3	C
50	25	2	93	SS	SO	40	20	1	B	3	N
51	16	3	93	RC	SO	42	20	1	B	3	N
52	21	3	93	SV	SS	52	58	1	C	3	N
53	27	7	93	SR	SO	22	25	2	N	3	N
54	31	8	93	SH	SS	28	37	1	B	3	N
55	13	10	93	SR	SS	35	43	1	A	3	N
56	18	11	93	IS	SO	23	44	1	A	3	N
57	28	1	94	EO	SO	37	20	3	N	3	N
58	23	2	94	EO	SO	40	20	1	B	3	N
59	25	3	92	SW	SO	25	40	1	A	3	N
60	30	8	92	SH	SS	21	63	1	A	2	N

Part II. Case Descriptions

Case 1
This 27 year old male spec war diver made a no "D" dive using SCUBA. The dive was on air to 50 fsw for :52. Upon surfacing the diver experienced extreme fatigue following submarine lock out. The diver was examined and no other deficit was found. He was compressed to 60 fsw and had complete relief :55 at depth. The diver was treated on a TT 6 with one extrnsion (*sic*) at 60 fsw. No meds were used, final diagnosis was DCS II, treated by DMO, 2 days loss of work and 28 days restricted from diving.
NMRI Diagnosis: Uncertain if decompression illness or not
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 2
This 25 year old male Spec War diver made a no "D" dive using SCUBA. The dive was on air to 50 fsw for :52. Upon surfacing the diver experienced extreme fatigue following submarine lock out. The diver was examined and no other deficit was found. He was compressed to 60 fsw and had complete relief :55 at depth. The diver was treated on a TT 6 with one extension at 60 fsw. No meds were used, final diagnosis was DCS II, treated by DMO, 2 days loss of work and 28 days restricted from diving.
NMRI Diagnosis: Uncertain if decompression illness or not
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 3*
This 40 year old male Spec War diver made an SDV dive using open circuit SCUBA. The dive was to 30 fsw for 6 hours and 37 mins. The dive was reported as a no "D" dive. According to standard air tables the dive was 40 for 480 exceptional exposure because the max time of the repetative (*sic*) group designator table was exceeded. After a restless night the diver reported to work in the morning. Physical discomfort was reported to the diving supervisor. A neurological exam was normal but neuropsych screening was borderline. The diver was compressed to 60 fsw and treated on a treatment table 6. No meds were used. No days loss of work, 4 days restricted from diving, final diag. DCS Type Type (*sic*) II by DMO. The other diver on this dive had DCS II and treated (*sic*).
NMRI Diagnosis: Uncertain if decompression illness or not
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 4*
This 41 year old male Spec War diver make (*sic*) an SDV dive using open circuit SCUBA. The dive was to 30 fsw for 6 hrs and 37 mins. The dive was reported as a no "D" dive. According to standard air tables the dive was 40 for 480 exceptional exposure because the max time of the repetitive group designator table was exceeded. The following morning the diver reported a restless evening and a physical discomfort to the Div Sup. A neuro revealed decreased light touch and pin prick sensation over right lateral thigh. The diver was compressed to 60 fsw and treated on a TT 6. No meds were used, no loss days from work, 4 days restricted from diving. Final diag. DCS II by DMO. The other diver on this dive had DCS II and treated (*sic*).
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness)
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 5
This 29 year old Navy male 1st class diving student made a training dive using Mark XII SSDS air. The dive was to 52 fsw for :13 min bottom time no "D". Forty five minutes after surfacing he reported pain in the left shoulder and elbow. A neuro also revealed nystagmus in the right eye. The diver was compressed to 60 fsw and treated on a TT 6 with 2 extensions at 60 fsw. Complete relief was noted at 8 mins. into 2nd O2 period at 60 fsw. Medications used: 1000 cc of normal saline. Two days loss of work and 14 days restricted from diving. Final diagnosis DCS Type 2 by MDV.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness)
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 6
This 20 year old male Marine Corps SCUBA student made an open water SCUBA training dive. The dive was to 45 fsw for :46 min no "D". Nine hours after surfacing the diver complained to the supervisor of pain in the left knee. A neuro was conducted and neurological deficit was found. The diver was compressed to 60 fsw and treated on a TT 6. Complete relief occurred during the 4th O2 period at 60 fsw. No drugs were used, no days loss from work and 28 days restricted from diving. Final diagnosis was DCS Type one by DMO.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness)
Naval Safety Center Diagnosis: Type I Decompression Sickness

Case 7
This 21 year old male 2nd class diver made an underwater coinst. ops dive in open water using MK XII, air, swimmers configuration. The depth was to 52 fsw for 46 min no "D". Approx. five minutes after surfacing the diver noted a dull pain behind right kneecap. A neuro was completed by a DMT with no other findings. The same pain waxed and waned over the next 50 minutes. The diver was compressed to 60 fsw, complete relief was obtained upon reaching treatment depth. Treated on a treatment table 5, no days loss of work, 5 days restricted from diving, no meds used, final diagnosis DCS I by DMO.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness)
Naval Safety Center Diagnosis: Type I Decompression Sickness

Case 8
This 26 year old male ship yard diver made a ships husbandry dive using open circuit SCUBA. The dive was to 40 fsw for 19 minutes no "D". The previous day this diver made a no "D" dive to 40 fsw for 74 minutes bottom time. During ascent of this dive he noticed pain in his right hip. This pain was not reported. The next dive he made the 40 fsw for :19 dive. He noticed the pain improved on the bottom of this dive. On ascent this pain increased. Upon surfacing he was taken to the DMO and compressed to 60 fsw and had complete relief upon reaching treatment depth. Due to the location of the pain he was treated on a TT 6 with one extension at 60 fsw. No meds were used, one day loss of work, 14 days restricted from diving, final diagnosis was DCS II by DMO.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness)
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 9
This 24 year old male SEAL made an SDV training dive with SDV air system and full face mask. The gas media was air. The dive was to 29 fsw for 2:15 no "D". :45 after surfacing the diver reported numbness to left nostril and left quadriceps. He was compressed to 60 fsw and had complete relif upon reaching treatment depth. No meds were used, no days loss of work, 14 days restricted from diving. Final diagnosis was Type 2 DCS by DMO. Suspect circulation impaired by tightness of equipment.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness)
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 10
This 24 years old male SCUBA diver made a security swim using open circuit SCUBA. The dive was to 36 fsw or (*sic*) :30 BT. Approx 3 hours after the dive this diver became dizzy, felt nauseated and had a painful left ear. A neuro was performed by a DMO and DCS Type II was diagnosed. The diver was transported to a recompression chamber and compressed to 60 fsw on O2. Complete relief was obtained during the 1st O2 period. He was treated on a TT 6, Meclizine was given, no days loss of work, 30 days restricted from diving.
NMRI Diagnosis: Uncertain if decompression illness of not
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 11*
This 23 year old 2nd class diver made a ships husbandry using MK 21 air. The dive was to 40 fsw for 180 minutes no "D". Approx one hour after surfacing the diver noticed pain and a slight numbness in his left forearm. The diver did not report these symptoms until five hours later. He was compressed to 60 fsw on O2 and had 1st relief on descent at 30 fsw. Complete relief was obtained 33 minutes into the treatment. A TT 6 was completed, no meds were used, no days loss of work and 14 days restricted from diving. Final diagnosis DCS Type II by DMO.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness)
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 12
This 19 year old 2nd class diver made a ships husbandry dive using MK 21 air. The dive was to 26 fsw for :50. No "D". Upon surfacing this diver reported that his foot was numb. A neuro was completed with no significant findings. He was transported to a chamber and treated on a TT 6. First relief was noted :13 into the treatment and complete relief at :29. No meds were used, no days loss of work and 21 days restricted from diving. Final diagnosis was DCS II by DMO. Phoncon to his master diver, who was TAD at the time of the dive and the treatment, reported that this diver was very cold and tired and wore an ill fitting wet suit. He feels that the DCS II diagnosis was highly unlikely due to the dive profile.
NMRI Diagnosis: Uncertain if decompression illness or not
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 13
This 33 year old Navy Saturation Diver made a search dive using MK 21. The dive was to 55 fsw for :29 BT no "D". Upon surfacing the diver noticed numbness and tingling in the top of his left foot. The diver also reported that his boot was too tight. MDV and DMT performed thorough neurological examination. No other findings were noted. DCS could not be ruled out so the diver was compressed to 60 fsw on O2. Partial relief of symptoms were noted after :03 at depth and complete relief was obtained after :14. No meds were used, no days loss of work and 14 days restricted from diving. Final diagnosis DCS Type II by MDV and DMT.
NMRI Diagnosis: Definitely not decompression illness
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 14
This 32 year old Navy HeO2 diving officer made a ships husbandry dive using MK-1 air. The dive was to 27 fsw for :17 BT. :67 after surfacing the diver complained of left arm tremors, numbness, and weakness. Deamethasone (*sic*) 10 MGM was given during medivac to the recompression chamber. He was compressed to 60 fsw on O2. First relief was obtained upon reaching depth and complete relief during the first O2 breathing period. He was treated on a TT six. Three days loss of work. 28 days reftricted (*sic*) from diving. Final diagnosis DCS II.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness or Arterial Gas Embolism)
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 15
This 28 year old Navy 1st class diver made a ships husbandry dive using MK-1 air. The dive was to 30 fsw for :30 no "D". Approx 15 min after surfacing the diver felt slight disorientation but did not report this until 40 mins later. A neuro exam revealed vestibular imbalance and lower extremity weakness. He was placed on O2 and transported to recompression chamber. Compression was to 60 fsw on O2. Complete relief was obtained 22 minutes into the treatment. A TT 6 was completed. No meds were used, one day loss of work and 7 days restricted from diving. Final diagnosis was DCS Type II by DMO.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness or Arterial Gas Embolism)
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 16
This 20 year old male 2nd class diver made a ships husbandry dive using ESDS AGA. The dive was to 37 fsw for 2:14 no "D". Approx. four hours after the dive the dive (*sic*) the diver complained of pain in the right thigh. No type two symptoms were noted. The diver was compressed to 60 fsw and had first relief eight minutes into the treatment. Complete relief was noted twenty one minutes later. A TT 6 was completed. No meds were used, no days loss of work, 7 days restricted from diving. Final diagnosis, DCS 1 by MDV.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness)
Naval Safety Center Diagnosis: Type I Decompression Sickness

Case 17
This 30 year old 1st class diver made a ships husbandry dive using open circuit SCUBA. The dive was to 35 fsw for 1:16. Thirty minutes after surfacing the diver complained that his left hand was not feeling as it should. A neuro exam showed numbness of the left thumb, index, and middle finger. He was compressed to 60 fsw on O2. First relief was noted upon reaching treatment depth and complete relief :09 into the treatment. A TT 6 was completed. No meds were used, no days loss of work and 14 days restricted from diving. Final diagnosis was DCS II by DMO.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness or Arterial Gas Embolism)
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 18
This 22 year old male 2nd class diver made a ships's (*sic*) husbandry dive using MK 21. The dive was to 31 fsw for 8M (*sic*) mins. Three weeks after dive this diver reported severe headaches, dizziness, and memory loss. Neuro exam conducted by DMO and MDV with no neuro deficit noted. Referred member to Naval Hospital for full neurological testing and decision made to treat member on htperbaric (*sic*) oxygen. Recompressed to 60 fsw with no relief noted during treatment. A TT6 was completed. No meds were used. 17 days loss of work and 17 days restricted from diving.
NMRI Diagnosis: Definitely not decompression illness
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 19
This 26 year old male first class diver made a MK-21 dive to 41 fsw for 99 mins while inspecting patches for leaks during salvage operations on a ship. 4 hrs 50 mins after surfacing diver complained of numbness to left great toe. Neuro exam conducted with no other symptoms noted. Diver recompressed to 60 fsw and treated on a TT-6 for DCS type II. Diver had complete relief 4 hrs 37 mins into the treatment. No meds were used. No days loss of work and 14 days restricted from diving.
NMRI Diagnosis: Definitely not decompression illness
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 20
This 21 year old male second class diver made a ship's (*sic*) husbandry dive using ESDS to a maximum depth of 42 fsw for 1 hr 37 mins. Approximately 10 hrs after surfacing diver reported radiating pain in his left leg and "something not being quite right". Neuro exam revealed numbness on the left leg from the knee to the toes and weakness in the lower extremity of the left leg. Diver recompressed to 60 fsw and treated on TT6 for DCS Type II. Complete relief noted 5 hrs 4 mins into treatment. No meds were used. 1 day loss of work and 28 days restricted from diving.
NMRI Diagnosis: Uncertain if decompression illness or not
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 21*
This 29 year old male SEAL Diver made a SCUBA hookah dive from a Dry Deck Shelter (DDS) to 33 fsw for 4 hrs 38 mins. During drain down at 20 fsw diver noticed pain in his lower back. Drain depth was increased to 30 fsw for duration with no change noticed by diver. Upon surfacing a neuro exam was conducted with no other symptoms noted. Diver was recompressed to 60 fsw and treated on TT5 for DCS type I. Diver had complete relief 1 min into the treatment. No meds were used. No days loss of work and 2 days restricted from diving.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness)
Naval Safety Center Diagnosis: Type I Decompression Sickness

Case 22
This 22 year old male second class diver made a dive to perform a shaft wrap using MK 21. His dive profile was 25 fsw for 2 hrs 20 mins. While removing his gear on the surface the diver noticed that his right foot seemed to drop and he had decreased sensation over the dorsum of the right foot. Neuro exam was conducted with no other neurological symptoms noted. Diver recommpressed (*sic*) to 60 fsw and treated on a TT-6 for DCS type II. Diver had some relief 25 mins into the treatment but remained unchanged during the rest of the treatment. 1000 ML of Ringers Lactate administered IV. One day loss of work and 21 days restricted from diving.
NMRI Diagnosis: Uncertain if decompression illness or not
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 23
This 22 year old male second class diver made a recreational dive using open circuit scuba to 30 fsw for 45 mins. 2 hours after surfacing diver noticed intermittent tingling radiating from his right shoulder to his hand. Diver noticed right arm feeling numb the following morning and reported symptoms. Neuro exam revealed marked weakness to right arm and numbness of right shoulder to hand. Diver recompreesed to 60 fsw and treated on TT 6 for DCS type II. No drugs were used. Diver had complete relief 3 hours and 14 mins into the treatment. 2 days loss of work and 30 days restructed (*sic*) from diving.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness)
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 24
This 38 year old male Master Diver made a ships husbandry dive using MK 21 to a depth of 22 fsw for 1 hr 31 mins. Diver surfaced with soreness in his right arm and feeling tired. Diver did not report these symptoms for two days. Neuro exam revealed right arm pain and soreness. Diver also was very fatigued. Diver recompressed to 60 fsw and treated on TT 6 for DCS Type II. No drugs were used. Diver had complete relief of symptoms 2 hrs 45 mins into the treatment. No days loss of work and 30 days restricted from diving.
NMRI Diagnosis: Uncertain if decompression illness or not
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 25
This 36 year old male civilian rigger diver made a ship's husbandry dive to 38 fsw for 1 hr 31 mins using MK 21. Upon surfacing the diver noticed the tip of his fifth digit on his left hand felt numb. Dive sup felt it may have been caused by a mechanical injury. After the diver had showered and warmed up he noticed the numbness had spread to his next finger. Diver transported to nearest chamber and recompressed to 60 fsw and treated on TT 6 for DCS Type II. No drugs were used. Diver had complete relief 23 mins into the treatment. No days loss of work and 14 days restricted from diving.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness or Arterial Gas Embolism)
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 26
This 23 year old male SEAL Diver made a SCUBA dive while conducting SDV diving operations. During the dive the diver reported that his wet suit was very tight and restrictive. Upon completion of his dive the diver noticed a patch of numbness on his left forearm. Neuro exam revealed no other symptoms. Diver was recompressed to 60 fsw and treated on TT 6 for possible DCS Type II. Diver had no relief of symptoms during the treatment. No days loss of work and 5 days restricted from diving.
NMRI Diagnosis: Definitely not decompression illness
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 27
This 24 year old male Navy SCUBA diver made a ship's husbandry dive to 45 fsw for 15 mins using open circuit SCUBA. Appox 1 and 1/2 hrs after surfacing diver complained of feeling "heavy" and tired. Diver was recompressed to 60 fsw and treated on TT 6 for DCS Type II. Diver had complete relief of symptoms 50 mins into the treatment. 4 Liters Ringer's Lactate IV was used. No days loss of work and 30 days restricted from diving.
NMRI Diagnosis: Uncertain if decompression illness or not
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 28
This 28 year old male First Class Diver made a ship's husbandry dive to 36 fsw for 1 hr 53 mins using MK -20. Approx 1 hr after surfacing diver developed a headache and fatigue. The next morning he reported his symptoms to the Diving Supervisor. Diver was recompressed to 60 fsw and treated on TT 6 for DCS type II. Diver had complete relief of symptoms 33 mins into the treatment. No drugs were used. No days loss of work ond 30 days restricted from diving.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness)
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 29
This 30 year old male USMC combat diver made a compass/navigation dive to 27 fsw for 1 hr 13 mins using open circuit SCUBA. Approx 30 mins after surfacing diver complained of tingling in his right forearm. Diver recompressed to 60 fsw and treated on TT6 for DCS type II. Diver had complete relief of symptoms 1 hr 54 mins into the treatment. No drugs were used. No days loss of work and 28 days restricted from diving.
NMRI Diagnosis: Uncertain if decompression illness or not
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 30
This 22 year old female student officer made a training dive using SCUBA. The dive was to 29 fsw for :29 min No D. Approx. upon surfacing she complained of a mild headache. A neuro was conducted by a DMO and no deficits were found. Oral motran (*sic*) was given at this time. Approx. one hour later she reported headache worsening, nauseous (*sic*), lightheaded and "not feeling right". A second neuro showed: pronounced weakness in left side of neck muscles, weakness in left extremities and degraded neural responses in left foot. Compressed to 165 fsw with 1st relief at 04: After leaving the surface. A TT 6A was completed with one extension at 60 fsw. An I.V. of Ringers Lactate was administered during treatment. The following AM left leg weakness was found on follow up neuro. A TT 6 was conducted with 1st relief at 1:29. A neuro on the following day still showed left leg weakness. A TT 6 was administered with complete relief at :28. Three days loss of work, 28 days restricted from diving, final diagnosis AGE.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness or Arterial Gas Embolism)
Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 31
This 20 year old male basic combat swimmer made an SDV training dive using SCUBA. The dive was to 40 fsw for 2 hrs and :01 min. Instructors observed him having difficulty maintaining depth control of the SDV. Upon surfacing the diver was unresponsive and aluggish (*sic*). The diving med tech on scene conducted a neuro and found upper extremity weakness. He was placed on surface 02 and transported to the chamber. He was recommpressed (*sic*) to 165 fsw where another neuro by a DMO showed upper extremity weakness, loss of coordination, proprioception and positive Babinski of right foot. Complete relief was obtained within :30 mins at 165 fsw. He was treated on a TT 6AM (*sic*), no meds were used, one day loss of work, 60 days restricted from diving, final diagnosis AGE.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness or Arterial Gas Embolism)
Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 32
This 20 year old male Navy diving student made a training dive using open circuit SCUBA. The dive was to 24 fsw for :40 mins no "D". He surfaced complaining of feeling light headed. A neurological exam revealed no deficits. Approx. :30 minutes later he complained of pain in the left elbow. A neurological exam again showed no neurological deficits and the diver returned to the dive station. Approx. :20 to :30 the diver complained of tingling in left hand and fingers. Again the neuro was normal. AGE could not be ruled out so the diver was compressed to 165 fsw and treated on a TT 6A. Relief was obtained at :05 mins at treatment depth. No meds were used, no days loss of work and 28 days restricted from diving. Final diagnosis was AGE by DMO.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness)
Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 33
This 24 year old male UDT diver made a SPEC WAR ops dive using open circuit SCUBA. The dive was to 36 fsw for 50 minutes no "D" two minutes after surfacing this divers buddy experienced nausea and vomiting. A rapid upward excursion of approximately 12 fsw occurred during submarine lock in lock outs. A diagnosis of AGE could not be ruled out on the other diver so both divers were compressed to 165 fsw. 6 minutes after reaching treatment depth the afflicted diver was asymptomatic and neuros were normal in both divers. The divers air was obtained from the submarine's hp flasks and contamination could not be ruled out. An air sample was never recovered due to a mix up of SCUBA bottle during the transport of divers. No drugs were used one day loss of work and 30 days restricted from diving. Final diagnosis AGE by DMO.
NMRI Diagnosis: Definitely not decompression illness
Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 34
This 21 year old UDT diver made a SPEC WAR ops dive using open circuit SCUBA. The dive was to 36 fsw for 50 minutes. Two minutes after surfacing this diver experienced nausea and vomiting. A rapid upward excursion of approximately 12 fsw occurred during submarine lock in lock out. A diagonosis of AGE could not be ruled out. This diver was compressd on to (*sic*) 165 fsw where he had complete relief after 6 minutes at treatment depth. A neuro was conducted at depth and was reported as normal. The divers (*sic*) air was obtained from the submarine's HP flasks and contamination could not be ruled out. An air sample was never recovered due to a mix up of SCUBA bottles during the transport of the divers. No drugs were used, one day loss of work, 30 days restricted from diving, final diagnosis AGE by DMO.
NMRI Diagnosis: Uncertain if decompression illness or not
Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 35
This 18 year old male 2nd class diver made a searching dive using MK XXI air. The dive was to 26 fsw for 61 min. no "D". The members head being too small for the liner the oral nasal mask did not make a proper seal. This caused the mask to free flow. From 21 fsw to the surface this happened 3 times. Approx. 20 minutes after surfacing the diver noticed that he was feeling unusually tired he did not report this. 45 mins later he was found asleep. Upon being awakened it was noted that he had poor balance. A neuro produced a poor Romberg and patient was deteriorating rapidly. Compression to 165 commenced and complete relief was obtained at 100 fsw. A TT, (*sic*) 6A was completed. No meds were used, 3 days loss of work, 30 days restricted from diving, final diagnosis was AGE by DMO.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness or Arterial Gas Embolism)
Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 36*
This 27 year old male 2nd class diver made a ships husbandry dive using ESDS air. The dive was to was to (*sic*) 37 fsw for 2 hours and 56 minutes no "D". Approx. one hour after surfacing the diver reported fullness around the neck, slight discomfort under sternum and tingling in left thoracic area. Initial neuro was normal. 25 minutes after the initial symptoms the diver reported pain in the left wrist. Another neuro revealed weakness in left leg. He was compressed to 60 fsw for treatment where the diver failed a Rhomberg Test. He was taken of (*sic*) O2 and compressed to 165 fsw (*sic*) All symptoms resolved at treatment depth. The Diver was treated on a TT 6A, and I.V. of Ringers Lactate was given. One days loss of work, 6 weeks restricted from diving, final diagnosis AGE by DMO.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness)
Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 37
This 23 year old 2nd class diver made a ships husbandry dive using MK 21 air. The dive was to 25 fsw for :44 min. no "D". Approx. 20 minutes after surfacing this diver experienced weakness, dizziness and fatigue. The dive was uneventful except he stated that his hat free floowed (*sic*) on two occasions during the dive. A neuro showed unsteady gait, Romberg Test was abnormal and a loss of feeling on portions of his back. A chest X-ray disclosed mediastinal emphysema. The diver was compressed to 60 fsw on O2 and had first relief after two minutes at 60 fsw with complete relief after the 2nd O2 period. A TT 6 was completed with one extension at 60 fsw. No meds were used, no days loss of work and 28 days restricted from diving. Final diagnosis possible AGE caused by improper fit of MK 21 diving helmet.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness or Arterial Gas Embolism)
Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 38
This 25 year old male 1st class diver made a salvage dive using MK 21 air. The dive was to 33 fsw for 2:14 no "D". During the last three minutes of the dive this diver reported sudden onset of nausea, vertigo and headache. He vomited three times on the bottom. After several vents the diver was surface (*sic*). During the up and over phase the diver had trouble holding the ladder. A neuro conducted by the MDV confirmed weakness in shoulder and elbow muscle groups on left side. He was transported on O2 to chamber. Compressed to 165 fsw with first relief at 2 minutes on the bottom. Relief of all symptoms at 29 minutes. A TT 6A was completed. No meds were used, no days loss of work, 28 days restricted from diving. Final diagnosis hypercapnia and AGE.
NMRI Diagnosis: Uncertain if decompression illness or not
Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 39*
This 28 year old male 1st class diver made a ships husbandry dive using ESDS (AGA) on air. The dive was to 34 fsw for 3:11 no "D". Approx 15 to 20 minutes after the dive this diver noticed a loss of hearing in his left ear. No other neurological deficits were noted. Diver was compressed to 165 fsw. EDU was notified of mishap and concurred with treatment. First relief was noted at 1:45 into the treatment at 60 fsw on O2. A TT 6A was completed with no extensions. The diver surfaced with substantial relief. No meds were used, one day loss of work and 30 days restricted from diving. Final diagnosis was AGE by DMO.
NMRI Diagnosis: Uncertain if decompression illness or not
Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 40
This 24 year old female diving officer made searching dive using open circuit SCUBA. The dive was to 40 fsw for 3 minutes. While at depth this diver reported vertigo. The dive was aborted. On the surface she complained of dizziness and severe headache. A neuro revealed neurological deficits heel to toe walk. The diver was compressed to 165 fsw. 1st relief was noted upon reaching treatment depth. Complete relief was noted 2 minutes into the 2nd O2 period at 60 fsw. (*sic*) and I.V. of normal saline and I.V. decadron was given. No days loss of work, 28 days restricted from diving, final diagnosis AGE by MDV.
NMRI Diagnosis: Definitely not decompression illness
Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 41
This 20 year old 2nd class diver made a salvage dive using open circuit SCUBA. The dive was to 35 fsw for :51 BT. This diver was not acting normal after the dive. A neuro was conducted. He could not pass the Romberg portion of the exam. 11 minutes after surfacing he was compressed to 165 fsw. :13 minutes into the treatment complete relief was obtained. A TT 6A was completed, no meds were used, one day loss of work and 28 days restricted from diving. Final diagnosis was AGE by DMO.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness or Arterial Gas Embolism)
Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 42
This 3M (*sic*) year old 2nd class diver made a salvage dive using open circuit SCUBA. The dive was to 35 fsw for :52 BT. Approx. eight minutes after surfacing this diver reported muscle tightness (mechanical injury) in the right arm. He was swinging a hammer at depth. A neuro was performed by a DMO. AGE could not be ruled out for his diving buddy showed neurological deficit in his neuro exam. This diver was compressed to 165 fsw 2 and one half hours after surfacing. A TT 6A was completed with full relief noted :10 into the treatment. No meds were used, one day loss of work and 28 days restricted from diving. Final diagnosis was AGE by DMO.
NMRI Diagnosis: Uncertain if decompression illness or not
Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 43
This 21 year old male Navy EOD assistant diver made an EOD dive using open circuit SCUBA. The dive was to 50 fsw for :40 BT no "D". This diver make (*sic*) 3 rapid ascents to the surface from 40 fsw to retrieve buoyant objects. He exceeded 60 fpm on ascent passing his own bubbles. Blood was in his face mask upon surfacing. Symptoms of numbness both hands and feet were noted five hours post dive but not reported until 15 hours after surfacing. He was compressed to 60 fsw on O2, 1st relief was obtained upon reaching treatment depth, complete relief at 1:00 into the treatment. TT 6 with 1 ext at 60 fsw was completed. No meds were used, one day loss of work and 28 days restricted from diving. Final diagnosis was DCS II by DMO. Note: reported as DCS II. The dive profile and type of symptoms strongly suggest AGE.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness)
Naval Safety Center Diagnosis: Type II Decompression Sickness

Case 44
This 37 year old male Navy Sat Diving Officer made a ships husbandry dive using MK 21 on air. The dive was to 30 fsw for :25. After the dive the Diving Supervisor, which was under instruction, performed a training neuro on this diver which revealed a neurological deficit. A lack of communication was aparent (*sic*). The deficit was thought to be manufactured by the diver for the training neuro. The nest (*sic*) day he was evaluated for the deficit. It consisted of personality changes. Lack of coordination and a positive Babinski sign. He was compressed to 60 fsw on O2. Complete relief was noted :19 into the treatment. An I.V. of NACL was used, 2 days loss of work, 35 days restricted from diving. Final diagnosis was AGE by DMO.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness or Arterial Gas Embolism)
Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 45
This 21 year old male Navy diving student made a training dive using Mark 21 on air. The dive was to 29 fsw for :22 BT. :08 after surfacing this diver complained of a headache. A neuro was normal. The diver stated that his headache was worsening. He was compressed to 165 fsw. He reported complete relief on descent at 18 fsw. No meds were used, no days loss of work and 28 days restricted from diving. Final diagnosis was AGE by DMO.
NMRI Diagnosis: Uncertain if decompression illness or not
Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 46

This 23 year old male SPECWAR Diver made a lock in lock out dive using open circuit SCUBA. The dive was to 29 fsw for 1:14. The diver used a lift bag to float an outboard engine to the surface. Upon surfacing he experienced dizziness. He made a descent for lock in. The neuro was normal except for dizziness. He was compressed to 165 fsw. First relief was noted :02 into the treatment at 60 fsw. Complete relief was noted :10 into the treatment. A TT 6A was completed. An I.V. of Ringers D5W was given. 3 days loss of work, 42 days restricted from diving. Final diagnosis was AGE by DMO.

NMRI Diagnosis: Definitely decompression illness (Decompression Sickness or Arterial Gas Embolism)

Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 47

This 23 year old male 2nd class diver made a ships husbandry dive using ESDS on air. The dive was to 35 fsw for 1:55. This diver (red) noted that he was not feeling well on the bottom and turned over his work to his dive buddy (yellow). Red divers (*sic*) condition did not improve. The supervisor recovered both divers. Once on the surface yellow diver reported the same feeling earlier but it cleared. Red diver on the surface complained of nausea and light-headedness. At the chamber a neuro showed short-term memory loss, difficulty in talking and nystagmus. He was compressed to 165 fsw. First relief was noted upon reaching treatment depth and complete relief at 2:14 into the treatment. A TT 6A was completed. No meds were used, no day loss of work and 30 day restricted from diving. Final diagnosis was AGE by DMO. Cranial nerve deficite (*sic*)

NMRI Diagnosis: Uncertain if decompression illness or not

Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 48

This 23 year old male EOD assistant made an EOD OP dive using open circuit SCUBA. The dive was to 45 fsw for :23 BT. While on the bottom this diver experienced a headache and surface (*sic*). On the surface he had extreme weakness and had difficulty remaining alert. He was examined by DMO and MDV. A diagnosis of AGE was made. He was transported to the chamber and compressed to 165 fsw. Complete relief was noted at 130 fsw on descent. At (*sic*) TT 6A was completed. No meds were used, no days loss of work and 42 days restricted from diving.

NMRI Diagnosis: Definitely decompression illness (Arterial Gas Embolism)

Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 49

This 40 year old male civilian diver made an inspection dive using open circuit SCUBA and a dry suit. The dive was to 47 fsw for 5M mins. 20 mins after surfacing this diver complained of dizziness and nausea. He was diagnosed as having shallow water AGE by DMO. Recompressed to 60 fsw. First relief occured (*sic*) 4 mins into the treatment followed by complete relief 5 hours and 36 mins into the treatment. A TT6 was completed. No meds were used. No days loss of work and 30 days restricted from diving.

NMRI Diagnosis: Definitely decompression illness (Decompression Sickness or Arterial Gas Embolism)

Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 50

This 23 year old male second class diver made a SSBN security swim using surface tended open circuit SCUBA. Diver's tending line snagged on rudder and as he attempted to unsnag himself he made an uncontrollable ascent (8 to 10 fsw) to the surface. Dive profile was 40 fsw for 20 mins. Approximately 3 mins after surfacing diver complained of numbness in lips and facial area. While transiting to the chamber diver reported numbness and loss of strength to left arm and shoulder, dizziness, and blurred vision. Seconds prior to entering chamber diver became unconsciousness (*sic*). Recompressed to 165 fsw and treated on TT6A for AGE. Complete relief noted 5 M mins into the treatment. 1000ML 2% sodium chloride IV used. Three days later this same diver reported feeling fatigued, headache, back pain and left elbow pain. Neuro exam conducted revealing pain in back of head, pain middle left side of back, poor coordination, tingling left hand, and slurred speech. Diver recompressed to 60 fsw on a TT6. Complete relief noted 40 mins into the treatment. No meds were used. No days loss of work and 2 days restricted from diving.

NMRI Diagnosis: Definitely decompression illness (Arterial Gas Embolism)

Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 51

This 38 year old male HeO2 diving officer was assisting during a recovery of a DSRV using open circuit SCUBA. His dive profile was 42 fsw for 20 mins. 3 mins after surfacing diver became unconscious and had a grand mal seizure. Seizure lasted approximately 1 min and diver regained consciousness about 15 mins later. Diver medivaced to chamber by helo. Neuro exam conducted with no neurological symptoms noted. Diver recompressed to 60 fsw on TT6 for AGE. Ringers lactated (*sic*) used during treatment. No days loss of work and 42 days restricted from diving.

NMRI Diagnosis: Definitely decompression illness (Arterial Gas Embolism)

Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 52
This 22 year old male second class diver was patching a wreck using MK 21. His dive profile was 52 fsw for 58 mins. 30 mins after surfacing diver complained of pain in his lower back and stated that he did not feel well. Neuroexam was conducted and a loss of hand to eye coordination and loss of balance was noted. He was recommpressed (*sic*) to 165 fsw on a TT6A for AGE. Neuro exam at 165 fsw noted short term memory loss, weakness in the left arm, and drooping facial muscles. Complete relief noted 23 mins into the treatment. No meds were used. Upon surfacing neuro exam revealed roving left eye. Diver recompressed to 60 fsw and treated on TT6. Complete relief noted 19 mins. into the treatment. No meds used. 1 day loss of work and 28 days restricted from diving.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness or Arterial Gas Embolism)
Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 53
This 21 year old male dive student was conducting underwater sonar operations using a hand held Dukane sonar while diving SCUBA. His dive profile was to 22 fsw for 25 mins. Upon handing the sonar to his dive partner he noticed tingling in his 1st and 2nd fingers on his right hand. Two minutes later he aborted the dive and reported his symptoms to the Diving Supervisor. Diver was transported to the chamber and examined by DMO where he was diagnosed as having fatigue/altered (*sic*) sensation to his right hand due to holding the sonar. DO elected to treat the diver for AGE due to neurological symptom being present. Attempted to recompress diver to 165 fsw but diver had problems clearing and descent was stopped at 71 fsw and diver brought back up to 60 fsw and treated on TT-6. Diver had complete relief of all symptoms at 39 fsw on descent. No meds were used. One day loss of work and 28 days restricted from diving.
NMRI Diagnosis: Definitely not decompression illness
Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 54
This 24 year old male first class diver made a dive to seal a cofferdam which had developed a leak using MK 20. As the diver was returning to the cofferdam, it blew out a two foot section of the rubber releasing a large air pocket which hit the diver forcing him to the surface. His dive profile was to 28 fsw for 37 mins. Upon surfacing the diver was semi-conscious. A neuro exam was conducted which revealed tingling and loss of sensation in the right upper extremity from the shoulder down phrough (*sic*) the hand and the left wrist down through the hand. The diver also complained of nausea. Diver was recompressed to 60 fsw and treated on a TT-6 for AGE. Diver had complete relief 22 mins into the treatment. 1000 ml Ringers Lactate and 10 mg Dexamethasone given IV. 1 day loss of work and 28 days restricted from diving.
NMRI Diagnosis: Definitely decompression illness (Arterial Gas Embolism)
Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 55
This 26 year old male first class diver made a bottom search dive using MK-20 to 35 fsw for 43 mins. 40 mins. after surfacing the diver complained of pain in his left elbow. A neuro exam was conducted and weakness of his left arm and shoulder were discovered as well. Diver was put on O2 and transported to nearest recompression chamber. Diver had complete relief of symptoms enroute to the chamber. Diver recompressed to 60 fsw and treated on TT 6 for AGE. No meds were used. 1 day loss of work and 28 days restricted from diving.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness)
Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 56
This 22 year old male second class diver made a dive to inspect a shaft system using SCUBA to a depth of 23 fsw for 44 mins. Approx 26 hours after surfacing diver complained of pain and weakness of left foot and tightness across right chest area. Diver recompressed to 60 fsw and treated on TT 6 for AGE. Diver had complete relief five minutes into the treatment. No meds were used. No days loss of work and 28 days restricted from diving.
NMRI Diagnosis: Definitely decompression illness (Decompression Sickness)
Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 57
This 26 year old male EOD diver made an open circuit SCUBA dive to 37 fsw for 20 mins using a drysuit. During the dive the diver experienced difficulty controlling the buoyancy of his drysuit. Approx 1 hr after the dive the diver complained of a dull pain in his neck apound (*sic*) the area of the spinal cord. A neuro exam was conducted with no other symptoms noted. Diver recompressed to 60 fsw and treated on a TT6 for AGE. No meds were used. No days loss of work and 42 days restricted from diving.
NMRI Diagnosis: Uncertain if decompression illness or not
Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 58
This 22 year old male EOD diver made an open circuit SCUBA dive to 40 fsw for 20 mins. During the dive the diver lost his weight belt and was unable to control his ascent to the surface. Upon surfacing the diver felt disorientated (*sic*). Neuro exam revealed weakness of right arm and leg. Diver recompressed to 60 fsw and treated on TT 6 for AGE. No drugs were used. Diver had complete relief 51 mins into the treatment. No days loss of work and 14 days restricted from diving.
NMRI Diagnosis: Definitely decompression illness (Arterial Gas Embolism)
Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 59

This 34 year old male Navy SPECWAR SOT tech made a SPECWAR dive using open circuit SCUBA. The dive was to 25 fsw for :40. Forty minutes after surfacing he complained of pain in the left hand. This may have been present during the dive and probably due to a grip maintained during the dive. The exam was normal and told to return if symptoms worsened. Later on that night he noticed paresthesia in the hand, a funny feeling in his left elbow, shoulder and lower back. He called in and was told to report ASAP. The exam this time was positive for neurological deficits. He was compressed to 165 fsw. First relief was noted :11 into the treatment and complete relief :16 later. A TT 6A with extensions at 60 and 30 fsw was completed. No meds were used, 2 days loss of work and 14 days restricted from diving. Final diagnosis was AGE by DMO.

NMRI Diagnosis: Definitely decompression illness (Decompression Sickness)

Naval Safety Center Diagnosis: Arterial Gas Embolism

Case 60

This 19 year old male second class Navy diver made a ships husbandry dive using Mark 20. The dive was to 21 fsw for one hour and three minutes, no "D". The next AM while working out at the gym this diver noticed slight numbness and tingling in his right hand. He stopped his exercise and returned to the dive locker. His symptoms exacerbated during transit including numbness and loss of strength in the lower right extremity and a decrease in peripheral vision. The neuro at the chamber revealed six significant deficits. He was compressed to 60 fsw on O2. First relief was noted 8 minutes in to the treatment and complete relief during the second O2 period. A treatment table 6 was completed. No meds were used, no days loss of work and 28 days restricted from diving. Finial (sic) diagnosis was DCS Type II by the DMO.

NMRI Diagnosis: Definitely decompression illness (Decompression Sickness)

Naval Safety Center Diagnosis: Type II Decompression Sickness