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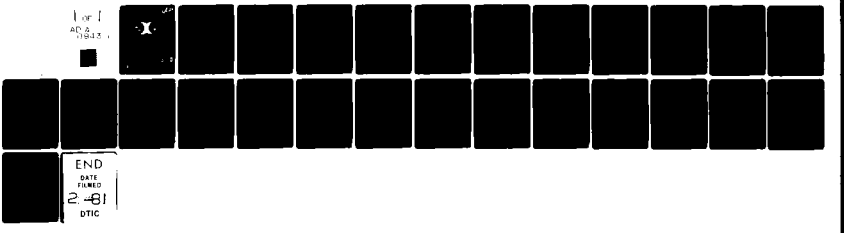

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U.S. NAVY AIR DECOMPRESSION SCHEDULE RISK ANALYSIS

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Commanding Officer

Naval Medical Research Institute

NAVAL MEDICAL RESEARCH AND DEVELOPMENT COMMAND

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The purpose of this report is to provide the diving community with an estimate of the risk associated with the use of the U.S. Navy's air decompression tables. A search of the diving data bank of the U.S. Navy Safety Center for the years 1971 to 1978 revealed 16,170 dives in which an air decompression schedule was used. These dives were sorted and tabulated by decompression schedule and decompression outcome. From these data, estimates of the incidence of decompression sickness associated with each schedule were derived. The overall --

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incidence rate for the air decompression schedules was 1.25%; the incidence rate for individual schedules having more than 50 dives ranged from 0% to 4.8%. Only 43 of the 295 U.S. Navy air decompression schedules were used 100 times or more during the past 7 years. Over one-half of the available schedules were not used at all during this 7-year period. Although the Navy's experience with individual air decompression schedules is restricted, there is little evidence that the same incidence rate would not hold for all schedules in the air decompression table.

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Naval Medical Research and Development Command, Work Unit No. M0099.PN.001.1190. The opinions and assertions contained herein are the private ones of the writers and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large.

The authors wish to express their appreciation to Doris N. Auer for her assistance in the preparation of this manuscript.

Introduction

Within the diving community sea stories have persisted for years concerning the risks associated with various decompression schedules. It has generally been accepted that the decompression schedule for the 160 foot-30 minute exposure produces a high incidence of decompression sickness. The current statistical support for this and other similar assertions is weak at best, and at the time they were originally proposed it was nonexistent.

The anecdotal information that is the basis for our concern with individual decompression schedules has served the purpose of focusing attention on decompression safety. It has made fleet personnel aware of the risk associated with decompression even when the U.S. Navy air decompression schedules are accurately followed. Rather than basing this safety education on anecdotal information, however, it would be better to have the actual statistics. Information based upon actual data is much more effective in persuading people to change their behavior.

The systematic collection and analysis of diving data did not start until the Navy Safety Center initiated its program in 1970. Even today, however, it is far from complete. Many shallow working dives are not recorded and the data on other dives is suspect due to high error rates in data recording. Despite these shortcomings the data at the Navy Safety Center is the best that is presently available. Although we know that not all of the fleet dives are recorded, it is less likely that the dives requiring decompression are omitted than it is for the more routine shallow "no-de" dives. Based upon this naive optimism the authors set out to construct a risk analysis table for the U.S. Navy

Air Decompression Schedules. The objective of the analysis was twofold: (1) determination of the risk of decompression sickness associated with each of the U.S. Navy's air decompression schedules, and (2) evaluation of the impact of exposure time and pressure on the incidence of decompression sickness.

Method

Data Description

The data for this analysis were obtained from the U.S. Navy Safety Center in Norfolk, Virginia. All of the air decompression dives conducted and recorded by the U.S. Navy during the period between 1 October 1971 and 30 November 1978 were used to calculate risk statistics. For each dive on a given depth/time schedule the following information was obtained:

Dive Log Item	Description
21-24	Decompression Schedule Depth
25-28	Decompression Schedule Time
42-45	Actual Dive Depth
46-52	Actual Bottom Time
54	Decompression Schedule Followed
56	Type of Work
70	Number of Dives
51-53	Bottom Water Temperature
27	Diving Dress
28	Supplemental Heat Used
54	Dive Outcome
65	Type of Accident

Proposed Analysis

Using the data shown on page 2, we intended to construct a risk analysis table similar to the following:

Decompression Schedule Used	Conservative Use		Designed Use		Overextended Use		Overall	
	RATE	%	RATE	%	RATE	%	RATE	%
160/30	0/400	0	1/300	.33	4/100	4.0	5/800	.625

The dives done on each of the 295 air decompression schedules were to be evaluated as to the appropriateness of the schedule used. A three-category classification was to be employed to differentiate the risk associated with conservative, designed, and overextended use of the schedules. Assignment of dives to a given category was to be based upon dive depth, bottom time, exercise level, water temperature, and the use of supplemental heat.

Actual Analysis

Because of the relatively small number of decompression dives done in the U.S. Navy and the high incidence of recording error, it became apparent that to subdivide the fleet dives into three categories would remove all hope of gleaning meaningful information from the analysis. Even restricting the statistics to a single overall incidence rate for each decompression schedule stretches the data very thin in several places. Despite these limits we have calculated the incidence of decompression sickness for each air decompression schedule. These statistics are the best possible given the data presently available. We have also attempted to evaluate the effects of exposure pressure and time on decompression risk by grouping data.

Results

The search of the Navy Safety Center diving data bank produced 16,167 dives in which air decompression schedules had been reported as being used. This number is for a period of approximately 7 years and amounts to 2,310 decompression dives per year or 9 per work day (calculation based upon 261 work days per year). The 16,170 decompressions have resulted in 202 cases of decompression sickness for an overall incidence rate of 1.25%. This means that the U.S. Navy can on average expect about one case of decompression sickness every 8 or 9 working days. Figure 1 shows the depth/time exposure combinations that are covered by the air decompression schedules. Also shown are schedules actually used by the fleet and the schedules for which there have been reported cases of decompression sickness. It is apparent that the fleet is only using a fraction of the air decompression schedules available to them. Generally they are using the ones for short duration exposures. The actual figures associated with each decompression schedule are shown in Table 1 (provided in the Appendix). If one concentrates on those exposure depths and times that have at least 100 dives or more (Table 2 in the Appendix), the relationships shown in Figs. 2 and 3 result. There appears to be very little difference ($p = .10$) among the decompression schedules for various exposure pressures (depths); the incidence of decompression sickness is roughly the same across all exposure pressures. The same does not appear to be true for the schedules for various exposure times ($p = .03$). Decompression schedules for longer exposures do not appear to be as adequate as those for short exposures.*

During the past 7 years, only 43 of the 295 air decompression schedules in the U.S. Navy Diving Manual have been used more than 100

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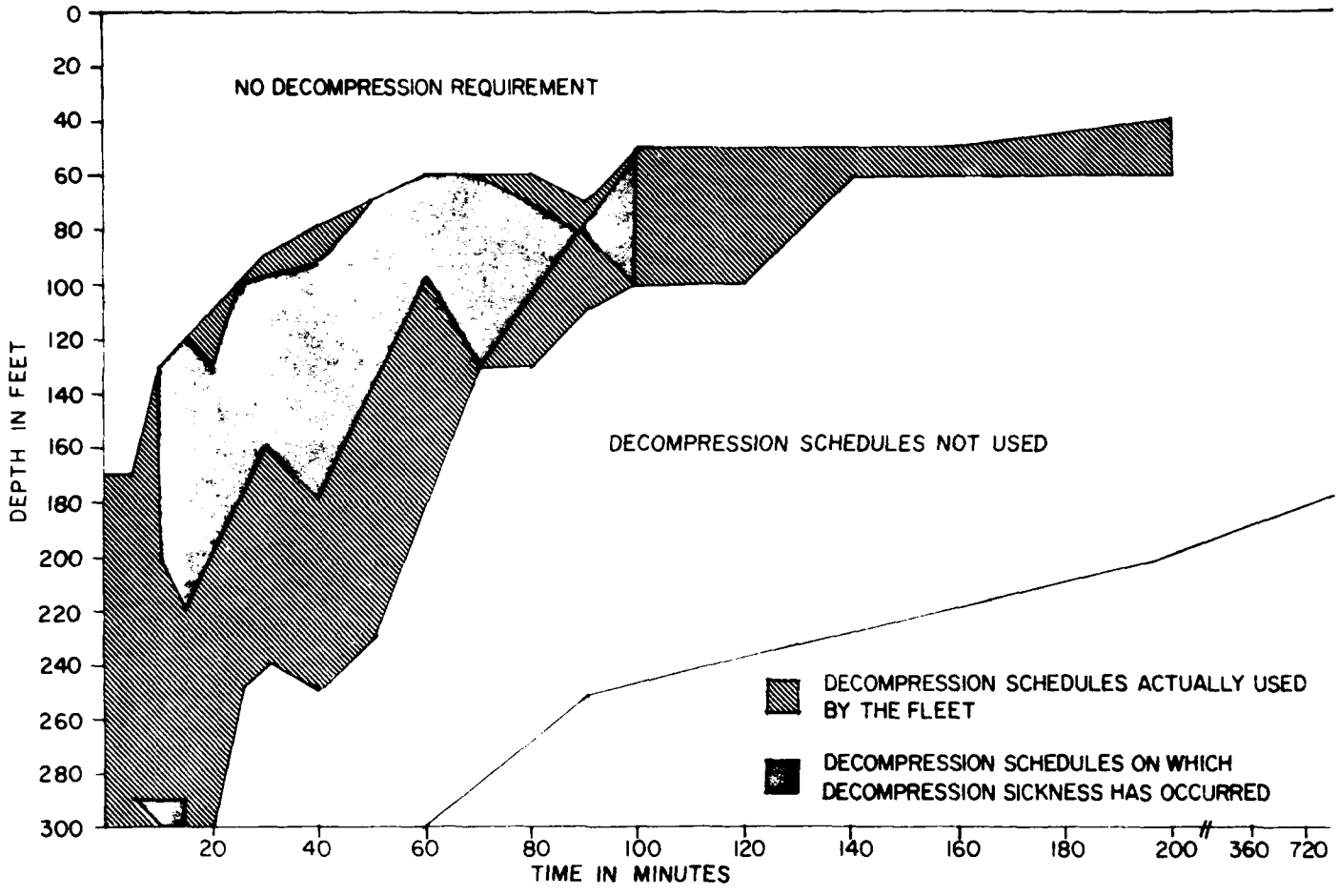
*Statistical significance of the correlation coefficients.



AIR DECOMPRESSION SCHEDULES AVAILABLE AND USED BY THE FLEET

Fig. 1. Hyperbaric air exposures (depth/time) protected by air decompression schedules; schedules actually used by the U.S. Navy during the past 7 years; and schedules which have produced cases of decompression sickness.

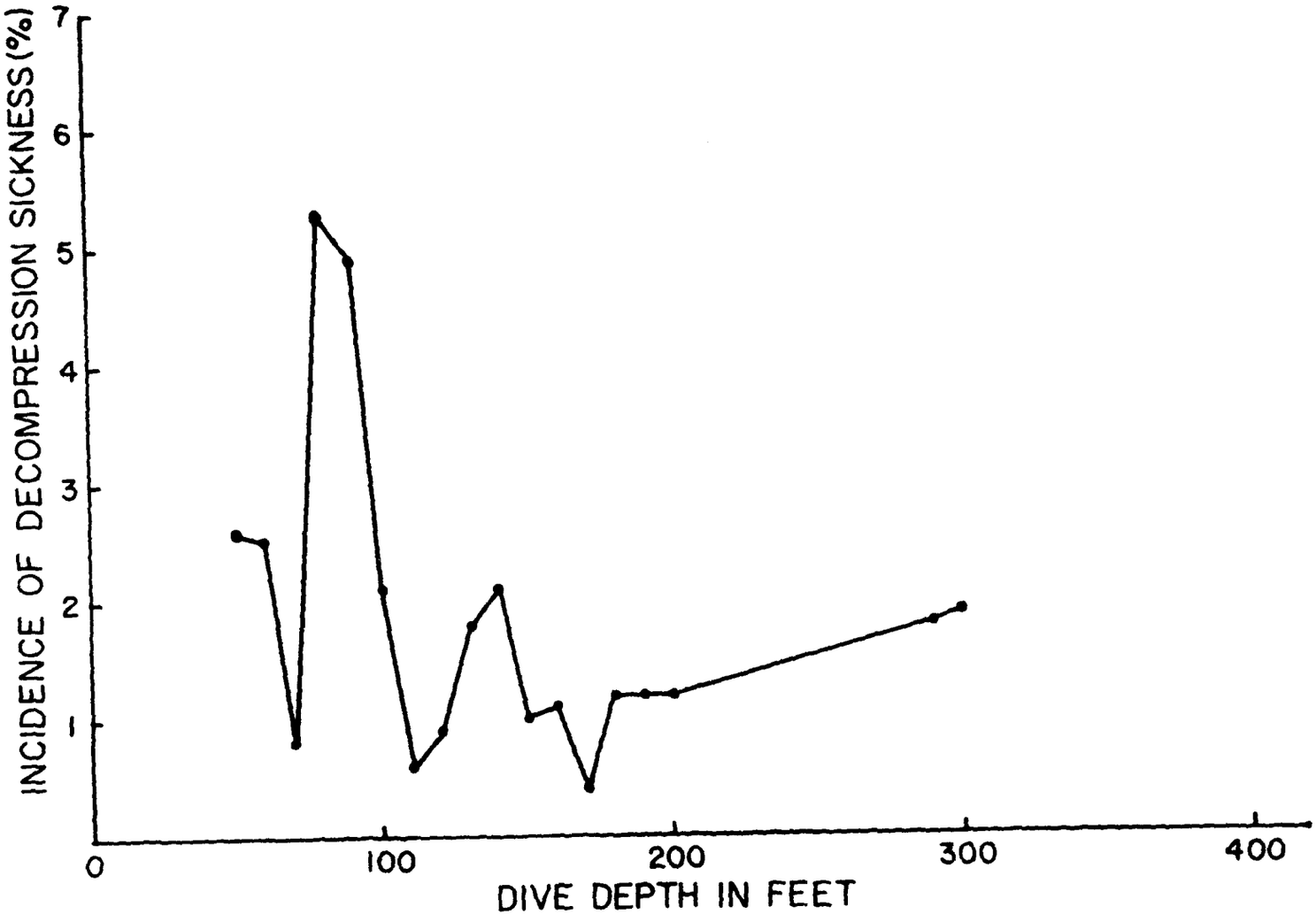


Fig. 2. The relationship between exposure pressure and the incidence of decompression sickness on the U.S. Navy air decompression schedules.

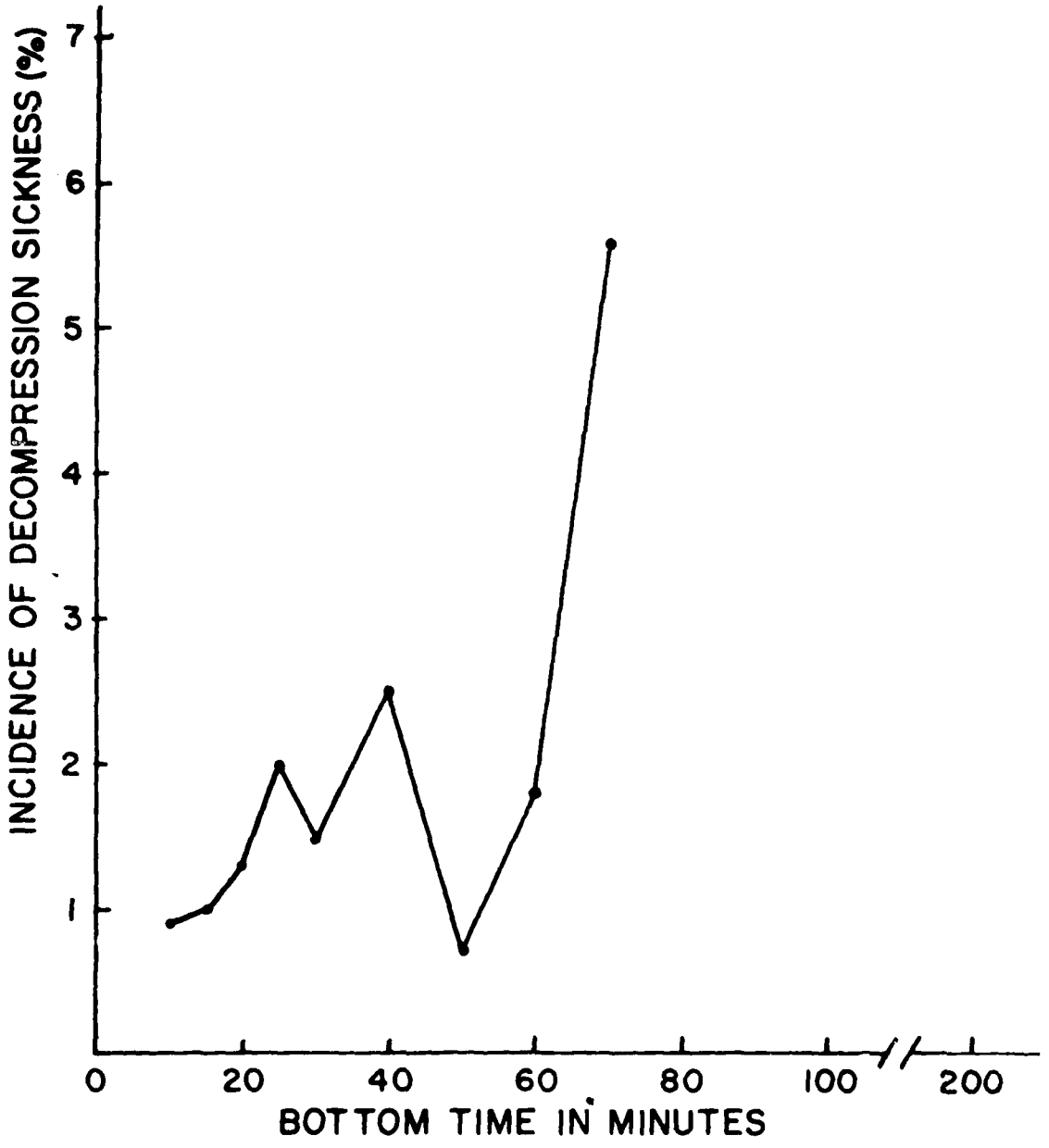


Fig. 3. The relationship between exposure time and the incidence of decompression sickness on the U.S. Navy air decompression schedules.

times (marked by asterisk in Table 1). The average incidence of decompression sickness on these 43 schedules is 1.1%, slightly less than the overall incidence. The highest incidence level (4.8%) is for the 100 ft for 60 min table. If we confine our analysis to these 43 decompression schedules and calculate our statistics based upon the total number of dives actually made on all of these schedules together, we obtain what is probably the best picture of the adequacy of the U.S. Navy's air decompression procedures.

Discussion

It is apparent that the majority of the U.S. Navy's experience with air decompression is for short duration exposures (Table 2). This type of exposure is generally adequate for the routine type of diving now being done. For a major salvage job or underwater construction project, however, long exposures will be needed. Results of this analysis suggest that we might have some difficulty with these longer exposures. The statistics are sketchy and the experience limited, but the trend toward a higher incidence of decompression sickness with longer exposures is there (Fig. 3).

Four air decompression schedules appear to be producing a statistically significant ($p \leq .05$) higher incidence of decompression sickness than what might be expected by chance. The four tables are:

Depth/Time	Incidence (%)	p
100/60	4.8	.001
130/20	3.9	.007
140/30	3.1	.038
150/15	3.4	.021

These schedules have been evaluated, but there does not appear to be anything unique about them. They all have substantial initial ascents to the first stop, but so do a lot of other schedules. There is a slight relationship between the number of dives done on a schedule and the

incidence of decompression sickness. Because the number of dives done on these four schedules is relatively low the significant results may be nothing more than a function of small sample size.

The results of this analysis leave one with two distinct impressions: 1) there are a very limited number of air decompression schedules that are actually being used with any regularity; and 2) the overall incidence of decompression sickness on the U.S. Navy's air decompression tables is very low. The only consistent trend that has been identified is the increase in "bends" incidence associated with exposure time. If this trend persists it might be worth exploring in more detail through the medical research program.

APPENDIX

Table 1. U.S. Navy Air Decompression Schedules and their Associated Risk

Table 2. Number of Dives at each Schedule Depth and Time

Table 1

U.S. Navy Air Decompression Schedules and their Associated Risk

Depth	Bottom Time (min)	Time to First Stop (min:sec)	Decompression Stops (feet)																				Total Ascent Time	Number of Dives in 7 Years	Cases of DCS in 7 years	DCS Rate per 1000 Dives
			200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10				
40	200	0:00																				0	0:40	13	0	-
	210	0:30																				2	2:40	0	0	-
	230	0:30																				7	7:40	2	0	-
	250	0:30																				11	11:40	3	1	333
	270	0:30																				15	15:40	0	0	-
	300	0:30																				19	19:40	0	0	-
	360	0:30																				23	23:40	0	0	-
	480	0:30																				41	41:40	0	0	-
	720	0:30																				69	69:40	0	0	-
50	100	0:00																				0	0:50	43	1	23
	110	0:40																				3	3:50	24	0	0
	120	0:40																				5	5:50	19	0	0
	140	0:40																				10	10:50	22	2	91
	160	0:40																				21	21:50	2	0	0
	180	0:40																				29	29:50	1	0	0
	200	0:40																				35	35:50	0	0	-
	220	0:40																				40	40:50	2	0	0
	240	0:40																				47	47:50	2	0	0
60	60	0:00																				0	1:00	183	2	11*
	70	0:50																				2	3:00	62	3	48
	80	0:50																				7	8:00	28	0	0
	100	0:50																				14	15:00	17	1	59
	120	0:50																				26	27:00	10	1	100
	140	0:50																				39	40:00	4	1	250
	160	0:50																				48	49:00	2	0	0
	180	0:50																				56	57:00	2	0	0
	200	0:40																			1	69	71:00	0	0	-

Table 1 cont'd

Depth (feet)	Bottom Time (min)	Time to First Stop (min:sec)	Decompression Stops (feet)																				Total Ascent Time	Number of Dives in 7 Years	Cases of DCS in 7 years	DCS Rate per 1000 Dives
			200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10				
60	240	0:40																			2	79	82:00	5	0	0
	360	0:40																			20	119	140:00	3	0	0
	480	0:40																			44	148	193:00	0	0	-
	720	0:40																			78	187	266:00	0	0	-
70	50	1:00																				0	1:10	33	1	30
	60	1:00																				8	9:10	26	0	0
	70	1:00																				14	15:10	26	0	0
	80	1:00																				18	19:10	5	0	0
	90	1:00																				23	24:10	8	0	0
	100	1:00																				33	34:10	0	0	0
	110	0:50																			2	41	44:10	21	0	0
	120	0:50																			4	47	52:10	4	0	0
	130	0:50																			6	52	59:10	0	0	-
	140	0:50																			8	56	65:10	0	0	-
	150	0:50																			9	61	71:10	0	0	-
	160	0:50																			13	72	86:10	0	0	-
	170	0:50																			19	79	99:10	0	0	-
80	40	0:00																				0	1:20	40	0	0
	50	1:10																				10	11:20	34	2	59
	60	1:10																				17	18:20	21	0	0
	70	1:10																				23	24:20	7	2	286
	80	1:00																			2	31	34:20	2	0	0
	90	1:00																			7	39	47:20	4	2	50
	100	1:00																			11	46	58:20	1	0	0
	110	1:00																			13	53	67:20	0	0	-
	120	1:00																			17	56	74:20	5	0	0
	130	1:00																			19	63	83:20	0	0	-

Table 1 cont'd

Depth (feet)	Bottom Time (min)	Time to First Stop (min:sec.)	Decompression Stops (feet) 200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	Total Ascent Time	Number of Dives in 7 Years	Cases of DCS in 7 Years	DCS Rate per 1000 Dives
60	140	1:00																			26	69	96:20	0	0	-
	150	1:00																			32	77	110:20	0	0	-
	180	1:00																			35	85	121:20	0	0	-
	240	0:50																		6	52	120	179:20	0	0	-
	360	0:50																		29	90	160	280:20	0	0	-
	480	0:50																		59	107	187	354:20	0	0	-
	720	0:40																	17	108	142	187	455:20	0	0	-
90	30	0:00																				0	1:30	18	1	56
	40	1:20																				7	8:30	27	2	74
	50	1:20																				18	19:30	41	2	49
	60	1:20																				25	26:30	28	1	36
	70	1:10																			7	30	38:30	8	0	0
	80	1:10																			13	40	54:30	0	0	-
	90	1:10																			18	48	67:30	0	0	-
	100	1:10																			21	54	76:30	0	0	-
	110	1:10																			24	61	86:30	0	0	-
	120	1:10																			32	68	101:30	0	0	-
	130	1:00																		5	36	74	116:30	0	0	-
100	25	0:00																				0	1:40	33	4	93
	30	1:30																				3	4:40	61	2	33
	40	1:30																				15	16:40	44	4	91
	50	1:30																			2	24	27:40	549	3	5*
	60	1:20																			9	28	38:40	104	5	48*
	70	1:20																			17	39	57:40	11	0	0
	80	1:20																			23	48	72:40	2	0	0
	90	1:10																		3	23	57	84:40	5	0	0
	100	1:10																		7	23	66	97:40	2	0	0

Table 1 cont'd

Depth (feet)	Bottom Time (min)	Time to First Stop (min:sec)	Decompression Stops (feet) 200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	Total Ascent Time	Number of Dives in 7 Years	Cases of DCS in 7 Years	DCS Rate per 1000 Dives
100	110	1:10																		10	34	72	117:40	17	0	0
	120	1:10																		12	41	78	132:40	5	0	0
	180	1:00																	1	29	53	118	202:40	0	0	-
	240	1:00																	14	42	66	142	283:40	0	0	-
	360	0:50																2	42	73	111	187	416:40	0	0	-
	480	0:50																21	61	91	142	187	503:40	0	0	-
	720	0:50																55	106	122	142	187	613:40	0	0	-
110	20	0:00																				0	1:50	209	0	0*
	25	1:40																				3	4:50	128	3	23*
	30	1:40																				7	8:50	455	4	9*
	40	1:30																			2	21	24:50	60	1	17
	50	1:30																			8	26	35:50	1198	5	4*
	60	1:30																			18	36	55:50	31	0	0
	70	1:20																		1	23	48	73:50	4	0	0
	80	1:20																		7	23	57	88:50	2	0	0
	90	1:20																		12	30	64	107:50	8	0	0
	100	1:20																		15	37	72	125:50	1	0	0
120	15	0:00																				0	2:00	156	2	13*
	20	1:50																				2	4:00	164	0	0*
	25	1:50																				6	8:00	198	3	15*
	30	1:50																				14	16:00	244	3	12*
	40	1:40																			5	25	32:00	111	1	9*
	50	1:40																			15	31	48:00	474	2	4*
	60	1:30																		2	22	45	71:00	11	0	0
	70	1:30																		9	23	55	89:00	1	0	0
	80	1:30																		15	27	63	107:00	2	0	0
	90	1:30																		19	37	74	132:00	0	0	-

Table 1 cont'd

Depth (feet)	Bottom Time (min)	Time to First Stop (min:sec)	Decompression Stops (feet)																				Total Ascent Time	Number Dives in 7 Years	Cases of DCS in 7 Years	DCS Rate per 1000 Dives
			200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10				
120	100	1:30																		23	45	80	150:00	1	1	1000
	120	1:20																	10	19	47	98	176:00	7	0	0
	180	1:10																5	27	37	76	137	284:00	3	0	0
	240	1:10																23	35	60	97	179	396:00	0	0	-
	360	1:00															18	45	64	93	142	187	551:00	0	0	-
	480	0:50														3	41	64	93	122	142	187	654:00	0	0	-
	720	0:50														32	74	100	114	122	142	187	773:00	0	0	-
130	10	0:00																				0	2:10	152	2	13*
	15	2:00																				1	3:10	227	1	4*
	20	2:00																				4	6:10	181	7	39*
	25	2:00																				10	12:10	156	0	0*
	30	1:50																			3	18	23:10	92	3	33
	40	1:50																			10	25	37:10	25	0	0
	50	1:40																		3	21	37	63:10	226	2	9*
	60	1:40																		9	23	52	86:10	6	0	0
	70	1:40																		16	24	61	103:10	5	4	800
	80	1:30																	3	19	35	72	131:10	3	0	0
	90	1:30																	8	19	45	80	154:10	0	0	-
140	10	0:00																				0	2:20	40	0	0
	15	2:10																				2	4:20	54	1	19
	20	2:10																				6	8:20	125	0	0*
	25	2:00																			2	14	18:20	47	2	43
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	50	1:50																		6	24	44	76:20	100	2	20*
	60	1:50																		16	23	56	97:20	15	0	0
	70	1:40																	4	19	32	68	125:20	0	0	-

Table 1 cont'd

Depth (feet)	Bottom Time (min)	Time to First Stop (min sec)	Decompression Stops (feet) 200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	Total Ascent Time	Number of Dives in 7 Years	Cases of DCS in 7 Years	DCS Rate per 1000 Dives
140	80	1:40																	10	23	41	79	155:20	0	0	-
	90	1:30																2	14	18	42	88	166:20	0	0	-
	120	1:30																12	14	36	56	120	240:20	0	0	-
	180	1:20															10	26	32	54	94	168	368:20	1	1	1000
	240	1:10														8	28	34	50	78	124	187	511:20	0	0	-
	360	1:00													9	32	42	64	84	122	142	187	684:20	0	0	-
	480	1:00													31	44	59	100	114	122	142	187	801:20	0	0	-
	720	0:50												16	56	88	97	100	114	122	142	187	924:20	0	0	-
150	5	0:00																				0	2:30	0	0	-
	10	2:20																				1	3:30	686	2	3*
	15	2:20																				3	5:30	147	5	34*
	20	2:10																			2	7	11:30	108	1	9*
	25	2:10																			4	17	23:30	55	2	36
	30	2:10																			8	24	34:30	178	2	11*
	40	2:00																		5	19	33	59:30	19	0	0
	50	2:00																		12	23	51	88:30	26	0	0
	60	1:50																	3	19	26	62	112:30	14	0	0
	70	1:50																	11	19	39	75	146:30	0	0	-
	80	1:40																1	17	19	50	84	173:30	0	0	-
160	5	0:00																				0	2:40	0	0	-
	10	2:30																				1	3:40	108	0	0*
	15	2:20																			1	4	7:40	71	0	0
	20	2:20																			3	11	16:40	92	4	43
	25	2:20																			7	20	29:40	56	1	18
	30	2:10																		2	11	25	40:40	270	3	11
	40	2:10																		7	23	39	71:40	184	1	5*
	50	2:00																	2	16	23	55	98:40	3	0	0

Table 1 cont'd

Depth (feet)	Bottom Time (min)	Time to First Stop (min:sec)	Decompression Stops (feet) 200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	Total Ascent Time	Number of Dives in 7 Years	Cases of DCS in 7 Years	DCS Rate per 1000 Dives
160	60	2:00																	9	19	33	69	132:40	3	0	0
	70	1:50																1	17	22	44	80	166:40	0	0	-
170	5	0:00																				0	2:50	22	0	0
	10	2:40																				2	4:50	854	4	5*
	15	2:30																			2	5	9:50	494	2	4*
	20	2:30																			4	15	21:50	142	0	0*
	25	2:20																		2	7	23	34:50	34	0	0
	30	2:20																		4	13	26	45:50	115	0	0*
	40	2:10																	1	10	23	45	81:50	60	1	17
	50	2:10																	5	18	23	61	109:50	2	0	0
	60	2:00																2	15	22	37	74	152:50	0	0	-
	70	2:00																8	17	19	51	86	183:50	1	0	0
	90	1:50															12	12	14	34	52	120	246:50	0	0	-
	120	1:30													2	10	12	18	32	42	82	156	356:50	4	0	0
	180	1:20												4	10	22	28	34	50	78	120	187	535:50	1	0	0
	240	1:20												18	24	30	42	50	70	116	142	187	681:50	0	0	-
	360	1:10											22	34	40	52	60	98	114	122	142	187	873:50	0	0	-
	480	1:00										14	40	42	56	91	97	100	114	122	142	187	1007:50	0	0	-
180	5	0:00																				0	3:00	2	0	0
	10	2:50																				3	6:00	104	0	0*
	15	2:40																			3	6	12:00	396	2	5*
	20	2:30																		1	5	17	26:00	397	6	15*
	25	2:30																		3	10	24	40:00	39	1	26
	30	2:30																		6	17	27	53:00	6	0	0
	40	2:20																	3	14	23	50	93:00	7	2	286
	50	2:10																2	9	19	30	65	128:00	1	0	0
	60	2:10																5	16	19	44	81	168:00	0	0	-

Table 1 cont'd

Depth (feet)	Bottom Time (min)	Time to First Stop (min:sec)	Decompression Stops (feet)																				Total Ascent Time	Number of Dives in 7 Years	Cases of DCS in 7 Years	DCS Rate per 1000 Dives
			200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10				
190	5	0:00																				0	3:10	11	0	0
	10	2:50																			1	3	7:10	473	5	11*
	15	2:50																			4	7	14:10	191	0	0*
	20	2:40																		2	6	20	31:10	34	1	29
	25	2:40																		5	11	25	44:10	35	0	0
	30	2:30																	1	8	19	32	63:10	0	0	-
	40	2:30																	8	14	23	55	103:10	9	0	0
	50	2:20																4	13	22	33	72	147:10	87	4	46
	60	2:20																10	17	19	50	84	183:10	6	0	0
200	5	3:10																				1	4:20	10	0	0
	10	3:00																			1	4	8:20	1458	13	9*
	15	2:50																		1	4	10	18:20	257	5	19*
	20	2:50																		3	7	27	40:20	111	3	27*
	25	2:50																		7	14	25	49:20	56	0	0
	30	2:40																	2	9	22	37	73:20	30	1	33
	40	2:30																2	8	17	23	59	112:20	6	1	167
	50	2:30																6	16	22	39	75	161:20	0	0	-
	60	2:20															2	13	17	24	51	89	199:20	0	0	-
	90	1:50												1	10	10	12	12	30	38	74	134	324:00	0	0	-
	120	1:40											6	10	10	10	24	28	40	64	98	180	473:20	3	0	0
	180	1:20									1	10	10	18	24	24	42	48	70	106	142	187	685:20	0	0	-
	240	1:20									6	20	24	24	36	42	54	68	114	122	142	187	842:20	0	0	-
	360	1:10								12	22	36	40	44	56	82	98	100	114	122	142	187	1058:20	0	0	-

Table 1 cont'd

Depth (feet)	Bottom Time (min)	Time to First Stop (min:sec)	Decompression Stops (feet)																				Total Ascent Time	Number of Dives in 7 Years	Cases of DCS in 7 Years	DCS Rate per 1000 Dives
			200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10				
210	5	3:20																				1	4:30	2	0	0
	10	3:10																			2	4	9:30	345	0	0*
	15	3:00																		1	5	13	22:30	95	0	0
	20	3:00																		4	10	23	40:30	73	0	0
	25	2:50																	2	7	17	27	56:30	5	0	0
	30	2:50																	4	9	24	41	81:30	2	0	0
	40	2:40																4	9	19	26	63	124:30	0	0	-
	50	2:30															1	5	17	19	45	80	174:30	0	0	-
220	5	3:30																				2	5:40	1	1	100
	10	3:20																			2	5	10:40	9	1	111
	15	3:10																		2	5	16	26:40	7	1	143
	20	3:00																	1	3	11	24	42:40	1	0	0
	25	3:00																	3	8	19	33	66:40	3	0	0
	30	2:50																1	7	10	23	47	91:40	0	0	-
	40	2:50																6	12	22	29	68	140:40	2	0	0
	50	2:40															3	12	17	18	51	86	190:40	0	0	-
230	5	3:40																				2	5:50	0	0	-
	10	3:20																		1	2	6	12:50	4	0	0
	15	3:20																		3	6	18	30:50	22	0	0
	20	3:10																	2	5	12	26	48:50	5	0	0
	25	3:10																	4	8	22	37	74:50	0	0	-
	30	3:00																2	8	12	23	51	99:50	5	0	0
	40	2:50															1	7	15	22	34	74	156:50	6	0	0
	50	2:50															5	14	16	24	51	89	202:50	4	0	0
240	5	3:50																				2	6:00	0	0	-
	10	3:30																		1	3	6	14:00	1	1	1000
	15	3:30																		4	6	21	35:00	7	0	0

Table 1 cont'd

Depth (feet)	Bottom Time (min)	Time to First Stop (min.sec)	Decompression Stops (feet)																				Total Ascent Time	Number of Dives in 7 Years	Cases of DCS in 7 Years	DCS Rate per 1000 Dives
			200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10				
																			3	6	15	25	53:00	0	0	-
240	20	3:20																1	4	9	24	40	82:00	0	0	-
	25	3:10																4	8	15	22	56	109:00	1	1	1000
	30	3:10															3	7	17	22	39	75	167:00	1	1	1000
	40	3:00														1	8	15	16	29	51	94	218:00	0	0	-
	50	2:50																			1	2	7:10	1	0	0
250	5	3:50																		1	4	7	16:10	6	0	0
	10	3:40																	1	4	7	22	38:10	0	0	-
	15	3:30																	4	7	17	27	59:10	6	0	0
	20	3:30																2	7	10	24	45	92:10	2	1	500
	25	3:20																6	7	17	23	59	116:10	0	0	-
	30	3:20															5	9	17	19	45	79	178:10	4	0	0
	40	3:10												4	10	10	10	12	22	36	64	126	298:10	0	0	-
	60	2:40									8	10	10	10	10	10	28	28	44	68	98	186	514:10	0	0	-
	90	2:10							5	10	10	10	10	16	24	24	36	48	64	94	142	187	684:00	0	0	-
	120	1:50					4	8	8	10	22	24	24	32	42	44	60	84	114	122	142	187	931:00	0	0	-
	180	1:30					9	14	21	22	22	40	40	42	56	76	98	100	114	122	142	187	1109:00	0	0	-
	240	1:30																			1	2	7:20	0	0	-
260	5	4:00																		2	4	9	19:20	0	0	-
	10	3:50																	2	4	10	22	42:20	2	0	0
	15	3:40																1	4	7	20	31	67:20	0	0	-
	20	3:30																3	8	11	23	50	99:20	0	0	-
	25	3:30															2	6	8	19	26	61	126:20	0	0	-
	30	3:20														1	6	11	16	19	49	84	190:20	0	0	-
	40	3:10																			1	3	8:30	0	0	-
270	5	4:10																		2	5	11	22:30	2	0	0
	10	4:00																	3	4	11	24	46:30	0	0	-
	15	3:50																2	3	9	21	35	74:30	0	0	-
	20	3:40																								

Table I cont'd

Depth (feet)	Bottom Time (min)	Time to First Stop (min:sec)	Decompression Stops (feet)																				Total Ascent Time	Number of Dives in 7 Years	Cases of DCS in 7 Years	DCS Rate per 1000 Dives
			200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10				
270	25	3:30															2	3	8	13	23	53	106:30	0	0	-
	30	3:30															3	6	12	22	27	64	138:30	0	0	-
	40	3:20														5	6	11	17	22	51	88	204:30	0	0	-
280	5	4:20																			2	2	8:40	0	0	-
	10	4:00																	1	2	5	13	25:40	14	0	0
	15	3:50																1	3	4	11	26	49:40	0	0	-
	20	3:50																3	4	6	23	39	81:40	0	0	-
	25	3:40															2	5	7	16	23	56	113:40	0	0	-
	30	3:30														1	3	7	13	22	30	70	150:40	0	0	-
	40	3:20													1	6	6	13	17	27	51	93	218:40	0	0	-
290	5	4:30																			2	3	9:50	2	0	0
	10	4:10																	1	3	5	16	29:50	511	9	16*
	15	4:00																1	3	6	12	26	52:50	51	1	20
	20	4:00																3	7	9	23	43	89:50	2	0	0
	25	3:50															3	5	8	17	23	60	120:50	0	0	-
	30	3:40														1	5	6	16	22	36	72	162:50	0	1	1000
	40	3:30													3	5	7	15	16	32	51	95	228:50	3	0	0
300	5	4:40																			3	3	11:00	0	0	-
	10	4:20																	1	3	6	17	32:00	668	13	19*
	15	4:10																2	3	6	15	26	57:00	85	2	24
	20	4:00															2	3	7	10	23	47	97:00	8	0	0
	25	3:50														1	3	6	8	19	26	61	129:00	0	0	-
	30	3:50														2	5	7	17	22	39	75	172:00	0	0	-
	40	3:40													4	6	9	15	17	34	51	90	231:00	5	0	0
	60	3:00									4	10	10	10	10	10	14	28	32	50	90	187	460:00	7	0	0
	90	2:20					3	8	8	10	10	10	10	16	24	24	34	48	64	90	142	187	693:00	0	0	-
	120	2:00			4	8	8	8	8	10	14	24	24	24	34	42	58	66	102	122	142	187	890:00	0	0	-
	180	1:40	6	8	8	8	14	20	21	21	28	40	40	48	56	82	98	100	114	122	142	187	1168:00	0	0	-

*Those schedules used in the establishment of the final incidence rate.

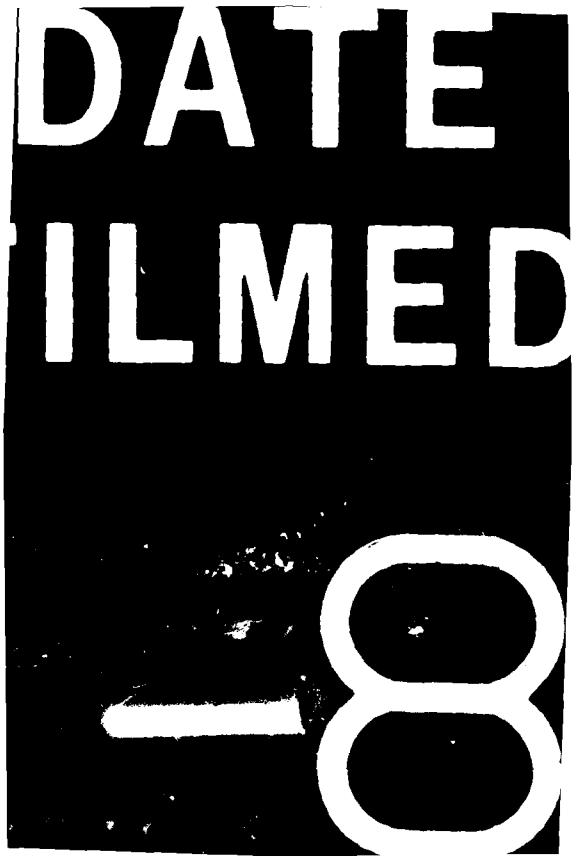
Table 2

Number of Dives at Each Schedule Depth and Time

Decompression Schedule Depth	Number of Dives*	Percent of Total	Cumulative Percent	Decompression Schedule Time	Number of Dives**	Percent of Total	Cumulative Percent
40	18	0.1	0.1	5	51	0.3	0.3
50	115	0.7	0.8	10	5435	33.6	33.9
60	316	2.0	2.8	15	2262	14.0	47.9
70	123	0.8	3.6	20	1658	10.3	58.2
80	114	0.7	4.3	25	857	5.3	63.5
90	122	0.8	5.1	30	1577	9.8	73.3
100	843	5.2	10.3	40	654	4.0	77.3
110	2096	13.0	23.3	50	2778	17.2	94.5
120	1372	8.5	31.8	60	452	2.8	97.3
130	1073	6.6	38.4	70	125	0.8	98.1
140	520	3.2	41.6	80	44	0.3	98.4
150	1233	7.6	49.2	90	25	0.2	98.6
160	787	4.9	54.1	100	65	0.4	99.0
170	1729	10.7	64.8	110	62	0.4	99.4
180	952	5.9	70.7	120	57	0.4	99.8
190	846	5.2	75.9	130	0	0.0	99.8
200	1931	11.9	87.8	140	26	0.2	100.0
210	522	3.2	91.0	150	0	0.0	
220	23	0.1	91.1	160	4	0.0	
230	46	0.3	91.4	170	0	0.0	
240	10	0.1	91.5	180	8	0.0	
250	19	0.1	91.6	200	13	0.0	
260	2	0.0	91.6	210	0	0.0	
270	2	0.0	91.6	220	2	0.0	
280	14	0.1	91.7	230	2	0.0	
290	569	3.5	95.2	240	7	0.0	
300	773	4.8	100.0	250	3	0.0	
				270	0	0.0	
	16170	100		300	0	0.0	
				360	3	0.0	
				480	0	0.0	
				720	0	0.0	
					16170	100	

*The values are found by summing across times at each depth.

**The values are found by summing across depths for each exposure time.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