TOWARDS SAFER DIVING BRUCE BASSETT'S REVISED NO-Decompression TABLES

John Knight

Over the past couple of years decompression sickness presenting for treatment has become more common in Australia. The reasons for this increase must include some or all of the following.

1. An unchanged incidence of DCS with a better understanding of the need for treatment among the sufferers. I think that much of the Victorian increase is real, whatever the case is for other areas.

2. Diving exactly the dive set out in the tables. Many divers seem to believe that decompression tables have a zero incidence of DCS if followed properly. This is a delusion fostered by the fact that few sports divers dive in the pattern of the tables which is go straight to the bottom, stay on the bottom at that depth, and return straight to the surface. Those that do such dives, diving on deep wrecks, prove that the tables have an "acceptable" incidence of DCS!

3. Poor dive planning has always been a hazard. With the increase in available treatment chambers some of the less sensible divers may have decided that there is no need to worry about planning dives. If anything goes wrong there is a chamber to treat and cure one. Again this is a fallacy as not every victim of DCS leaves the chamber in "as new" condition.

4. Many divers are unable to use decompression tables properly, especially when calculating repetitive dives.

5. Many depth gauges are inaccurate. If they read deep this does not matter. In fact it is a safety factor as long as the diver does not allow for it! The dangerous gauges are those that read shallow. This is especially true if the diver thinks that the gauge is accurate. Flying can affect Bourden tube depth gauges if they are not kept at sea level by being sealed in a pressure proof container. Fortunately not all depth gauges are affected every flight! The manufacturers of the Bendeez oxygen adaptor have produced a "Jackpot" which is a portable compression chamber for testing depth gauges, and for those with some $400 there is an easy way to know how accurate one's depth gauge is.

6. Finally there is the problem of not diving the planned dive. A friend of mine developed an elbow bend when he surfaced rapidly from 24m (80 feet) when he saw the anchor of his boat go past. He caught his boat and came back to pick up his wife.

One man, who had neither watch nor depth gauge, drifted an unknown distance below his companions on a dive planned to go to 60m (200 feet). The three divers decompressed as for a longer dive to 63m (210 feet) however the wanderer developed DCS (an elbow bend) soon after surfacing. His companions thought that the correct treatment was to repeat his stops, so he got back into the water. Shortly after reboarding the boat he developed neurological symptoms. It took 6 hours to get him to a chamber by which time he was quadriplegic. A week later he was taken from the chamber with a residual paraplegia which has now improved so that he is walking again.

What can be done to reduce the incidence of DCS? One has to alter the behaviour of divers so that they dive more safely. A very obvious statement but difficult to achieve.

The only time most divers are taught anything is during their training course. This is when they are introduced to decompression tables and, judging by divers I have met over the years, introduced is unfortunately the correct word, as many divers do not know how to use the tables correctly.

The simplest layout for any decompression table that I have seen is the RNPL/BSAC table (Figure 1). This table has the depths in increments of 2m. Problems arise with repetitive dives as, although there is an allowance for outgassing nitrogen with time, the second dive's decompression requirements are based on the deepest (sic) depth reached in the two dives. It is easy to forget this when calculating the no-stops time for the second dive.

In 1981 Dr Bruce Bassett delivered a paper entitled "The safety of the United States Navy decompression tables and recommendations for sports divers" at the SPUMS Annual Scientific Meeting at Madang.2 He pointed out that in chamber dives the USN no-decompression table, when dived to the limit, gave a 6% incidence of DCS. In practice the USN rate for DCS is less than 0.1%. What is the explanation for this large difference? It is because the USN divers never dive the USN tables. For decompression dives they always add at least one depth and one time increment and decompress for the time applicable to the fictitious depth and time. For no-decompression dives within 5 minutes of the limit for that depth they again add one depth and one time! As most USN diving is surface supplied the decisions are taken by the supervisor, who is unaffected by nitrogen narcosis, and not by the diver.

In the December 1984 issue of Undersea Biomedical Research, Dembert et al give the USN DCS figures for 1981. Thirty-five divers developed DCS out of 92,484 dives which is 0.037%.[3] Almost all USN scuba diving on air is shallow.

Obviously if the USN air tables are used as the USN actually uses them they are as good as any other table in preventing DCS.

Would promoting the use of Dr Bruce Bassett's Revised "No-Decompression" Limits Decompression table reduce the incidence of decompression sickness (DCS)? I believe that it would, especially using the layout that John Lippmann and I have worked out (Figure 4)

Dr Bruce Bassett is a physiologist who served 20 years in the US Air Force. His last assignment was to construct a Set of tables for flying at 10,000 feet immediately after finishing a dive. This was, I understand so that combat

RNPL/BSAC Air Diving Decompression Table

Max Depth metres	No Stop mins	BOTTOM TIME					
9	NO LIMIT						
10	232	431	–	–	–	–	
12	137	140	159	179	201	229	270
14	96	98	106	116	125	134	144
16	72	73	81	88	94	99	105
18	57	59	66	71	76	80	84
20	46	49	55	60	63	67	70
stops at	5m	5	10	15	20	25	30

Max Depth metres	No Stop mins					
22	38	42	47	51	55	58
24	32	37	41	45	48	51
26	27	32	37	40	43	45
28	23	29	33	36	39	41
30	20	25	30	33	36	37
32	18	23	27	30	32	34
34	16	21	25	28	30	31
36	14	20	23	26	27	29
38	12	18	21	24	26	27
40	11	17	20	22	24	25
42	10	16	19	21	22	24
44	9	15	18	20	21	
46	8	14	17	18	20	
48	8	13	16	17		
50	7	12	15	17		
stops at	10m	5	5	5	5	5
	5m	5	10	15	20	25

ASCENT RATE 15 metres per min
DESCENT RATE Max. 30 metres per min
No more than 8 hrs. in 24 hrs. spent under pressure (submerged).

DOUBLE DIVES (A, B)	
Decompress for the deepest depth	
1st dive duration	A mins
2nd dive duration	B mins
B < 9 metres – No stop	
Interval	**Bottom Time**
Both dives less than 40 metres	
Up to 2 hr.	A + B
2-4 hr	A/2 + B
4-6 hr.	A/4 + B
6 + hrs.	B
Either dive more than 40 metres	
Up to 2 hr.	A + B
2-4 hr.	A/2 + B
4-8 hr.	A/4 + B
8-16 hr.	A/8 + B
16 + hrs.	B

DETAILS OF PREVIOUS DIVE
Time Depth Duration

swimmers could be picked up by helicopter and then flown away in normal aircraft.

He calculated, using the mathematics of the USN air diving tables, a set of equivalent no-decompression dives so that the supersaturation levels and ratios allowed by the USN no-decompression table were achieved in the diver at 10,000 ft. If the USN tables were safe these shorter dives followed by decompression to altitude, with the same supersaturation ratios at altitude as the USN tables had on surfacing, should have been safe. They were not as they had a DCS incidence of 6%, which was unacceptable.[2]

Dr M Spencer in Seattle had already tested the USN No-decompression tables in a chamber and found that he had about a 6% incidence of DCS.

These two sets of dry chamber data and the knowledge that the USN divers always added depth and time before calculating decompression led Dr Bassett to recalculate his dive schedule using lesser M values, that is he reduced the allowable supersaturation in the various half time tissues. The two sets of supersaturation ratios for each half time tissue appear in Table 1.

TABLE 1

LIMITING VALUES OF USN AND BASSETT TABLES

HALF TIME	US NAVY RATIO	BASSETT RATIO
5	3.15	2.88
10	2.67	2.52
20	2.18	2.03
40	1.76	1.63
80	1.58	1.41
120	1.51	1.33

When Dr Bassett tested his revised decompression procedures in the chamber there were no bends.

NO-DECOMPRESSION LIMITS AND REPETITIVE GROUP DESIGNATION TABLE FOR NO-DECOMPRESSION AIR DIVES

Depth (feet)	No-decompression limits (min)	Group Designation A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
10		60	120	210	300											
15		35	70	110	160	225	350									
20		25	50	75	100	135	180	240	325							
25		20	35	55	75	100	125	160	195	245	315					
30		15	30	45	60	75	95	120	145	170	205	250	310			
35	310	5	15	25	40	50	60	80	100	120	140	160	190	220	270	310
40	200	5	15	25	30	40	50	70	80	100	110	130	150	170	200	
50	100		10	15	25	30	40	50	60	70	80	90	100			
60	60		10	15	20	25	30	40	50	55	60					
70	50		5	10	15	20	30	35	40	45	50					
80	40		5	10	15	20	25	30	35	40						
90	30		5	10	12	15	20	25	30							
100*	25		5	7	10	15	20	22	25							
110	20			5	10	13	15	20								
120	15			5	10	12	15									
130	10			5	8	10										
140	10			5	7	10										
150	5			5												
160	5				5											
170	5				5											
180	5				5											
190	5				5											

RESIDUAL NITROGEN TIMETABLE FOR REPETITIVE AIR DIVES

*Dives following surface intervals of more than 12 hours are not repetitive dives. Use actual bottom times in the Standard Air Decompression Tables to compute decompression for such dives.

Repetitive group at the beginning of the surface interval

Repetitive group at the beginning of the surface interval	Z	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
A																0:10 12:00*
B															0:10 2:10	2:11 12:00*
C														0:10 1:39	1:40 2:49	2:50 12:00*
D													0:10 1:09	1:10 2:38	2:39 5:48	5:49 12:00*
E												0:10 0:54	0:55 1:57	1:58 3:22	3:23 6:32	6:33 12:00*
F											0:10 0:45	0:46 1:29	1:30 2:28	2:29 3:57	3:58 7:05	7:06 12:00*
G										0:10 0:40	0:41 1:15	1:16 1:59	2:00 2:58	2:59 4:25	4:26 7:35	7:36 12:00*
H									0:10 0:36	0:37 1:06	1:07 1:41	1:42 2:23	2:24 3:20	3:21 4:49	4:50 7:59	8:00 12:00*
I								0:10 0:33	0:34 0:59	1:00 1:29	1:30 2:02	2:03 2:44	2:45 3:43	3:44 5:12	5:13 8:21	8:22 12:00*
J							0:10 0:31	0:32 0:54	0:55 1:19	1:20 1:47	1:48 2:20	2:21 3:04	3:05 4:02	4:03 5:40	5:41 8:40	8:41 12:00*
K						0:10 0:28	0:29 0:49	0:50 1:11	1:12 1:35	1:36 2:03	2:04 2:38	2:39 3:21	3:22 4:19	4:20 5:48	5:49 8:58	8:59 12:00*
L					0:10 0:26	0:27 0:45	0:46 1:04	1:05 1:25	1:26 1:49	1:50 2:19	2:20 2:53	2:54 3:36	3:37 4:35	4:36 6:02	6:03 9:12	9:13 12:00*
M				0:10 0:25	0:26 0:42	0:43 0:59	1:00 1:18	1:19 1:39	1:40 2:05	2:06 2:34	2:35 3:08	3:09 3:52	3:53 4:49	4:50 6:18	6:19 9:28	9:29 12:00*
N			0:10 0:24	0:25 0:39	0:40 0:54	0:55 1:11	1:12 1:30	1:31 1:53	1:54 2:18	2:19 2:47	2:48 3:22	3:23 4:04	4:05 5:03	5:04 6:32	6:33 9:43	9:44 12:00*
O		0:10 0:23	0:24 0:36	0:37 0:51	0:52 1:07	1:08 1:24	1:25 1:43	1:44 2:04	2:05 2:29	2:30 2:59	3:00 3:33	3:34 4:17	4:18 5:16	5:17 6:44	6:45 9:54	9:55 12:00*
	0:10 0:22	0:23 0:34	0:35 0:48	0:49 1:02	1:03 1:18	1:19 1:36	1:37 1:55	1:56 2:17	2:18 2:42	2:43 3:10	3:11 3:45	3:46 4:29	4:30 5:27	5:28 6:56	6:57 10:05	10:06 12:00*

NEW → GROUP DESIGNATION / REPETITIVE DIVE DEPTH	Z	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
40	257	241	213	187	161	138	116	101	87	73	61	49	37	25	17	7
50	169	160	142	124	111	99	87	76	66	56	47	38	29	21	13	6
60	122	117	107	97	88	79	70	61	52	44	36	30	24	17	11	5
70	100	96	87	80	72	64	57	50	43	37	31	26	20	15	9	4
80	84	80	73	68	61	54	48	43	38	32	28	23	18	13	8	4
90	73	70	64	58	53	47	43	38	33	29	24	20	16	11	7	3
100	64	62	57	52	48	43	38	34	30	26	22	18	14	10	7	3
110	57	55	51	47	42	38	34	31	27	24	20	16	13	10	6	3
120	52	50	46	43	39	35	32	28	25	21	18	15	12	9	6	3
130	46	44	40	38	35	31	28	25	22	19	16	13	11	8	6	3
140	42	40	38	35	32	29	26	23	20	18	15	12	10	7	5	2
150	40	38	35	32	30	27	24	22	19	17	14	12	9	7	5	2
160	37	36	33	31	28	26	23	20	18	16	13	11	9	8	4	2
170	35	34	31	29	26	24	22	19	17	15	13	10	8	6	4	2
180	32	31	29	27	25	22	20	18	16	14	12	10	8	6	4	2
190	31	30	28	26	24	21	19	17	15	13	11	10	8	6	4	2

RESIDUAL NITROGEN TIMES (MINUTES)

The Bruce Bassett "Revised No-decompression limits for the Sports Diver", to give the table its full name, are based on these reduced supersaturation ratios. The result is a no-stops table which differs from both the USN, RN, and RNPL/BSAC tables.

The main difference is that the Bassett Table, being designed for sports divers, does not go below 42m (or 140 ft) as he has evidence that deep dives are more dangerous. The USN no-decompression table (Figure 2) allows dives to 57m (190 ft) while the RNPL/BSAC table (Figure 1) allows dives to 50m (165 ft). Dr Bassett holds that sports divers dive for fun and that fun does not include getting bent! I agree with him.

The UK Health and Safety Executive limits air diving in the North Sea oilfields to 50m (165 ft) partly because of a high accident rate at these depths in the early years, and partly because of diver inefficiency meant that jobs were badly done. If it is unsafe for professional divers to go below 50m on air it must be equally unsafe for sports divers. As the professionals are usually using surface supplied equipment, which means an unlimited air supply, the balance is tilted even further against the sports diver who always uses scuba and may run out of air.

Another difference is that Dr Bruce Bassett puts a time limit on dives to 9m (30 ft) which none of the other tables do. The limit is hardly going to inconvenience a scuba diver as it is 220 minutes. It should be an exceptionally peaceful diver who could make a single cylinder last 3 hours 40 minutes!

By using lower allowable super-saturation ratios the bottom times have to be shorter. This is especially noticeable at shallower depths. At 10m (35 ft) the USN limit is 310 minutes, the RNPL/BSAC limit is 232 minutes and Bruce Bassett's is 180 minutes. At 12m (40 ft) the USN allows 200 minutes, the RNPL/ BSAC table 137 minutes and Bassett's limit is 120 minutes. At 15m (50 ft) the USN limit is 100 minutes while Bassett's is 70 minutes. The RNPL/BSAC table is in multiples of 2m, so the next deeper depth is 16m when 76 minutes are allowed. At 18m (60 ft) the USN limit is 60 minutes, the RNPL/BSAC one is 57 minutes and Bassett's is 50 minutes.

For 21m (70 ft) the USN allows 50 minutes, the RNPL/ BSAC allows 38 minutes (at 22m), while Bassett allows 40. At 24m (80 ft) the USN limit is 40 minutes, the RNPL/ BSAC one is 32 minutes and Bassett's is 30 minutes. At 27m (90 ft) the USN allows a 30 minute dive, the RNPL/ BSAC dive is 23 minutes (at 28m), while the Bassett limit is 25 minutes. At 30m (100 ft) the USN limit is 25 minutes, the RNPL/BSAC and the Bassett tables allow 20 minutes. At 33m (110 ft) the USN allows 20 minutes, the RNPL/ BSAC allows 16 minutes (at 34m), while Bassett allows 15 minutes. At 36m (120 ft) the USN limit is 15 minutes, the RNPL/BSAC has 14 minutes and the Bassett tables allow 12 minutes. At 39m (130 ft) both the USN and Bassett tables allow a 10 minute dive while the RNPL/BSAC limit is 11 minutes (at 40m). At 42m (140 ft) the USN and RNPL/BSAC table allow 10 minutes while Bassett has 5 minutes.

TABLE 2

"NO-DECOMPRESSION" LIMITS

DEPTH		TIME IN MINUTES		
FEET	METRES	USN	BS-AC	BASSETT
30	9			220
35	10.5	310	232	180
40	12	200	137	120
50	15	100	72	70
60	18	60	57	50
70	21	50	38	40
80	24	40	32	30
90	27	30	23	25
100	30	25	20	20
110	33	20	16	15
120	36	15	14	12
130	39	10	11	10
140	42	10	10	5

The depths in the BS-AC table are in increments of 2m. For odd numbered depths in metres the standard procedure, of using the next greater depth, has been followed for the BS-AC table.

To summarize, the Bassett tables call for shorter bottom times than the USN No-decompression tables allow. As the USN table, taken to its limits has a 6-8% DCS rate, in the chamber, a reduction in bottom time seems reasonable as chamber dives are known to have a lower rate of DCS than in water dives. The reduction is 5 minutes at depths of 27m (90 feet) and below. From 18 to 24m (60 to 80 ft) the reduction is 10 minutes. Above 18m (60 ft) the reductions from USN limits are considerable but leave plenty of diving time, 70 minutes at 15m (50 ft), 120 minutes at 12m (40 ft), 180 minutes at 10m (35 ft) and 220 minutes at 9m (30 ft).

Dr Bassett's revised no-decompression limits are made safer still by adding a 3 to 5 minute safety stop at 3 to 5m (10 to 16 ft) for all dives below 9m (30 ft). He uses both belt (shorter bottom times) and braces (suspenders in his words), because developing DCS is not fun and sports divers dive for fun.

The introduction of a safer set of no-decompression limits is excellent, but would sports divers use them? Unfortunately very few sports divers are willing to accept only one dive a day. They want at least two, and most are unwilling to limit themselves to a second dive at 9m (30 feet) or less, or three or more. Personally I limit myself to 2 dives a day. The RNPL/BSAC tables (Figure 1) have failed to catch on in Victoria inspite of being taught in many of the diving schools. I think that one of the reasons is the fact that the second dive has to be less than 9m or decompression has to be calculated for the deeper of the two depths, and there is no provision for a third dive. The USN tables (Figure 2) do allow for second and third dives. By using repetitive groups and the surface interval table one can calculate the "residual nitrogen" which is expressed as minutes already "dived" on the next dive. Simple

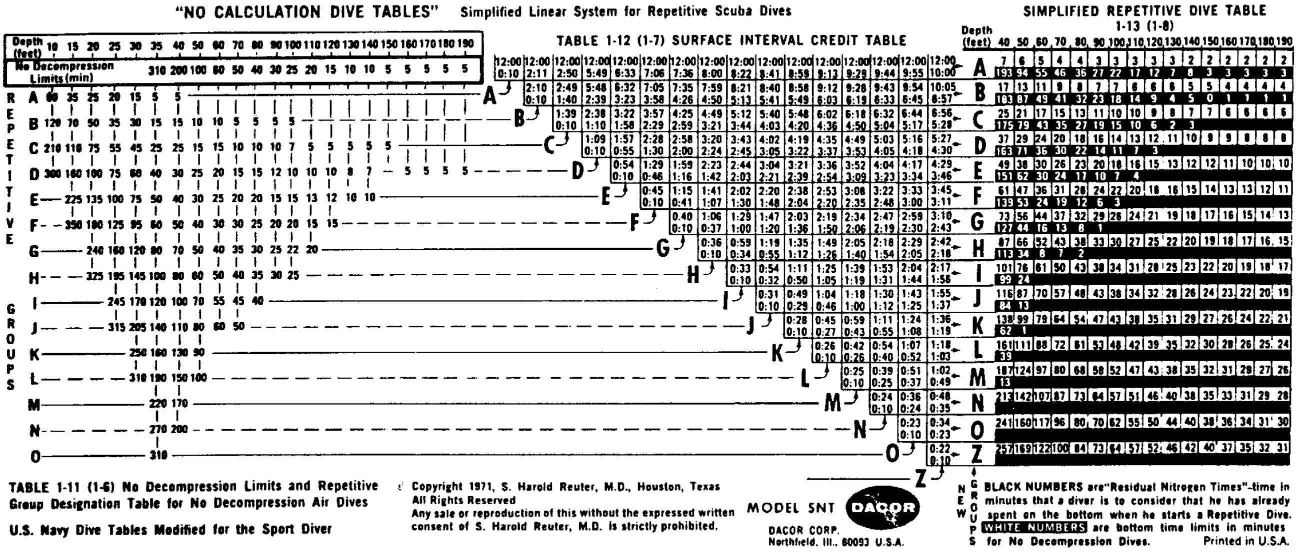

TABLE 3

<u>REPETITIVE DIVE TABLE</u>
(No Decompression Dives)

For each repetitive group the upper line is USN Residual Nitrogen Time, the *lower line is the time available for "no decompression" diving using Dr Bruce Bassett's revised "no decompression limits"*.

Depths (m)	9	12	15	18	21	24	27	30	33	36	39	42
(feet)	30	40	50	60	70	80	90	100	110	120	130	140
A		7	6	5	4	4	3	3	3	3	3	2
	213	*113*	*64*	*45*	*36*	*26*	*22*	*17*	*12*	*9*	*7*	*3*
B		17	13	11	9	8	7	7	6	6	6	5
	203	*103*	*57*	*39*	*31*	*22*	*18*	*13*	*9*	*6*	*4*	-
C		2.5	21	17	15	13	11	10	10	9	8	7
	195	*95*	*49*	*33*	*25*	*17*	*14*	*10*	*5*	*3*	*2*	-
D		37	29	24	20	18	16	14	13	12	11	10
	183	*83*	*41*	*26*	*20*	*12*	*9*	*6*	*2*	-	-	-
E		49	38	30	26	23	20	18	16	15	13	12
	171	*71*	*32*	*20*	*14*	*7*	*5*	*2*	-	-	-	-
F		61	47	36	31	28	24	22	20	18	16	15
	159	*59*	*23*	*14*	*9*	*2*	*1*	-	-	-	-	-
G		73	56	44	37	32	29	26	24	21	19	18
	147	*47*	*14*	*6*	*3*	-	-	-	-	-	-	-
H		87	66	52	43	38	33	30	27	25	22	20
	133	*33*	*4*	-	-	-	-	-	-	-	-	-
I		101	76	61	50	43	38	34	31	28	25	23
	119	*19*	-	-	-	-	-	-	-	-	-	-
J		116	87	70	57	48	43	38	34	32	28	26
	104	*4*	-	-	-	-	-	-	-	-	-	-
K		138	99	79	64	54	47	43	38	35	31	29
	82	-	-	-	-	-	-	-	-	-	-	-

subtraction from the no-decompression limit of the second dive depth gives the time available for a second no-decompression dive. And the process can be repeated time and time again. Very convenient and used by most Australian sports divers. Unfortunately the USN seldom uses its repetitive dive table, so there are no statistics of how safe they are in USN hands diving the USN way (adding at least one depth and one time). However there are drawbacks to this system. DCS is seen more often after repetitive dives than after single dives. Also there is always the possibility of an error when subtracting the residual nitrogen time from the "no-decompression" time. Errors of ten minutes are very easy to make.

The subtraction error is avoided in such layouts of the USN tables as the "Nu-way" and the "No calculation dive tables" (Figure 3) where both the residual nitrogen time and the time available for the second dive are given. The only problem then is to choose the right numbers. Is it the black on white numbers that give the residual nitrogen time or is it the white on black numbers? The answer is printed on the card but in very small print.

Another possible error is forgetting to add the residual nitrogen time to the bottom time of the second dive. In this case the wrong repetitive group will be taken at the end of the second dive.

How can Dr Bassett's table be used for repetitive dives? It is quite simple. The Bassett tables use the same mathematical formulae as the USN tables with different M values (super-saturation ratios). So the USN residual nitrogen calculations apply with all their imperfections. The residual nitrogen table is based on the 120 minute tissue. In Madang Dr Bassett said that he wanted to revise the repetitive dive tables. However as far as I know he has not done so yet. As the Bassett tables produce a lower surfacing super-saturation the residual nitrogen after any given time will be less than that calculated by the USN tables so introducing an extra safety factor.

We can use the USN repetitive dive table to calculate the repetitive group when the Bassett tables are used, but instead of bottom time, which is the time from leaving the surface to starting the ascent, the total time underwater is used to enter the table. After the surface interval the residual nitrogen table is entered. The next dive can be calculated by subtracting the residual nitrogen time from the Basset limit. Table 3 shows the USN residual nitrogen times and the times available for Bassett no-decompression dives.

In order to encourage divers to use the Bassett Revised No-Decompression limits, John Lippman and I have laid out these tables in an easy to follow format (Figure 4). One enters the table by reading the instructions (Table 4). As these tables are derived from USN mathematics the ascent rate must be no faster than 60 feet (18m) a minute. I have chosen 10m (33 feet) a minute as we know that sports divers trying to come up at 60 feet a minute usually come up much faster, some even as fast as 120 feet a minute.

The top table in Figure 4 is for calculating repetitive groups at the end of a dive. Times inside the Bassett limits are in ordinary type. The times in italics are provided to find the repetitive group using the total time underwater. If the diver follows Dr Bassett's recommendations to do a safety stop of 3 to 5 minutes on all dives below 30 feet (9m) his total time underwater will often be more than five minutes longer than the Bassett no-decompression limit. So I have included times in italics that are at least 10 minutes longer than Dr Bassett's limits. Not all of the italic times are

TABLE 4

DR BRUCE BASSETT'S REVISED BOTTOM TIMES "NO DECOMPRESSION" DIVE TABLE
READ THIS BEFORE USING THE TABLES

Basic facts about the use of these USN derived decompression tables

1. Bottom time starts on leaving the surface and stops on starting the ascent.
2. Use the deepest depth of the dive as the depth of the dive for calculation.
3. If the deepest depth of the dive is between two depths in the table use the greater depth for calculations.
4. If the time is between two times in the table use the longer time for calculations.
5. After a dive calculate the repetitive group.
6. After the surface interval calculate the new repetitive group.
7. Using the planned depth of the next dive enter the repetitive dive table to find the no-decompression dive time available for that repetitive group and depth.

ASCENT RATE 10M A MINUTE

ON ALL DIVES DEEPER THAN 9M (30ft) DO A 3-5 MINUTE SAFETY STOP AT 3-5M.

USE THE TOTAL TIME UNDERWATER (BOTTOM TIME + ASCENT TIME + SAFETY STOP TIME) TO FIND THE REPETITIVE GROUP at the end of the dive.

FIGURE 4

DR BRUCE BASSETT'S REVISED BOTTOM TIMES "NO DECOMPRESSION" DIVE TABLE

ON ALL DIVES DEEPER THAN 9M (30ft) DO A 3-5 MINUTE SAFETY STOP AT 3-5 M.

USE THE TOTAL TIME UNDERWATER (BOTTOM TIME + ASCENT TIME + SAFETY STOP TIME) TO FIND THE REPETITIVE GROUP at the end of the dive.

The times in *italics* in the table are OUTSIDE the Bassett limits but are included for ease of calculating the repetitive group using the TOTAL TIME UNDERWATER

Depth M	Depth feet	Bassett Limits	Time Underwater											
9	30	220	15	30	45	60	75	95	120	145	170	205	*250*	*310*
10	35	180	5	15	25	40	50	60	80	100	120	140	160	*190*
12	40	120	5	15	25	30	40	50	70	80	100	110	*130*	*150*
15	50	70		10	15	25	30	40	50	60	70	*80*	*90*	*100*
18	60	50		10	15	20	25	30	40	50	*55*	*60*		
21	70	40		5	10	15	20	30	35	40	*45*	*50*		
24	80	30		5	10	15	20	25	30	*35*	*40*			
27	90	25		5	10	12	15	20	25	*30*		*40*		
30	100	20		5	7	10	15	20	*22*	*25*	*30*			
33	110	15			5	10	13	15	*20*	*25*				
36	120	12			5	10	12	*15*		*20*	*25*			
39	130	10			5	8	10	*15*		*20*				
42	140	5			5	*7*	*10*		*15*					
Repetitive group at the end of dive			A	B	C	D	E	F	G	H	I	J	K	L

ABBREVIATED U.S.N. SURFACE INTERVAL TABLE

Enter the table from the top using the appropriate repetitive group. Move across to the left until the appropriate interval is found then move down the column and out of the table into the REPETITIVE DIVE TABLE

0:10 12:00												← A
2:11 12:00	0:10 2:10											← B
2:50 12:00	1:40 2:49	0:10 1:39										← C
5:49 12:00	2:39 5:48	1:10 2:38	0:10 1:09									← D
6:33 12:00	3:23 6:32	1:58 3:22	0:55 1:57	0:10 0:54								← E
7:06 12:00	3:58 7:05	2:29 3:57	1:30 2:28	0:46 1:29	0:10 0:45							← F
7:36 12:00	4:26 7:35	2:59 4:25	2:00 2:58	1:16 1:59	0:41 1:15	0:10 0:40						← G
8:00 12:00	4:50 7:59	3:21 4:49	2:24 3:20	1:42 2:23	1:07 1:41	0:37 1:06	0:10 0:36					← H
8:22 12:00	5:13 8:21	3:44 5:12	2:45 3:43	2:03 2:44	1:30 2:02	1:00 1:29	0:34 0:59	0:10 0:33				← I
8:41 12:00	5:41 8:40	4:03 5:40	3:05 4:02	2:21 3:04	1:48 2:20	1:20 1:47	0:55 1:19	0:32 0:54	0:10 0:31			← J
8:59 12:00	5:49 8:58	4:20 5:48	3:22 4:19	2:39 3:21	2:04 2:38	1:36 2:03	1:12 1:35	0:50 1:11	0:29 0:49	0:10 0:28		← K
9:13 12:00	6:03 9:12	4:36 6:02	3:37 4:35	2:54 3:36	2:20 2:53	1:50 2:19	1:26 1:49	1:05 1:25	0:46 1:04	0:27 0:45	0:10 0:26	← L
A	B	C	D	E	F	G	H	I	J	K	L	

MAXIMUM TIME AVAILABLE FOR A REPETITIVE DIVE

Depth M	Depth feet											
9	30	213	203	195	183	171	159	147	133	119	104	82
12	40	113	103	95	83	71	59	47	33	19	4	
15	50	64	57	49	41	32	23	14	4	-	-	-
18	60	45	39	33	26	20	14	6	-	-	-	-
21	70	36	31	25	20	14	9	3	-	-	-	-
24	80	26	22	17	12	7	2	-	-	-	-	-
27	90	22	18	14	9	5	1	-	-	-	-	-
30	100	17	13	10	6	2	-	-	-	-	-	-
33	110	12	9	5	2	-	-	-	-	-	-	-
36	120	9	6	3	-	-	-	-	-	-	-	-
39	130	7	4	2	-	-	-	-	-	-	-	-
42	140	3	-	-	-	-	-	-	-	-	-	-

For each repetitive group the number shown is the MAXIMUM time available for a repetitive "no/decompression" dive using Dr Bruce Bassett's revised "no decompression" limits.

within the USN no-decompression limits, so the table is not the USN no-decompression table. It is a table to find the repetitive group applicable using the total time underwater as the entry point.

Having found the repetitive group the diver enters the surface interval table by running his (or her) finger down to the appropriate vertical line and then over to the left to find the surface interval. The new repetitive group is found at the bottom of that column.

The bottom table shows the maximum time available for a no-decompression dive for the various repetitive groups and depths. By showing only the time available the problems of subtraction and wrong answers are avoided.

Should one want to do a third dive, memory and arithmetic are required. The second dive has been to the Bassett limits if the total time available has been used so that total time underwater will be the Bassett limit time (set out beside the depths in the top table) plus ascent and safety stop times NOT the ACTU**AL** total time underwater of the second dive.

To calculate the repetitive group after a repetitive dive one must

1. Subtract the actual bottom time (ABT) from the maximum time available **(MTA)** in Table 3 to get an answer in minutes **MTA - ABT** = X minutes.

2. Subtract this time from the Bassett limits (BL) in Table 1. BL - X minutes is the equivalent bottom time of the repetitive dive.

3. To this add the ascent time (AT) and the safety stop time (SST). BL - X minutes + AT + SST is the equivalent total time underwater of the repetitive dive. Use this time to enter Table 1 to find the repetitive group at the end of the repetitive dive.

This procedure can be repeated after every repetitive dive. Remember a repetitive dive is defined by these tables as one within 12 hours of finishing the previous dive.

There is a need for a decompression table that can be dived as it is written. Dr Bruce Bassett's can. So problem 2, diving exactly the dive in the tables could be solved by promoting the Bassett tables.

The safety factors of the Bassett tables are shorter bottom times and lower surfacing supersaturation ratios, which reduce the nitrogen load; the ascent rate of 10m a minute reduces the chances of bubble formation while a safety stop at 3 to 5m has been shown to markedly reduce bubble formation on deep dives; using the total time underwater to calculate the repetitive group ensures that the diver has a lower tissue nitrogen tension than the tables assume; when calculating a repetitive dive the residual nitrogen time is assumed to be the same as that in the USN residual nitrogen table, but the diver's nitrogen load will be less.

The Bassett tables meet the sports diver's requirements for repetitive dives. They are easier to use than remembering to add a depth and time to every dive using the USN tables. I think that the Bassett tables are the answer to the sensible sports diver's prayer.

TABLE 5

BASSETT'S SAFETY FACTORS

SHORTER "NO-DECOMPRESSION" TIMES

The surfacing super-saturation ratios are less than those of the USN tables.

A SAFETY STOP AT 3 TO 5M FOR 3 TO 5 MINUTES ON ALL DIVES BELOW 9M REDUCES BUBBLE FORMATION

TOTAL TIME UNDERWATER IS USED FOR CALCULATING REPETITIVE GROUPS.

REPETITIVE DIVE STARTS WITH LESS RESIDUAL NITROGEN THAN THE TABLE ASSUMES.

Allways Travel and I presented all those who attended the SPUMS 1985 AGM with two copies (one large and one small) laminated in plastic to make them waterproof and a water soluble marker pen to write on the plastic to help work out repetitive dives. They were used by some for their diving in the Maldives. The smaller one was a size to fit in any BC pocket. Figure 2 was only the first edition. The second edition will soon be available in dive shops. It will be printed on flexible plastic, which can be written on with a 2B pencil. On the back will be the instructions for calculating the repetitive group after the second and later dives with a space for the calculations, and a modified USN air decompression table for those who accidentally exceed their no-stop limit.

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