

undercurrent

THE PRIVATE EXCLUSIVE GUIDE FOR SERIOUS DIVERS

April, 1976

P.O. Box 1658, Sausalito, California 94965

Cable Address: Gooddiving

Can What You *Don't* Know Hurt You?

The Sport Diver's Right to Product Information

In the last ten years, sport diving has become the hobby of students and teachers, vegetarians and septuagenarians, female doctors and male nurses. We can thank the training organizations and the manufacturers for simplifying a complex and potentially dangerous sport so that the masses may participate. Not everyone who wants to dive has a college education or can understand the theory behind decompression sickness or regulator performance, but nearly anyone in half-way decent physical shape can be instilled with the information and skill necessary to become an adequate diver capable of enjoying the undersea world in gentle circumstances.

Just how much information a diver must command to proceed safely is uncertain. Once certified, perhaps all the additional information he needs is whatever he cares to seek. After all, once certified he is no longer a student and has the responsibility to take care of himself. Certainly, though, we must all agree that the diver should have the information he needs to dive safely.

Can today's divers get that information about the equipment they purchase and use? Does the equipment manufacturer have the right to withhold information about his equipment which might be important to diver safety? Does the diver have "the right to know?" Within the industry the question has not been answered and it's fair to state that only recently has anyone considered asking it. A case in point is one which has been simmering for more than two years, but it has never been moved off the back burner. The facts remain in the hands of a few members of the industry and interested professionals, but they are indeed facts about which the diving public should be apprised.

They concern a leading company in the industry, Scubapro, and a widely used piece of equipment, the Scubapro Decompression Meter.

The Scubapro Decompression Meter has been on the market in this country for nearly 15 years. Scubapro does not itself manufacture the meter in this country, but obtains it from the Italian firm SOS. The meter is patented in at least seven countries and sells here for \$80.

The meter, a relatively simple device, is composed of four significant components: a gas-filled bag, a porous ceramic element (called "element X" by Scubapro), a Bourdon tube, and a gauge face with a moveable needle from which the diver takes his reading. The components are housed in a metal case. As the diver descends pressure increases on the gas-filled bag, forcing its contents through the ceramic element. As the diver moves between different depths pressure on the bag of course

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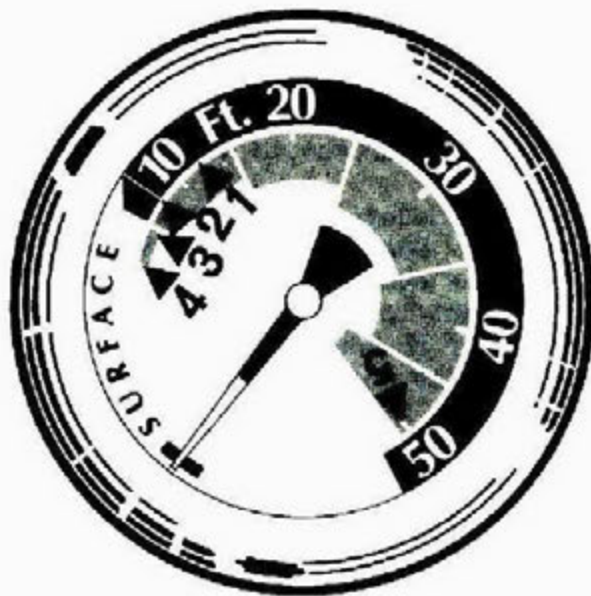
varies and the amount of gas forced through the element also varies. Once through the ceramic element, the gas enters the Bourdon tube causing that curved tube to slowly straighten out and, subsequently, to move the needle on the face of the dial. The quantity of the gas moving through the element into the tube is a function of two variables--time and depth--and those two variables then affect the position of the needle. The needle's position is supposed to tell the diver one of two things: when he should begin to surface and leave the water to avoid decompression or, if he is making a decompression dive, at what depth to make the first decompression stop (between 10 and 50 feet) and then when to rise to the next level for further decompression. The diver makes his determinations when the needle moves "into the red" the zone indicating that decompression is required.

A close reading of the instruction manual Scubapro provides with the meter indicates that the company sees the following limitations. In our opinion, no other limitations are indicated by the instructions.

1. It is not for use with mixed gas apparatus.
2. It is not for diving at high-altitude lakes.
3. It does not take into consideration those divers who are overweight, sick, physically run down, hung over, or otherwise dissipated.
4. It does not take into account excessive or prolonged exertion at extreme depths.
5. It cannot take into account dives which require decompression at depths greater than 50 feet.

On page 7 of the instructions is a statement which aroused our curiosity. "The decompression curve of the meter does not parallel exactly the U.S. Navy curve." Nowhere in the instructions was that statement expounded upon, but we thought further explanation should be required. That became the basis for this story.

In pursuit of information about the Scubapro Decompression Meter we interviewed in-person or by telephone over two dozen people with direct knowledge of the meter and its capabilities. It became quickly apparent that few people actually knew what decompression curve the meter followed and, in fact, only one article discussing the technical characteristics of the meter had been published in a journal of general circulation. Skin Diver, in 1970, published an article by Tom Mount, University of Miami Diving Officer, in which Mount disclosed results of meter tests. Mount produced some important conclusions. He stated that short deep bounce dives



This is a simplified version of the face of the Scubapro Decompression Meter: (1) The position of the movable needle indicates whether decompression is required; (2) No-decompression line for dive times less than 30 minutes on first dive; (3) No-decompression line for dive time between 30 and 60 minutes on first dive; (4) No-decompression line for dives lasting between 1-2 hours or for repetitive dives; (5) Numbers indicating depth for decompression stops. The present position of the needle indicates that the diver should stop at 10 feet to decompress until the needle moves counterclockwise out of the "red."

Undercurrent is published monthly by Undercurrent, Inc., 240 Redwood Highway, P. O. Box 1658, Sausalito, Ca. 94965. Copies of this guide are not available on newsstands, but are furnished directly to the diving public by mail subscription only. To maintain its independence, *Undercurrent* carries no advertising and is sup-

ported entirely by subscription income.

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on the meter could possibly be dangerous and that repetitive dives with a surface interval over 6 hours but less than 12 hours on the meter are unsafe. Regardless, Mount ended with the curious conclusion that in his opinion the meter provided a satisfactory decompression model. Mount's article raised eyebrows, but it seemed to be of no consequence to the diving public or Scubapro.

So far as we can tell the issue remained dormant until Red Howard and Kurt Schmitt, two latter-year graduate students at Scripps Institution of Oceanography conducted their own careful tests of the meter in late 1973. Their data supported Mount's and to Howard and Schmitt those results suggested such severe limitations with the meter that they sought a publisher for their research. Howard believes that Scubapro was instrumental in stopping publication; in a letter to Howard from Scubapro Director of Engineering Dave Denis, Denis said that they had sought to prevent the article from being published without first having the publications check with them because "some of the statements could be quite damaging to not only our company but the industry as well, at least as far as decompression meters are concerned." Denis also said that "one would be led to believe that the existing decompression meter and the new four tissue decompression meter are made, designed, and distributed by SOS."

Howard and Schmitt had conducted their study with care. They were loaned ten meters by San Diego divers and sent them to Scubapro for recalibration. Once returned, the meters were subjected to over 100 test dives in a water-filled pressure chamber. Their results were finally published in 1975 in the PADI Undersea Journal.

A similar test was conducted in late 1975 by Dr. Richard Boyd of the Petrie Scubalab. Boyd tested three off-the-shelf meters (#25052, 19378, and 19302) in a wet chamber. With the meters was a scientific test depth gauge which had been verified accurate to one-fourth of one percent. The results of both the Howard/Schmitt test and the Boyd test were not identical, but indeed similar. The chart below demonstrates those results in comparison to the Navy Tables.

Single Dives: What the Meter Reads and What the U.S. Navy Tables State:

Both studies demonstrate conclusively how the Scubapro meter differs from the Navy tables for single dives. Between 80 and 90 feet, the tables and the meter are in rough agreement with each other. The Navy tables allow 30 minutes at 90 feet, while Howard/Schmitt found that the meter permits between 30 and 33 minutes, while Boyd found the meters permitting between 30 and 31 minutes. However, at 80 feet both studies show that the meter provides a minute or two less than the Navy tables, making the crossover point approximately 85 feet. Both studies show that at deeper depths the meter provides more bottom time than the Navy tables and the difference between the meter and the tables becomes greater up to 150 feet.

Depth (feet)	Boyd Meter A	Boyd Meter B	Boyd Meter C	Howard/Schmitt*	Navy Tables
40	-	-	-	140	200
50	-	-	-	75%	100
60	61	60	62	60	60
70	50	50	51	50%	50
80	38	38	39	39	40
90	31	30	31	31%	30
100	28	27	28	29	25
110	26	26	26	26	20
120	21	20	21	22	15
130	18	18	19	20	10
140	17	16	17	16%	10
150	14	14	15	15%	5
160	13	13	14	13%	5
170	12	12	13	12%	5
180	12	11	11	11%	5
190	10	10	10	10%	5
200	8	9	9	9%	-

* Mid-point Meter/Table Readings in Minutes.

A comparison of wet chamber depth/time tests for each of three meters tested by Dr. Richard Boyd and the mid-point of ten meters tested by Red Howard and Kurt Schmitt. The time reported is the amount of time permitted at each depth *before* the meter indicates that decompression is needed.

At 100 feet, the Navy tables indicate that the diver has 25 minutes. The decompression meter, according to Howard/Schmitt, indicates 28 to 29 minutes and according to Boyd 27 to 28 minutes. At 130 feet, the tables provide 10 minutes of bottom time, while the meter provides nearly double. Boyd found between 18 and 19 minutes and Howard/Schmitt 19-21 minutes. At 150 feet the tables provide 5 minutes, while both Boyd and Howard/Schmitt found 15 to 16 minutes on the meter. At 190 feet, the tables provide 5 minutes while the meter provides from 10 to 11 minutes, according to both studies.

On the other hand, at depths below 85 feet or so, the meter is generally conservative yet not consistently so. According to Howard and Schmitt, the meter provides 72 to 78 minutes at 50 feet (the tables say 100 minutes). At 60 feet, they found it to be equal to the tables (60 minutes) while Boyd found the range from 60 to 62 minutes. At 70 feet the range found by Howard/Schmitt was 47 to 54 minutes while Boyd found from 45 to 51 minutes. The tables say 50 minutes.

Another study by Peter Wolfinger (published in the July/August 1974 issue of *Amphibian* magazine) corroborates this data. Furthermore, in the 1975 edition of *The New Science of Skin and Scuba Diving* (Published by the Council for National Cooperation in Aquatics), Dr. Edward Lamphier states: "Tests in my laboratory indicated that in a relatively limited range of depths and times one of these meters called for decompression very close to that specified by the U.S. Navy tables. Shorter and shallower dives were given unnecessarily conservative decompression according to the standard, while longer and deeper divers appeared to be handled inadequately." He does not mention "Scubapro" by name, but a drawing of the meter leaves no doubt as to which meter is being discussed.

No Decompression Repetitive Dives: The Meter and the Tables

The thrust of our article is based on the inconsistency on single dives, but we wish to report that Howard and Schmitt found that the meter gave bottom times comparable to the USN tables at 100 feet and 80 feet, after a 120 foot dive for 15 minutes. Howard and Schmitt voiced concern about a second dive of 60 feet after a first dive of 55 minutes at 60 feet. For surface intervals from 29 to 75 minutes between dives, the meter exceeded the Navy tables by 2 to 3 times.

Decompression Dives: The Meter and the Tables

We have not located recent studies, but Mount generally found that on these lost dives the meter provided decompression times that exceeded the Navy by nearly twice that required. Howard and Schmitt say "this inefficiency is usually interpreted as overly conservative and safe, although uneconomical."

The Discrepancy Between the Meter and the Tables: The Scubapro Position

It was our belief that the data we reviewed was valid and we wondered whether Scubapro had contrary data. In the instruction book accompanying the meter they acknowledge that the meter does not exactly parallel the U.S. Navy tables, but the size of the variance surprises us. We called Scubapro to discuss the matter by telephone, but President Dick Bonin said the matter was too complex for a telephone discussion. He suggested we visit the Scubapro plant.

On April 12 we spent 2½ hours with Dick Bonin, Board Chairman Gustav Dalla Valla, engineers Dennis Hart and Mike Coffey, and consultant Tony Christianson. We must thank Scubapro personnel for taking time from their busy schedules to meet with us. It was a cordial, candid and informative afternoon.

Our primary goal for the meeting was to obtain Scubapro data about the meter.

Our requests were always avoided. We asked repeatedly whether Scubapro data on the meter agreed with the data presented by Howard and Schmitt (Howard had discussed his data several times with Scubapro) and finally extracted responses from President Bonin and Christianson that their data "basically agreed" or "essentially matched" the data developed by Howard and Schmitt. No one in the meeting suggested that the Howard/Schmitt data was erroneous or that Scubapro data showed something different.

With an apparent agreement on the facts of the meter it became important to understand the Scubapro position on the discrepancy. As it turned out, it was simple and straightforward. The Scubapro faculty, as a unit, postulated that their meter has withstood the test of time. Chairman Dalla Valla pushed the argument that 300,000 meters have been in use, divers have made millions of successful dives, and that he himself, has used it in dives to 250 feet. Christianson said that "it diverges from the Navy tables, yet it is successful." The Navy tables are "too conservative" and the meter has much "more value" for the sport diver "since it is less conservative." The tables are based upon ten foot increments and imply that a diver goes to a single depth and remains there, while scuba divers move through a variety of depths on a dive. Only the meter can monitor that, was the Scubapro claim.

President Bonin pointed out that the meter has an excellent safety track record and, in fact, if it didn't he said that they would have had legal battles long ago. As it stands, Scubapro "has never been served," Bonin said. He has spoken with lawyers apparently representing a bent diver, but the lawyers have never undertaken a suit when the facts were straight. Indeed, Bonin stated that he has never been informed of a single case where a diver was bent using the meter correctly. In the other countries where the meter is being used no one is concerned about it; the meter "is only controversial here," Bonin said, because of the scientific studies conducted. To Scubapro, those studies remain only studies. The proof is in the track record of the meter which, Scubapro apparently believes, is perfect.

The U.S. Navy Tables: Are They Gospel?

The U.S. Navy tables indeed carry the weight of authority. Every sport diving training organization teaches the tables with religious fervor. They are the official tables of government divers, universities and researchers. The tables are a result of both empirical and theoretical studies and are continually undergoing analysis by government and private researchers. There have been modifications since the 1950's, but they remain basically the same.

Yet, are the tables gospel? Not quite. First, they were not designed for sports divers and experts agree that they are conservative. One researcher suggested that the theory behind the tables is "we'd rather be safe than sorry." Even so, the 1970 version of the U.S. Navy Diving Manual makes the following statement which Scubapro has quoted in the meter's instructional manual. The tables do not "contain an unnecessarily large safety factor; as a matter of fact, the tables generally represent the minimum decompression time that will permit average divers to surface safely from normal working dives without an unacceptable incidence of decompression sickness." That unacceptable incidence results in roughly 1% of the divers using the table to decompress or prevent decompression getting bent.

In our conversations with two officials in the commercial diving industry, Peter Edel (President of Sea Space, Inc.) and Carl Lundberg, (Research Director of Michel Lecler, Inc.) we were informed that there is no data to support the degree of deviance between the meter and the tables. Edel said that "190 feet will not support ten minutes bottom time (which is what the meter provides). It would be a brutal hit on that dive profile. At 150 feet the Navy tables give as much as 9 minutes (if the curve is drawn), but never 15. It can't be supported."

Curiously, the Scubapro instructions make a similar claim: the meter "follows a decompression curve calculated to give minimum decompression to a healthy diver in top physical condition with normal metabolism."

Two government sources, both of whom asked to remain off the record, said there is no theory behind the meter and that the decompression curve the meter provides certainly would lead to bent divers. R. D. Workman, M.D., who has conducted his own research into the tables and decompression illness, wrote to Red Howard that the limits provided by the meter at depths greater than 100 feet "are sure benders. Your (data) reflects this. This is the type of dive that tends to produce CNS (central nervous system) hits with good regularity."

Yet so far this is only conjecture, although with some theoretical base. The professional community is arguing that the profile of the meter must cause the bends when that profile is compared to the U.S. Navy tables. Scubapro disagrees.

Scubapro, which touts the acceptance of the meter by thousands of divers, argues that the proof is not in the text book, but in the history of the meter in the hands of divers. They believe their perfect track record is the answer to the diving professionals who criticize the meter. In our discussions with Scubapro personnel, they make no claim that the performance of the meter is based upon specially derived tables. Denis said that "the meter was designed to best follow acceptable tables like the Navy tables. But it cannot follow that table due to the limitations of the material." The construction of the meter produces its own curve and what is produced is what the diver gets. Many professionals critical of the meter base their criticism on the lack of theory to support the meter's curve.

To Scubapro, that's unacceptable. If it bends divers, "show us," they say. President Dick Bonin says that no one from recompression chambers has presented Scubapro with any information indicating that the meter caused the bends. Bonin said that safety is their primary concern and nearly pleaded for cases to come forward if they were indeed there. Scubapro is tired of the innuendo about the meter and if a recompression facility would present them with factual data "it would be beautiful," Bonin said. They want proof, not hearsay.

Is There Evidence: Does Proper Use of the Meter Lead to the Bends?

Gathering evidence that supports a causal relationship between the meter and decompression sickness is no easy task. A bent diver would have to report the data of his dive (depth and time and surface intervals between dives). The meter should then be tested using the same dive profiles to verify that the reading demonstrated that a diver was safe to surface. One should verify that the meters were performing according to factory standards. And still, the cases rest on the word alone of the diver. A further difficulty is that medical records of divers are confidential so they can not be released for confirmation. Regardless, Undercurrent has received the following cases through interviews or in writing which must, in the final analysis, rest upon the word of the unfortunate diver.

Dave Desautels, Director of Respiratory Therapy at Shands Hospital, reports three cases of bends resulting from it (the Scubapro decompression meter) when used correctly and about seven cases in which the diver was using it incorrectly. Desautels said that many individuals and organizations in Florida have "recommended against using the meter for 3-5 years . . . and have subsequently reduced the bends cases."

Dr. Andrew Pilmanis is Assistant Professor of Physiology at the University of Southern California and Director of the Catalina Recompression Chamber. He told Undercurrent that "at least 8 cases (of bends at the Catalina Chamber) were a direct result of using the meter. Some of the divers used it correctly, others incorrectly."

Another source, a military man directly connected with a major chamber, requested to remain unnamed. However, he reported that several cases of bends he had recorded were from people using the meter correctly.

Red Howard reports two cases of the bends from divers using the meter correctly. He tested their meter according to the dive profiles they described and the meters indicated that it was safe to surface. Howard said that that information had been provided Scubapro.

Another unnamed source, a University professor, told Undercurrent of one person at his University bent using the meter correctly. His University has since banned the use of the meter on school diving projects.

In a letter to Howard, dated 6 September, 1975, Technical Officer Dawn West of the School of Underwater Medicine, HMAS Penguin, Royal Australian Navy, reported that in 112 cases of decompression sickness among their divers, "4 apparently were directly or indirectly caused by a DCM, and in another two cases the DCM might have contributed to the accident. In four of these dives the meter either provided less decompression time than the Royal Australian Navy Tables (which differ from the US tables) or required no decompression. In three of those four cases the meter "was tested here at HMAS Penguin and found to comply with the manufacturer's standard for testing."

Approximately 1% of the divers observing the Navy Tables develop symptoms of decompression sickness. To compare the value of the Scubapro meter vis-a-vis the Tables would require a similar analysis of divers depending solely on the meter.

How the Meter is Viewed by the Diving Public: Is it to be relied upon?

During the last three months we have talked with nearly two dozen divers who either use the meter or have used it. The sample was not scientific, but the impressions we gained we believe to be fair. Most seem to believe that it's "a bit off" the Navy tables but don't know how or why. One diver told us that he uses it defensively. With his watch, his depth gauge and the meter he can pretty much determine when to get out or when to decompress, but the meter is only backup. "If I forget the tables I have the meter." Another said that "as soon as the needle hits the 'E' in 'SURFACE' I get out of the water." It would seem that his intuition has given him a way to correct the meter reading vis-a-vis the Navy tables.

On the other hand there are those who trust it blindly. An "old pro" with whom we recently dove in the Caribbean typifies this type of diver. His first dive of the day would invariably be a bounce dive where he would drop to 150 or more for a few minutes, then ascend slowly and burn up the remainder of his air in 30 feet of water. His second dive would occur in less than one hour and he would stay at 30 feet, but might drop to 60 feet, still depending upon the meter for his decisions to leave. He used no watch or depth gauge.

Many persons we interviewed said that the real danger in the meter is that it invites dependence. Divers who use it regularly often use the meter without a depth gauge and a watch or if they are carrying those instruments, they pay little attention to them. Our observations over the years support this. It would seem that a substantial number of divers using the meter rely on it for their decompression or no decompression decisions.

The Instructions and the Shops: Do they breed meter reliance?

Does Scubapro suggest this reliance? In our discussion with the Scubapro team they surely did not, yet a reading of the meter instruction booklet raises questions. On page 6 they state that "proper decompression depends upon an accurate depth reference. Because of this the DCP should be used in conjunction with an accurate, de-

pendable depth gauge such as one of the Scubapro oil-filled models. An accurate check of bottom time requires the use of a dependable diving watch."

A watch and depth gauge, however, must be used in conjunction with some set of tables and which tables are not suggested by the instructions. Since the meter does not parallel the U.S. Navy tables we would expect Scubapro to provide their own tables consistent with the meter, but those aren't provided. Instead, on the back of the instructional booklet is a curve entitled "Recommended No-Decompression Limits." It resembled the U.S. Navy tables and when we asked at the meeting with Scubapro officials about the curve Mike Coffey confirmed that the curve was the U.S. Navy curve.

The use of the Navy curve in the Scubapro brochure raised two questions which we addressed to the group. First, did Scubapro realize that on page eight of their instruction manual they prominently display the face of the meter allegedly after 19 minutes at 120 feet and state that "the diver could ascend to the surface at 60 feet per minute without decompression." The Navy tables show fifteen minutes and their graphs appears to show 14 minutes. Did Scubapro realize that if they were to plot their own example on the published curve that it would show that decompression would be required, contrary to the statement made inside the booklet? No, they had not realized it, was the group reply.

We also pointed out that if they were to plot the actual curve produced by their meter on top of the curve provided on the back of the instruction booklet, at every depth greater than 90 feet the graph would indicate that decompression was required while the meter would indicate it was safe to exit from the water. Was that not an inconsistency? Those around the table nodded, scratched their heads, and looked perplexed.

These inconsistencies become a bit more obvious when compared to the statement about the meter on page one of the instructions. "The DCP eliminates the need for complicated and optimistic guesswork by the diver. The unit is worn by the diver and is subject to identical time/depth exposure. The meter automatically computes the time/depth/decompression factor and this information is continuously available to the diver by referring to the Meter. Proper decompression is then obtained by following the ascent schedule prescribed by the Meter."

If the instructions are unclear, where else is the diver to get information about the meter? There are several sources, the most significant being dive shops which provide information at the time of purchase. We either called or visited ten dive shops, claiming to be interested in buying a meter but wanting to know about the operation and limitations. We were pleasantly surprised to find that nearly all of the salespersons grasped the mechanics of the meter, but just as surprised to learn that no one knew of the inconsistencies between the meter and the USN tables. In response to the question "did the meter basically read out the Navy tables," the answer was essentially "yes" in all but two cases. In those cases the salesperson said that there was a difference, but wasn't sure what it was and suggested that we use a watch and depth gauge and plan our dives. We asked five shop owners if they knew of the data generated by Howard and Schmitt (or similar data). None did.

A second source of information comes through certification courses. We have no way of learning whether instructions teach the facts about the meter or teach about it at all. But we did review instructional books and noted that Dacor's Diving for Fun tends to recommend against all meters, and the Council for National Cooperation in Aquatics' The New Science of Skin and Scuba Diving reports the limitations. It's also interesting to note that the NASDA book Safe Scuba has a picture of the Scubapro meter superimposed on a chart of the U.S. Navy tables. The statement says that on the dial of the instrument "the required decompression is reflected. The decompression meter accurately calculates repetitive dives and has a six hour memory zone. Since sport divers knowingly or unknowingly are on the repetitive tables when diving, this instrument is a necessity when Scuba diving."

Are there other limitations to the meter? The six hour memory zone.

When following the Navy tables a diver is instructed that any dive taking less than 12 hours after a previous dive is considered a repetitive dive. The reason is simple. Upon completion of the first dive, excessive nitrogen remains in the body. That residual nitrogen takes at least 12 hours to be eliminated. Repetitive dives increase the residual nitrogen dissolved in the blood. Therefore when using the Navy tables the diver always calculates his surface time of up to 12 hours to establish the plan for the next dive. In our research we located no sources to the contrary. Even the NASDS Safe Scuba book states the 12 hour limitation.

The Scubapro decompression meter has a 6 hour memory which the instructions explain as follows. "The Memory Zone represents residual nitrogen from the preceding dive. It will take six hours for the needle to return to its starting point. If you dive again within that six hour period the residual nitrogen saturation will be automatically added to the prescribed decompression for the repetitive dive."

Nowhere in the instructions is there a caution that the body takes 12 hours to eliminate the nitrogen absorbed under pressure and nowhere is there theory supporting a six hour memory zone. Nowhere is there the caution that the meter may not be valid for repetitive dives undertaken after 6 to 12 hours surface time. Yet Mount, Wolfinger, and the National Oceanographic and Atmospheric Administration (NOAA) recommend that the meter not be used for dives with surface duration from 6 to 12 hours. Mount states that "if we use the tables as a safe reference then we can state that repetitive dives with a surface interval over 6 hours and less than 12 hours on the meter is unsafe and should be discouraged." When Undercurrent asked the Scubapro faculty whether this meter limitation posed a problem we were told that the 6 hour memory was adequate for the dives performed by scuba divers, but we were offered no supporting data.

In addition, Mount determined that the meter "apparently reaches a total saturation with a bottom time of two hours." There is no mention of this in the Scubapro manual nor did we discuss it in our meeting with Scubapro.

Official Use of the Meter:

We asked whether there were any organizations which officially sanctioned the meter. No names were provided. We have learned that the University of Miami, the University of Michigan and Scripps Institution have banned the meter. It is not authorized by the U.S. Navy. Two oil rig sources quoted earlier, Lundberg and Edel, said that it is not used in the commercial industry. Edel stated that no company in his business, professional diving, will allow use of the meter. Lundberg said that "there's a verbal agreement in the industry not to use the SOS. It is not recognized as a safe method of decompression." NOAA permits the meter use if the dive officer permits it, but at the same time states that the meter should not be used if the U.S. Navy tables can be used or if the dive will require decompression.

The Facts on the Meter: What the Diver Should Know According to Scubapro

As we have indicated, in our discussions with Scubapro personnel, no effort was made to refute the data so far presented, with the single exception that they had no evidence that anyone had been bent using the meter. We then explored the question whether Scubapro has or should inform the diver of the facts of meter operation.

Scubapro acknowledged that they have not published the curves for their meter. And they did indeed acknowledge that the curve published in their instruction booklet was the USN curve. We asked whether it would be possible for them to publish

the meter curve and the group at first said that there was an infinite number of variables and it would not be possible to develop them in chart form. President Bonin said "it's virtually impossible to mention all the discrepancies. Where do you stop?" We pointed out the possibilities are no greater than the possibilities under the USN Tables and those had been published in chart form. Tony Christianson acknowledged that it would be "theoretically possible, but difficult."

We asked whether a diver ought not to know what the meter will do and the consensus of the group seemed to be that the diver should not. That of course is supported by the behavior of the company, which has so far not informed divers of the meter facts. When we explored the question "why the divers should not know," there was basically a single response. The Board Chairman and the President replied such facts would only "confuse the diver." Dalla Valla said that "they must simplify diving for divers" and everyone seemed to agree. No one wanted divers to be confused by the complex information. Christianson suggested that the typical diver doesn't think about the tables or the meter's tables. Yet when asked whether this was reason for not providing the specifications of the meter the question got lost in further discussion.

Christianson, a consultant to the firm, said that he believed the company was concerned about letting the diver know the full facts about the meter because it "might destroy the market for it."

We asked whether it was not possible to modify the face of the meter or the instruction booklet and Dalla Valla said "if we find a way to do it we will and if not we won't." There was some modification roughly two years ago. A sentence was inserted in the instruction which reads "For maximum safety, on dives in excess of 150 feet, divers should decompress for a minimum of five minutes at ten feet even though the meter may not indicate decompression is necessary." That would seem to be an acknowledgement of the data developed by Howard and Schmitt, among others.

Dick Bonin pointed out that they had devoted long hours to discussing revisions but they could not determine the best means. Even with what they believed to be a valid track record for the meter, they could not dispute the U.S. Navy tables because "the U.S. Navy is the authority." At least it is perceived as the authority, even though Scubapro believes the meter is far superior to the tables for sport divers. Dave Denis, former Scubapro Director of Engineering, said in a telephone interview that "the face could be redesigned, but even that is a major job, taking up to a year, and what do we do with the meters on the shelf?"

There have been offers to help. Peter Wolfinger provided several ideas for diver modification of the meter face which have some merit for factory revision of the face. Howard and Schmitt presented a research proposal which included developing a full range of accurate data about the meter and revising the instructions. And there have been a range of other proposals both from outside and within Scubapro. With the one modification of "taking five at ten" the company apparently has decided to stand pat.

For the Careless Diver: An important device.

Besides citing the good track record of the meter, Scubapro makes another claim for its meter which was best explained in our conversation with Dave Denis. Denis said "a lot of people are saved using the meter. One is better off using the meter and staying an extra five minutes longer than he would be by not paying attention to the tables and staying longer than that." In our meeting with Scubapro officials the point was made so many divers fail to observe the tables that the meter becomes their only safety device. We did not pursue the question whether they ignore the tables because they have the meter or if they dove without the meter whether they would still ignore the tables.

We have observed countless divers who pay little attention to the tables, but rather dive on intuition. Few have memorized the tables. Most have a feeling for the tables and don't get into trouble. For the diver who otherwise avoids observing the tables, the meter would seem to provide a valid safety margin for dives less than 90 feet. We spoke with no one who indicated disagreement with this use of the meter.

Howard, who has repeatedly urged Scubapro to modify the meter and the instruction, sees this value. He believes that the meter has a place on the market and that it probably has prevented a number of divers from having serious problems. On the other hand, he sees severe risks if the meter is not modified and has expressed those risks in writing to President Bonin. On January 24, 1975, Howard wrote to Bonin that the meter "permits no decompression bottom times appreciably exceeding the safe limits advocated internationally in standard decompression tables. This problem is easily demonstrated in the laboratory, and has apparently and unfortunately been verified in the field . . . I am confident that the (meter) can be altered to provide satisfactory guidelines . . . Surely you concur that this could be done more promptly and properly without governmental intervention."

A Point to Ponder

For several years Scubapro has been working on a more complex meter to read decompression or no-decompression times for each of the four body tissues. Dave Denis said that "Scubapro had been counting on having the new meter and that's why no changes were made in the old one." Dick Bonin explained that nearly \$300,000 had been spent trying to develop their new meter. It didn't occur to us to ask "why, if the meter has a perfect track record," as Scubapro claimed in our conversation, "would they spend \$300,000 developing another?" It's a point worth pondering.

Conclusion:

For the time being we will draw no conclusion except in the commentary that follows. We would like, however, to solicit the feedback of our readers. We would like additional facts on the meter. If you have used it successfully let us know. If you know of cases where a diver using the meter was bent, let us know who he

THE UNDERCURRENT PHILOSOPHY

We have been informed that the Diving Equipment Manufacturers' Association (DEMA) "is concerned" about *Undercurrent*. The industry apparently wonders whether the "*Undercurrent* philosophy" is to seek government regulation of the sport or whether *Undercurrent's* stories will lead to government control.

With respect to the first point, *Undercurrent* can foresee no circumstances in which it would support government control of sport divers. Nor do we see any reason to support government control of the industry if the industry demonstrates honesty, technical proficiency and self-regulation. On the other hand, we see no harm in an occasional nudge by public officials. We reported that the Los Angeles Dive Law (*Undercurrent*, 1975) had a beneficial effect on the industry from the standpoint of the sport diver. We believe that the Consumer Product Safety Commission played a valuable role in "helping" Farallon advertise the recall of its faulty decomputer (February, 1976).

We don't permit government fishing expeditions into our files (no one has asked, by the way) nor do we call officials to tell them what we know. We interview public officials in conjunction with stories, but we do not call to inform. We believe the industry has the capacity to regulate itself—but, like any industry, it will move slowly unless prodded. We'll continue to prod.

There are a few people who still believe that it was the press, not his illegal and immoral behavior that brought about President Nixon's downfall. If that's your belief, then you don't understand the press—or *Undercurrent*. If a diving manufacturer or a product is affected by an article in *Undercurrent*, it will be the result of facts, not philosophy.

ABOUT THE AUTHOR

The author holds a bachelor's degree in mathematics, has worked for the National Aeronautics and Space Administration, and is an occasional instructor at the University of Southern California where he is completing his Doctorate in Public Administration. In 1974 he managed a successful \$500,000 state-wide initiative campaign in California to end secrecy in politics. He bought his first front-entry dry suit in 1956 and his first Scubapro Decompression Meter in 1975.

is and how to get in touch with him. If you have your own experiences with the meter, let us hear from you. We believe a story of this significance requires continuing attention.

Undercurrent Comments:

The debate on the Scubapro meter has been kept in the closet far too long. Our intent is to bring it into the sunshine for full inspection so that the facts may provide a resolution.

We believe that the sin in this case is one of omission, not commission. Although the juxtaposition of the meter and the Navy tables may lead a diver to presume that the meter and tables are in agreement, we have no information to suggest that there has been any effort to intentionally mislead the diver. Rather, we believe lack of responsibility is represented by withholding important information about the meter from its users. We have no doubt that shops which sell the meter, and instructors and sport divers who use the meter, have received inadequate information about the meter's capabilities. We believe that not only do divers have the right to know such important information about life supporting equipment, but also we believe that Scubapro has the responsibility to provide that data. We see no merit whatsoever in the argument that "divers will be confused" or that the "market for the meter will be affected." Hiding behind such claims reflects a pre-Watergate mentality, a fear that the truth will be damaging, and utter disregard for the ability of the sport diver to make his own decisions based upon the facts. If Scubapro cannot provide facts that support the use of the meter then what does support the use of the meter? The burden of proof is on Scubapro.

Undercurrent believes that the sport diver has the right to know as much about the life sustaining equipment he purchases as the manufacturer knows about that equipment. The diver has a right to know that the Scubapro meter differs substantially from the U.S. Navy tables. The diver has a right to know the reason behind the difference. Scubapro has an obligation to justify that differential. Though they complain of the innuendo and secrecy of those who are critical of the meter, they themselves offer inadequate data to support their claims of safety and no hard data to support the decompression limits established by the meter. If we are to believe Scubapro, then let them step forth with the facts.

Our industry and every company within the industry has a right to pursue a fair profit and a right to resist government intervention. The industry has long sought to retain its free market place and we don't deny that right. Yet, when American business operates in the free market, it is not best known for its unswerving protection of the interests of the consumer. History is replete with examples proving business not only needs gentle prodding, but it occasionally needs a heavy club if the consumer is to get his due protection. Ignoring the consumer is the single most important reason for government intervention, whether it be into the railroad, drug or automobile industry. If we are to preserve a free market in diving, then the consumer-diver must be zealously protected. One way is to ensure that he has all the relevant information about products so that he can make his choice wisely and correctly. If that information is withheld, then the free market benefits the industry alone, not the diver. That's not fair play.

Oceaneers, Kaloa Beach Hotel, Haiti

Can the Witch Doctors Bring Fish to the Reef?

I had never seen a face so black. Nor blacker eyes. Her body moved boldly to the incessant thumping of the drummers. As I watched her sensual movements her eyes frequently struck mine, not in passing, but in concentration. I wished to reciprocate but in a setting so alien I was unsure of myself. When she stared, she stared without a blink, as if entranced, yet her body continued to match the pounding rhythm. I could only turn away, hoping to be marked, yet afraid to be.

Twenty others danced, some in one place and others in a continuing circle, kicking up dust from the temple's dirt floor. Many chanted. Some moaned, but the 50 Haitian bystanders remained silent. The Beaucour bounced around the altar, shaking his rattle to encourage the building frenzy. Two women, now hypnotized by the beat, spun wildly around the room, falling into those of us who had come together. And the beat went on.

We had been told before we came that we may very well be the first outsiders to visit a voodoo ceremony in this isolated village two hours from Port-au-Prince. As we drove down the road through the black night, candles and charcoal glowed in mud houses along the road, but otherwise the only light came from our headlights. We drove for fifteen minutes over a road as rugged as a streambed, then abruptly turned off the road toward the mountains. The side road worsened, but in a minute or two we pulled into a short driveway. The driver turned off the lights and the motor.

The drums beat loudly. People were dancing. Some were chanting. And a hundred or so Haitians watched carefully as we nine Americans climbed from our van whispering nervously among ourselves. Immediately our bearded leader, Gene, was singled out by the Beaucour--the Voodoo chief--not because anyone had told him he was number one, but for intuitive reasons we never understood. The Beaucour beckoned to two women who stepped in behind Gene and crossed two flags behind his back. We were led past the dancers and drums into the temple.

In the background only the drums sounded. Gene was led to an altar in a tiny room and asked to sit, then told to rise. He was led from room to room while all along the path candles flickered across hanging pictures of Jean Claude Duvalier and Jesus Christ. There were hundreds of those pictures hanging in the darkness, all of which seemed to have been cut from popular magazines.

The group was led through several rooms down a passageway. In the last, a dark, tiny, musty room, three caskets lay, surrounded by bottles, trinkets, and pictures. On a baby casket sat a human skull. The Beaucour picked it up, turned it over, and pointed inside. It seemed as if part of the brain were still there.

I wondered whether my skull would be there for the next group passing through.

We were next led into the main room of the temple. It was a sparse room, again decorated with pictures, and lighted by a single lantern. Once we were seated in the corner the Haitians from outside filtered in to stand on the opposite side of the room. Artists, using what appeared to be rice, stooped over the dirt floor to create pictures with the kernels. After an hour, the altar was surrounded by intricate sketches of ships and crosses and animals. Immediately the drums began to beat and the drawings disappeared into the dirt under the dancers' feet.

I had noticed her gaze before the dancing began. After turn upon turn upon turn she came my way, falling into me and then into the others as she danced entranced. Then she stopped directly in front of me. I froze. In voodoo a living creature is sacrificed--a chicken, a goat, something. I prayed that tonight I was not the offering.

She reached down with both hands, running them through my long, curly hair. My fantasies ran wild. Surely the drums grew louder as her hands slipped down into mine. It was an invitation to dance.

Excited but frightened, I rose to dance. My body moved. Hers moved. We moved closer. Our hips touched. Our butts touched. Again. And again. To the rhythm of the drums.

To her it was voodoo. To me it was the bump. The crowd began to smile. Then laugh. Then cheer. We city-bred Americans and country bred Haitians had just discovered a common language in discotheque Voodoo. For the next hour, each American danced and we all left exhausted.

* * * * *

The splash of our anchor as it hit the water signalled the natives ashore to launch their craft. Four men, each ten years younger than his face indicated, shoved their boat into the calm sea. They were soon alongside and twelve of us climbed aboard for the trip to shore.

The village population numbered about 100 and nearly all watched carefully as we landed. We smiled to each other and we quickly became friends. There seemed to be as many children as adults, and hardly anyone between fifteen and thirty. They spoke Creole and we spoke English, but our joint curiosity and sensitivity to each other provided a bond for communication. The children played about our leader as if he were the piper. At the end of the stay, the village idiot came out to view us, himself a child of thirty whose genitals hung through his tattered pants as if pawnshop symbols decorated in bunting. He smiled infectiously and it was the smile that never left his face that labeled him the town clown.

The villagers lived in mud huts with woven roofs to protect them from the hot sun. There was little evidence of any exchange with their fellow countrymen on Hispaniola, twenty miles away, except for an occasional kerosene lantern, cooking utensils and the clothes they wore. They delighted in lifesavers, dimes, buttons and balloons. We bought beautiful shells for a dollar or two. We left after half an hour, knowing we had for a moment entered the nineteenth century just as the villagers, for a moment, had entered the twentieth century.

* * * * *

Indeed Haiti is a fascinating country, yet one overflowing with serious contradictions. It is one of the poorest in the world; for the few who hold jobs \$2/day is a top wage. Nearly everyone lives in hand-fashioned huts, scrimps for protein, and walks miles to collect water for drinking or washing clothes. Regardless, Haitians are kind and honest people, curious about strangers, but never hostile. The streets are safe and the smiles frequent. Haitian primitive art is the rage in the U.S., and the colorful murals decorating busses and shops give life and color to a poor country. Youthful Claude Duvalier has eliminated the tyranny perpetrated by his father, expecting to instill a kind of capitalistic dictatorship to improve the bleak economy. As the poor begin to taste foreign money, the roots of revolution will begin to sprout in the backlands. For the time being, however, the foreign visitor can experience the poverty and the peace of the Caribbean thirty years ago.

Daily the downtown is as crowded as Times Square on New Year's Eve. On the fringes of the sidewalk vendors and a million shoppers, one can stop at an old hotel such as the Oloffson to sip gin over, underneath a pith helmet, beneath overhead fans. But one should not come to Haiti for the decadent life. One should come to behold a prerevolutionary primitive nation beginning to awaken from a sleep imposed by tyrants, and to sample and explore the mystery and moods of its fascinating people, their voodoo and their art.

And one should not come just to dive. It does not rate among the very best in the Caribbean.

Perusing the advertisements, my eye spotted "HAITI" in bold print. I read on and decided to pay my \$359 for the five day/four night trip including air fare from Miami and "everything." The package and others are sponsored by the Oceaneers (5555 Hollywood Blvd., Hollywood, Florida; 33021; their toll free number is 800/327-3810), an adjunct of Take-Me-Along Travel. I and nine others were met at the airport by agency owner Gene Goldsmith, a nondiver and newcomer to the travel business, but with the sensibility and sensitivity to build an effective operation. At the Port-au-Prince Airport we were met by Gene Pavey, a gentle and enjoyable chap to whom I took a great liking. Both Gene and Stan contributed immensely to the camaraderie of the adventure. Neither, however, expects to on site for other tours, I learned, and I was on the first of their tours to Haiti. Oceaneers had opened the dive operation at Kaloa Beach and were seeking other sites. It will indeed be difficult to not give the best of reviews to an operation run by two such fine fellows, but I have my business and they have theirs.

My first point is simply a reflection on the nonsense cast by the entire travel industry. Eight days and seven nights (or five days and four nights) means six days and seven nights. Arriving at 7 pm the first night and leaving at 9 am on the eighth day to me adds up to six days, not eight. But then, I don't handle mathematics for the travel industry.

The Kaloa Beach Hotel is but a couple of years old and one wonders how it can stay in business. It is clean, well appointed and quite comfortable. And the staff is delightful, particularly the manager, Philip. Yet in the heart of tourist season it was less than one-third full and we--the first tour of divers--were among the one-third. Oceaneers hopes to fill the hotel with divers and they just may.

One disadvantage of being first to dive in an area--I'm certain very few have gone before--is that the guides may not have found the best dive spots yet. The converse is that by being among the first divers, one may encounter some surprising sights or even discover a treasure or two. To us, neither happened.

Captain Lee, an American expatriate, was our guide but he has since left and a new expatriate about whom I cannot comment has replaced him. There are two general areas for diving. On the eight day package there are five diving days of which two will be spent at the Arcadins, three small islands about a 25 minute boat ride away (assuming the boats are running properly). We spent three tanks at different spots along the patch reefs. They were pleasant reefs seldom exceeding 30 feet in depth; the visibility ranged between 30 and 60 feet. There were enormous sea fans perhaps the largest I've seen and on two dives eagle rays cruised in for nice photography. But I was disappointed in the fish life, seeing nothing more than the ubiquitous blueheads, grunts and hiding squirrelfish waiting for the sun to go down. My buddy and I did spend some time photographing a friendly French Angel, but other than that the Arcadins provided common Caribbean diving without unique fish, abundant schools, or startling coral or sponge formations.

But the Arcadins were a training spot, we were informed, the place to get our rusty snorkels wet before diving the great 45 mile long, Wall of Gonave. The brochure described it as "a huge underwater encampment bursting with sea life. Acres of shallow coral gardens at its top give way to twisted boulder strewn canyons forested with black coral. . .A dazzling realm for divers of all proficiencies.

This tends to be a fair description of any Caribbean wall--with permissible advertising puffery--and the wall of Gonave is similar to those other Caribbean walls in Cayman, the Bahamas, and elsewhere. But it did not seem quite as lush or as stimulating and it was curiously devoid of fish life. Oh, there were the common tropicals, but they were neither unique or abundant. The very largest fish that I or any other divers spotted in any of our dives, beside eagle rays which showed up here occasionally, were a couple of 3-4 pound snappers. Divers who ventured down to 150 to clip the black coral reported nothing different than what was found at 30 feet, 50 feet, or 100 feet. There were native fishermen along the reefs--their primitive boats at full sail against the sunset contribute to a romantic setting--but we speculated that they could hardly be the cause of limited fish life. They were few, they used hand lines, and we saw no evidence of substantial catches. Granted we dove in but three places, yet I talked with two other divers who visited the wall since my trip and they agreed with these statements. So there is indeed a mystery and, since I wish the Oceaneers good luck, I hope they find the fish.

The wall itself begins in 30 or 40 feet of water and goes down forever. Dropping down the wall is exhilarating sport for those who overweight and freefall, yet it is not recommended for amateurs. I enjoyed poking along the nooks and crannies to scout out the shy creatures, but I must reiterate. There were few surprises.

Now I must put this in perspective. Round trip boat trips to the wall take two hours (that should be the time with the new boat that apparently has arrived) so two tanks are the limit. There's no diving off the beach front and a couple of brief snorkel trips didn't turn up much. Regardless, the diving is enjoyable--quite similar, I believe, to Montego Bay, but nothing special. Frankly, for a person with a week off and hell bent on diving, I would recommend heading elsewhere.

But to some of us there is more than four tanks a day to our diving vacations. The food, for example, was as good as I've had in any dive resort, that is dinners were as good. Fish and beef were tops, always carefully prepared. Vegetables were fresh and cooked just right. One gets a choice of nine main courses and although lobster is on the menu, only one night it was available--the night one of our divers brought one back from the dive trip. Breakfasts and lunches are passable.

The two experiences beginning this article were mine and they are expected to be part of each dive trip to Kaloa Beach. Presently the two hour van trip to Port-au-Prince is brutal, but the road is supposed to be paved this summer. Until it is you will find yourself isolated except for the one day the tour group spends shopping in town. There's one night trip to the Casino, again over the same road, and unless you're an inveterate gambler, the ride home after midnight can't be worth the trip. Expect music one or two nights at the Kaloa Beach, but other than that the nightlife centers around dinner, after dinner drinks and midnight beach strolls. Now that ain't bad. Or, for those so inclined, overnight guests can be arranged for a mere pittance by hotel staff since that's a noble business in Haiti. Day-time swimming and sunning, sailboating and horseback riding can entertain the non diver.

Divers Compass. . Stan and Gene offer a full travel service for divers which means you can call on their toll free number (800/327-3810) to talk about various spots and arrange airfare and accommodations through them; we have not tested their service, but our hunch is that it would be excellent. . tip the fellows who assist divers at Kaloa Beach; John-O has 5 kids and makes \$60/month. . when you bargain for crafts in the city try to get down to 25% of the original asking price on paintings, at least half on the others. . You can't buy candy, aspirin or film at the hotel so come prepared. . we spotted few shells. . . . C.C. 2/28/75

Correspondents located strategically in the major diving areas of the world as well as on all coasts and major inland waters of the continental United States.