

**Yet Another Benchmark - Part II**

**Risk Management & FTA**

**ZACATON: The Tragic Death of Sheck Exley**

**Log of A Future Dive**

**Pushing The Ressel**

**Diving Pioneers & Innovators: A Series of  
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# Editorial

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Welcome to the 12<sup>th</sup> issue of Tech Diving Mag.

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A combination of historical diving landmarks, interesting stories, research initiatives, exploration attempts and first-hand experiences are put together by our generous contributors for this issue: world renowned industry professional Bret Gilliam, technical diving instructor Albrecht Salm (PhD), accomplished diver, instructor trainer and book author Steve Lewis and cave explorer and instructor trainer Erik Wouters. Get to know more about them and read their bio at [www.techdivingmag.com/contributors.html](http://www.techdivingmag.com/contributors.html).

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As you might know, Tech Diving Mag is based on article contribution from the readership. So you're always welcome to drop me a line if you're interested in volunteering an article. One more much appreciated thing is your photos (even without articles)! For submission guidelines, take a look at [www.techdivingmag.com/guidelines.html](http://www.techdivingmag.com/guidelines.html).

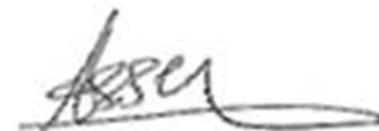
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Tech Diving Mag is very much your magazine and I am always keen to have your input. If you want to share your views, drop me a line at [asser@techdivingmag.com](mailto:asser@techdivingmag.com).

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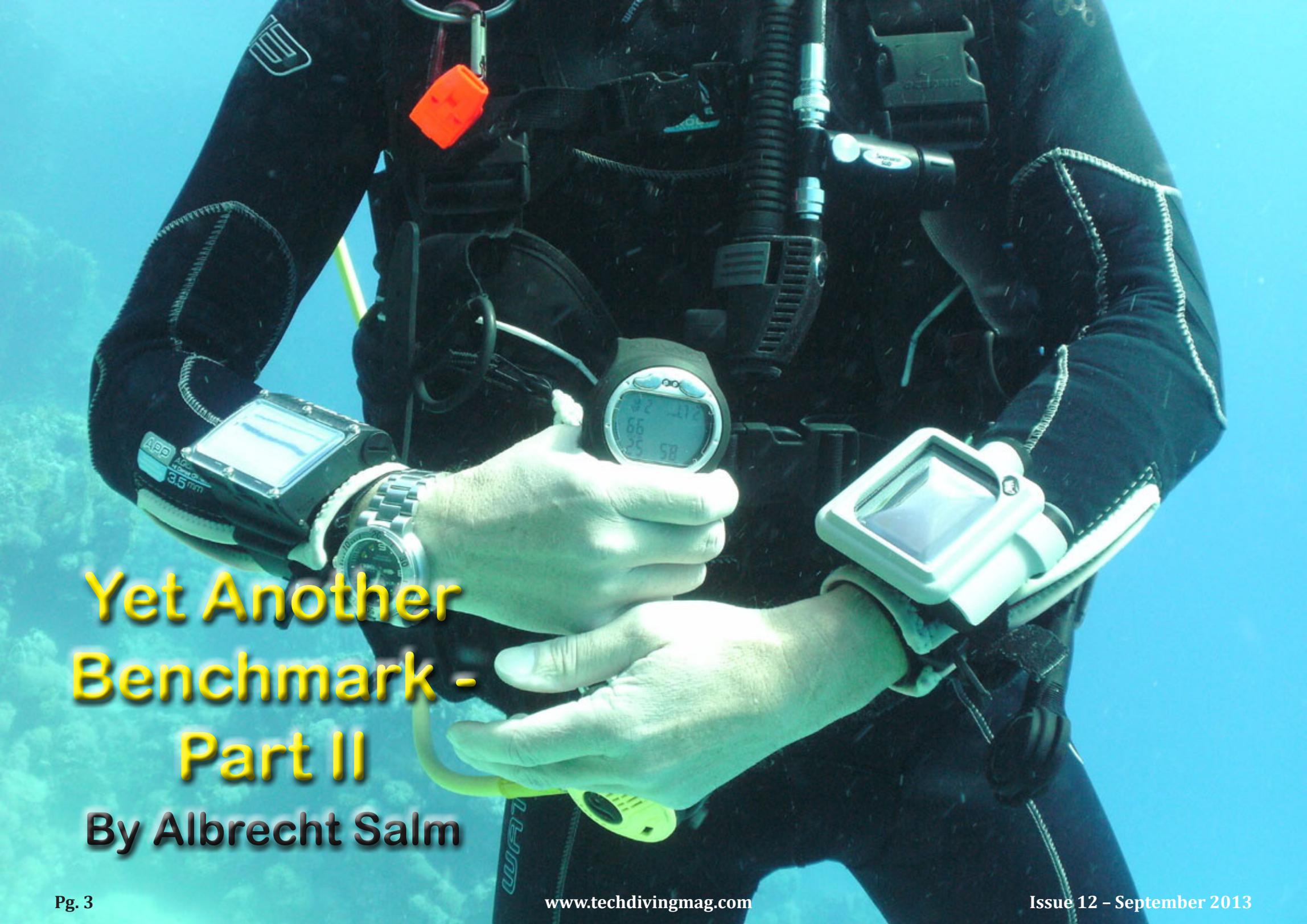
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**Asser Salama**

**Editor, Tech Diving Mag**



# Yet Another Benchmark - Part II

By Albrecht Salm

## Motivation

In “Yet Another Benchmark (YAB), Part I” (pls. cf. Tech Diving Mag, Issue 11, 2013, p. 3 – 10) we wanted to compare a couple of dive computers, diving tables and desktop deco software products with our notorious 42 m, 25 min dive on air. This, as such, is probably not a real tec dive to talk about for this magazine but a dive an ambitious recreational diver could do as well as a one tank dive. As well we wanted to lay in Part I the foundation to get the idea what is going on now in this issue, in Part II of this article.

Part II will cover the same dive and basically the same procedure but with a somewhat more technical, i.e. a non-standard mixture of Heliox20 (20 % Oxygen, balance Helium).

Basically we are going to discuss shortcomings not only of decompression algorithms in general but as well their implementations. This is more or less valid for all algorithms, be it a standard perfusion-dominated model like the Buehlmann-Hahn (ZH-L), Workman, diffusion-oriented like DCIEM or any colours of bubble models (VPM and VPM derivatives, RGBM, ...)

## The Heliox Test Dive

Let's recap YAB Part I, Table I: the air dive. The arithmetic mean of the TTS averaged at ca. 40 min, the standard deviation being ca. 18 min: that is, the most of the TTS fall into the region from 22 to 58 min.

Now here in YAB Part II, at Table II we have, again with the following data input:

- depth 42.00 m (freshwater, compensated for 25° C)
- instantaneous descent
- ascent with 9.0 m / min
- bottom time: 25 min

- 20 % O<sub>2</sub>, balance Helium, dry compressed air
- respiratory quotient = 1.00
- no workload
- ambient pressure at depth = 0m: 1013.00 mBar
- all standard gradient factors = 1.0 (i.e. 100 %), i.e.: no gradient factors at all
- no conservatism or J-factors
- no temperature adaptation
- no travel- or deco gases (the complete dive is done on the back gas)
- for ZH-L implementations, usage of the ZH-L 16C coefficients without the “1b” compartment

**Table II; Test Dive: 42 m, Bottom Time 25 min, Heliox 20 / 80**

| Type / Model / Version                         | time-to-surface (TTS) [min.]  |
|--|---|
| NHeO3 (11/2011)                                | 528 (Conservatism = 50)   |
| VR3 3.03 aC                                    | 295 (Conservatism = 0)  |
| Proplanner                                     | 206 (Conservatism = 0)  |
| NHeO3 (11/2011)                                | 196 (Conservatism = 0)  |
| Suunto Dive Planner 1.0.0.3                    | 177   |
| Professional Analyst 4.01.j<br>Cochran EMC-20H | 159; Conservatism= 50.0<br>(184 with version t; 181 with version u; 190 with version v) |
| Zplan v1.03                                    | 113   |
| Deco Planner 3.1.4                             | 107 (VPM = 2)   |
| Trust Trimix 2.2.17                            | 102   |
| M-Plan V 1.03                                  | 95; with Pyle Stops   |
| HLPlanner V 1.x                                | 90 (VPM = 0 %)  |

|  |  |
|--|--|
| Professional Analyst 4.01.j<br>Cochran EMC-20H | 87; Conservatism= 0.0<br>(93 with version t; 91 with version u; 98 with<br>version v ) |
| GAP 3.0.425.6                                  | 83; RGBM Recreational  |
| OSTC Planner v 434                             | 82; TDT: 107   |
| DIVE V 3_0                                     | 81; ZH-L 16 C (full blown numerical<br>solution)                                       |
| GAP 3.0.425.6                                  | 80; ZH-L 16 C  |
| Decotrainer V 3.01                             | 77; ZH-L 16 C mit $p_{H_2O}$ (without: TST = 67)                                       |
| M-Plan V 1.03                                  | 72   |
| Ultimate Planner 1.2                           | 70, TDT: 95  |
| Deco Planner 2.0.40 & 3.1.4                    | 70   |
| OSTC Planner v 470 Beta                        | 66; TDT: 91  |
| VGM ProPlanner Beta                            | 66 (default)   |
| Multilevel 1.6                                 | 65   |
| GAP 2.1  | 63; ZH-L 16 C  |
| GAP 2.1  | 53; RGBM aggressive (GAP 3.0.425.6: 30)  |
| GAP 3.0.425.6                                  | 50; RGBM nominal   |
| OSTC 3, V 0.9 from 05/2013                     | 41; 12/2', 9/5', 6/10', 3/19'  |

➔ legend to Table II: pls. cf. Tech Diving Mag, Issue 11, 2013, p. 7.

In order that these entries become comparable, i.e. that the inert gas dosing is more or less the same for all these schedules, we had to fiddle a little bit with the desktop deco-software products. Not all of them have all the parameters needed and some have unchangeable defaults.

This yields as well for the standard diving tables. There we have the phenomenon what we would call “undocumented features”. For e.g. for the USN 1983 table these are just some typos, or, later on for the 2008 version, as Ed Thalmann put it: “executive editing”. Just to put the results of Table II a little bit into perspective with regular and somewhat validated procedures in the US and the Canadian Navies, we have here Table III:

**Table III; Military Tables: 42 m, Bottom Time 30 min, Heliox 16/84**

| Stage /<br>Method:  | 18<br>m | 15<br>m | 12<br>m | 9<br>m | 6<br>m | TTS                          | Rem.:<br>(* ) 100 % O <sub>2</sub>                          |
|---------------------|---------|---------|---------|--------|--------|------------------------------|---|
| [min.]              |         |         |         |        |        | [min.]                       |   |
| U.S.N. old          |         | 10 (*)  | 45 (*)  | -      | -      | <b>58</b>                    | 140 feet  |
| U . S . N .<br>2008 |         |         |         | 18 (*) | 30 (*) | <b>72<br/>(+ 10)</b>         | 140 feet,<br>+ 2 * Air<br>Breaks,<br>each 5 min             |
| DCIEM               | 2       | 4       | 4       | 37 (*) | -      | <b>55</b>                    | I n - W a t e r<br>decompression                            |
| D C I E M<br>SurDO2 | 2       | 4       | 4       | 7 (*)  | -      | <b>72<br/>(40<br/>min *)</b> | 40 min Chamber<br>decompression,<br>with 5 min Air<br>Break |

Pls. note the various differences in the procedures (+ 5 min bottom time, dry decompression resp. SurD02, the surface decompression with Oxygen) and 4 % more inert gas, the various deco gases and the high pO<sub>2</sub> for the deco stages. So this is something you should not try out by yourself in open waters ...

The validation for each of these table sets is in the range of a couple of thousand dives, normally chamber dives with a controlled water temperature and a certain workload.

The underlying decompression model for the USN tables is a standard perfusion model with the compartments in parallel, whereas for the DCIEM it is a diffusion-based model with 4 compartments in series. Despite the very different decompression models, the TTS match a bit closer than those in Table II.

So let's look back to Table II: in the right column, the output of the TTS. Once again, our test diver will input all the TTS values into a spreadsheet. Then she will have fun letting it calculate the statistics: an arithmetic mean average of ca. 120 min, a standard deviation of ca. 98 min. This is a far broader range than for the previous TTS with the air dive in Table I. And this is, b.t.w., the rationale why we put such a relatively unorthodox mix for recreational TEC divers. As well the deco-procedure would turn out to be a bit cumbersome because no oxygen enriched gases were used. The deviations and / or errors in the various tables/dive computers/desktop deco software are thus much more pronounced: the more helium, the more! (pls. cf. Tech Diving Mag, Issue 5, 2011, p. 41 ff)

As well our test diver will notice the relation of  $528/41 = \text{ca. } 13$ . To narrow this a little bit down, she will eliminate from the list all TTS  $< 60$  min and  $> 180$  min. Because our girl had had a really good training during her career as a professional diver, she takes Table III into account and she will call TTS  $< 60$  min somewhat dangerous and TTS  $> 180$  min somewhat experimental, or, at least impractical, to put it mildly.

As well this mix makes clearly visible, if a procedure works with

tampered ZH-L coefficients: the original values are linked directly to the halftimes of the compartments; i.e.: basically the reciprocal of the perfusion rate (neglecting solubilities for the time being). These deviations from the standard ZH-L a- & b coefficients in the medium fast to slow compartments are brought to light via extremely long decompression stops in the shallow ... You may call this an "undocumented feature", or, to put it bluntly, errors in the calculations or negligent calculational procedures.

For professional use, i.e. construction and repair diving or saturation diving this Heliox20 is a more or less regular mix: but probably nobody in the commercial field would rely on the procedures or desktop deco software products or dive computers of Table II! One could as well question the wisdom of leaving a diver 3 to 8 hours decompressing for such a bounce dive (pls. cf. the 4 first entries at the top of Table II ...).

### **On P(DCS)?**

So the question would be, besides operational considerations like having enough gas or keeping a diver safe and warm for 3 to 8 h (and letting her [or him] pee and drink during these elongated periods ...): is there sort of objective reasoning, something like an Occam's razor, to separate the good TTS from the bad? Yes, there is, at least partially ... In YAB, Part I, we saw, that there are a couple of prominent factors, besides depth, time and  $fO_2$ , influencing the outcome of a dive. The outcome is: DCS, Yes or No? These factors are, among a lot of others, the skin temperature and the workload. So if your procedure is factoring these ones in: go with it!

And, btw., if you do, what a lot of other TEC divers do, i.e.: checking your dive comrades after a serious trimix-dive for inert gas bubbles with a little ultrasound doppler device, then you will collect your own

data on how you will use your gradient factors or not.

And there is still another one: it is the calculation of the P(DCS). P(DCS) is a measure of the statistical probability for a certain dive profile, if you would contract a decompression sickness or not. So a P(DCS) of 1.0000 (or 100 %) would mean that surely you will get bend, whereas a P(DCS) of 0 would imply the pure contrary, that is a relatively safe dive profile. The details and procedures we will cover in YAB, Part III, coming in this magazine early next year.

If we stay in this picture of Occam's razor, with the P(DCS) we are now working with a scalpel for microsurgery ... To arrive at a reasonable figure for P(DCS), we need thousands of thoroughly controlled dives with the medical outcome diligently documented. In the end there is a big pool of data where you can dip in your own dive and see if you could conduct your specific profile as planned, or if you should alter it a bit: i.e. make it shorter or shallower or more O<sub>2</sub>, or all of it. So to discuss the quality of the various TTS in Table II there are a couple of methods which rely on the TTS as such. One of them was developed by the United States Navy and by checking in the 2 screenshots below the entries designated as:

“Methode IV, NEDU Report 12/2004”

you will get a feeling why we are talking here about a very small razor. For our Heliox test dive the outcomes are for a

TTS of 40 min, P(DCS) is 0.11254 (1<sup>st</sup>. screenshot)  
TTS of 400 min, P(DCS) is 0.10463 (2<sup>nd</sup>. screenshot)

pls. cf. the following screenshots:

```
was jetzt?pdcs
Eingabe der TTS (fuer Methode IV) in min:
40
Methode I: Southerland 1992, P(DCS) = .19506
Methode II: PME enhanced 6 Compartments P(DCS) = .14138
Methode III: Stat. Tables Part VI, Model 4 P(DCS) = .20849
Methode III: obere Fehlergrenze, P(DCS) = .36221
Methode III: untere Fehlergrenze, P(DCS) = .16917
Methode IV: NEDU Report 12/2004, P(DCS) = .11254
Methode IV: untere Fehlergrenze, P(DCS) = .00643
Methode IV: obere Fehlergrenze, P(DCS) = .99988
Methode V: NEDU Report 03/2009, P(DCS) = .18064
SDEV = .03973 MEAN = .16762
```

```
was jetzt?pdcs
Eingabe der TTS (fuer Methode IV) in min:
400
Methode I: Southerland 1992, P(DCS) = .19506
Methode II: PME enhanced 6 Compartments P(DCS) = .14138
Methode III: Stat. Tables Part VI, Model 4 P(DCS) = .20849
Methode III: obere Fehlergrenze, P(DCS) = .36221
Methode III: untere Fehlergrenze, P(DCS) = .16917
Methode IV: NEDU Report 12/2004, P(DCS) = .10463
Methode IV: untere Fehlergrenze, P(DCS) = .00627
Methode IV: obere Fehlergrenze, P(DCS) = .99982
Methode V: NEDU Report 03/2009, P(DCS) = .18064
SDEV = .06293 MEAN = .20753
```

(The rest of the figures and methods will be described and discussed in YAB, Part III)

With a TTS for 40 min we reach a P(DCS) of ca 0.11, i.e.: 11 %, which means that in ca. 11 dives out 100 there will be DCS-related problems. Standard Navy procedures try to achieve approx. 3 to 5 %, the PADI RDP for eg. falls within a 2 to 3 % range. So staying additionally 6h in water decompressing will give you a statistical benefit of ca. just a half percent ... One important thing for the P(DCS) discussion is that your specific dive profile you want to check falls well within the parameters of the dives from the above cited data pool.

## **And bubble models?**

In contrast to the above cited perfusion models from Workman, Hahn, Buehlmann and others which rely on the dissolved gas phase only, the so-called “bubble models” try to consider the free gas phase. The free gas phase is just another word for “gas bubble”. As Haldane was pointing out already some 110 years ago, bubbles would hinder mechanically the blood flow and thus de-saturation. In the meantime it became quite clear that there is much more than blocking a blood vessel to DCS: there is a wealth of bio-physical and bio-chemical effects, primary and even secondary in nature, hard to reproduce and even harder to understand! Even micro-bubbles, unable to block but the smallest dead-ends of alveoli or just the surface, the gas-blood interface, of a gas bubble can do harm to you.

And this is basically the rationale why some think, that bubble models are somewhat superior to perfusion models. But this is more or less like Einstein’s relativity theory is somewhat superior to Newton’s mechanics. True, but only in certain aspects. For the day-to-day operations or walking ‘round the corner, driving in a car, and even flying in a hyper-sonic airplane, this superiority does not mean very much to us regular folks.

Let’s have a very quick, only superficial look, at one of the most prominent bubble models, the VPM (Varying Permeability Model). For the time being we neglect here the “RGBM”, the Reduced Gradient Bubble Model, because there is no cohesive and complete documentation of all the parameters and equations used. For the VPM, the inert gas partial pressures in the various compartments are calculated with the same method as the perfusion models do, it uses as well the same half-times. For determining the safe ascent depth (deepest deco stop, as you will have it), a couple of more parameters are needed, but these do not appear through a natural law or pure

reasoning, but instead through a best-fit of these free parameters to two traditional diving tables and the TEKTITE experiment. These have been the old U.S.N. and the RNPL air tables. The TEKTITE experiment being a saturation dive which happened to be in 1971 in the Caribbean, at the St. Johns island at 100 feet for 60 days with Nitrox10.

On the other hand it became as well quite clear that perfusion models with compartment half-times > 700 min are as well already “simulating” bubbles. This “simulation” of a mechanical hindered de-saturation came just with these long half-times, meaning a very limited perfusion.

## **My model is better than your model!**

Well, basically NO! All models are wrong, in principal. And some are even “wronger” than others; but a handful of them are at least useful to a limited extent.

## **Is there a way out?**

The above described method for getting at a P(DCS), that is an “a posteriori” analysis of the dive-outcomes, i.e.: “DCS yes-or-no” after a dive and a subsequent surface interval is a path, which has already been taken by various navies. But as well for recreational or TEC-rec. divers there could be a way out, if they are willing to contribute: it is DAN’s “PDE”! PDE is the “Project Dive Exploration” (more info at: [http://www.diversalertnetwork.org/research/studies/project\\_dive\\_exploration](http://www.diversalertnetwork.org/research/studies/project_dive_exploration)). DAN is collecting successful decompressions, i.e. the logfiles of the dive computers. Divers using the following dive computers: Cochran, Dive Rite, Suunto and Uwatec may contribute and send the logfiles to DAN for collection and subsequent statistical analysis. The basic problem of these huge data tomb of DAN’s is the following: the biometrics and specifically the skin-temperature

and the workload are not fully covered by the data sent in through thousands of divers. But anyway: it is a first and very important step towards the right direction!

### **What else?**

As well since the turn of the millennium there are things called “hybrid models”. These are combinations of perfusion- and/or bubble-oriented algorithms with ultrasonic doppler measurements. One of these hybrids is called “COPERNICUS”. It is a theoretical framework concerning bubbles, including the full scale of biometric parameters like: gender, age, aerobic capacity, BMI, workload and the like. The feedback through ultrasound doppler measurements at human divers is combined into the “deco stress”. The goal of all these hybrid models is to minimize this particular deco stress.

So after considering Part I & II, that is Table I & II, the very easy and basic take-home message is:

**“It doesn’t matter which model you use, provided it has a sound implementation!” ©ALBI 2008, Tech Austria**

Literature cited and sources for more information:

**VPM**; the real source being:

- D.E. Yount, D.C. Hoffman, On the Use of a Bubble Formation Model to Calculate Diving Tables. Aviation, Space, and Environmental Medicine, February, 1986: 57: 149 - 156. The rest of what is out there in the Internet is more or less padding; except the previous doctoral dissertation of Hofman himself:

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- UHMS ASM 2010, Session F10: Copernicus Decompression Procedures: NTNU, Brubakk et al.
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No-Fly Time Accelerator

O2[%] in the surface rich mix (99 or 100 for pure O2)

Use only pure O2 or nitrox mixes (not trimix or heliox)

Minutes of breathing pure O2 on the surface

Minutes of breathing normal air before applying the pure O2

Configuration

Units  
Depth  Meters  Ft. SAC (RMV)  Liters  Cubic ft.

VPM-B/U and Buhlmann-GF/U  
Symmetry [%]  100  95  88  78  67

VPM-B conservatism [%]  0  5  12  22  35  50

VPM-B tissue compartment set  Dec-12  ZHL-16

Buhlmann's model  ZHL-16B  ZHL-16C

Buhlmann's gradient factors Lo [%]  Hi [%]

Descent rate  m/min

Ascent rate - deep part  m/min

Ascent rate - shallow part  m/min starting at  m

Deco step size  m

Bottom SAC (RMV)  ltr/min

Deco SAC (RMV)  ltr/min

Minimum gas switch stop time (extended stops)  min

Last stop at double deco step size

ICD warnings for dives deeper than  m

Model the inner ear as  Lipid tissue  Water tissue

O2 narcotic in END calculations

CCR set points  Atm  Bar

An underwater photograph showing a diver in the lower right quadrant, swimming towards a large, dark, textured rock formation on the left. The water is dark blue, and a bright light source is visible in the upper left corner, creating a strong glow and illuminating the scene. The diver is wearing a black wetsuit, a blue tank, and blue fins.

# Risk management and the role of FTA in dive planning (FAULT TREE ANALYSIS)

By Steve Lewis

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The approach of most divers to risk, when they are taught risk management at all, is to assess risk based on its likelihood of occurrence. If the system designed to avoid or mitigate the risk being assessed has an “acceptable” degree of reliability, and the diver is familiar with and fluent with that system, the risk itself is said to be acceptable.

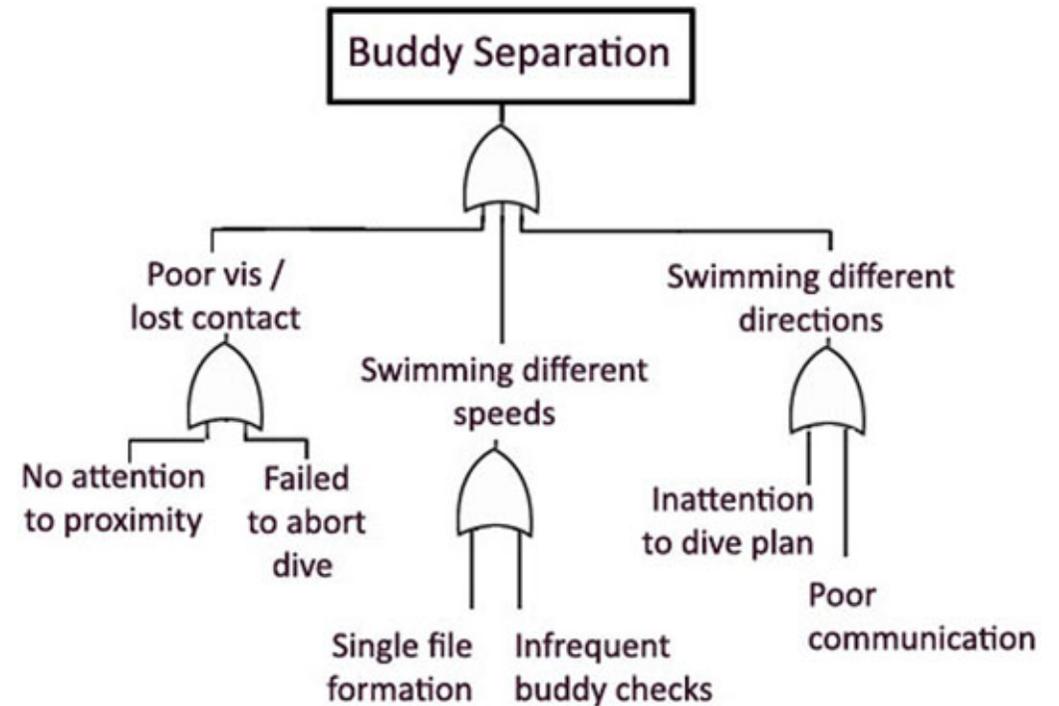
Another approach, and one all of us should be aware of, makes an assessment of risk based on the magnitude of regret should the risk happen. Individuals whose assessment of general risk falls into this grouping are most often unwilling to accept risk no matter how unlikely the event, and rarely if ever become serious divers... or one might venture, divers at all.

You may have heard it said that diving can never be safe and while the second approach to risk is safe, because no risk is ever acceptable, the first is not and in accepting it, we arrive at the first rule that we need to adopt as divers; certainly as technical divers. No form of diving is safe; and in real terms, no high-stress, high-risk, fun activity is.

However, this does not mean divers should be cavalier about personal safety or off-hand when it comes to risk management. Quite the opposite; the vast majority of experienced technical divers are what I would categorize as risk adverse. In other words, they use any and every tool they can to help them identify, assess, avoid and mitigate the risks inherent in poking one’s head underwater and breathing compressed gas.

In the art of risk management, one may use several tools to help. Perhaps the most engaging and simple to employ is something called Fault Tree Analysis. Here is a very simple example of a Fault Tree Diagram and how it can be used to analyze what went wrong... and

from that result, how it can be used to “fix” the problem identified in the initial analysis.



As you can see, the issue being analyzed is buddy separation. Something many divers have experienced.

Based on actual experience or reliable feedback, the Fault Tree Diagram lists lost visual contact; divers swimming at different speeds; and divers swimming in different directions as most common causes. Each of these causes is a “stand-alone” in this diagram and is connected with the fault (buddy separation) by the graphic element that signifies an OR statement.

For each of the three causes of buddy separation, the diagram lists a couple of contributing causes or effects. For lost visual contact it

highlights the dive team failing to keep close or not thumbing the dive as soon as it was apparent that the vis sucked.

Contributing factors to the cause swimming at different speeds, are shown as divers swimming in a single file formation, and divers conducting buddy checks too infrequently. This would be particularly true of the diver in the lead, wouldn't it?

When divers swim in different directions, the diagram indicates that the team has ignored their dive plan, or have poor communications skills.

### **Cheap and cheerful analysis**

As a result of this very simple Fault Tree Diagram, our Analysis of the situation and suggestions for managing the risk of buddy separation would run something like this.

To help lessen the risk of buddy or team separation, members should be mindful of losing contact because of poor visibility. If divers find the visibility poor during the dive, they should

- 1/ maintain close visual contact OR if visual contact is compromised
- 2/ abort the dive.

At all times, the team must swim at the same rate otherwise separation becomes more likely. Having the team swim side-by-side and conduct frequent buddy checks is the best strategy, but if swimming in single file is necessary, buddy checks must be made more frequently than usual.

One other issue is when a member of the team swims off in a different direction to his buddy(ies). A strong dive plan will only minimize this risk if it is followed at all times. Any mild deviation from this plan

(for example, swimming “off track” to explore something that looks interesting) should only be made if all team members can agree on the change, which requires excellent communications... which in turn requires pre-agreed signs or the use of a notebook or slate.

We can use FTA to overcome many of the risks associated with any type of diving, whether it be technical, advanced or basic open-water diving. The process of actually breaking the cascade of events that lead to the final risk and worst-case-scenario outcome can be beneficial to us all.

Try it sometime.



© T. Timothy Smith

A diver in a red wetsuit and blue tank is in the water in front of a rocky cliff with trees.

# ZACATON: The Tragic Death of Sheck Exley

By Bret Gilliam

© Randy Bohrer

*Zacaton* is the deepest of five ceynotes located on a large ranch, El Rancho Asufrosa, in northeastern Mexico. It was “discovered” by Jim Bowden and Ann Kristovich on a reconnaissance trip made at the end of two weeks of exploration and surveying in the Nacimiento Santa Clara, a cave system at the base of the El Abra near the Nacimiento Mante. Five ceynotes of variable size and character were located.

The team began the systematic exploration of the ceynotes. On May 2, 1990, divers Jim Bowden and Gary Walten entered the Nacimiento at the western boundary of the ranch. The river is formed by the spring run emanating from *Zacaton*. A typical “boil” was noted on the water’s surface near a limestone outcropping. Pursuing this current, the divers located a small cave and followed a northeast azimuth until they had exhausted the line on their reel. With passage obviously continuing, they turned the dive, obtained an additional exploratory reel, returned to their tie-off and resumed laying line. Now in the lead, Gary soon noticed a bottle green glow ahead. He covered his light and confirmed a natural light source that could mean but one thing, they had made a connection to the surface. The exuberant divers emerged into *Zacaton* at a depth of 26 ft. and surfaced in the beautiful ceynote which takes its name from the islands of tall grass, *zacate*, which float across it’s surface.

The “Proyecto” resumed the exploration of the five ranch ceynotes in April, 1993, fully equipped with mixed gas capabilities to allow the safer exploration of the deeper systems. Sheck Exley, perhaps the most renowned cave explorer of the era, joined the team for a week and with Bowden dove the previously unexplored depths. *Zacaton* revealed the greatest surprise. On air dives to 258 ft. by Bowden and 407 ft. by Exley, no bottom was in sight. The previously plumbed depth of 250 ft. was proven to be an error! The divers dove beyond the ledge which had captured the measured line in pursuit of the elusive

bottom. The following day, Bowden, Exley, and Kristovich returned to *Zacaton* to attempt a more accurate plumb. The line spun off the reel, past 500 ft. past 800 ft., past 1000 ft.! The weight finally stopped after some 1080 ft. had been measured.

The line was secured to the north wall of the ceynote and the divers completed plans to make a deep mixed gas dive the following day. In April 1993, Bowden dove to 504 ffw. and Exley to 721 ffw. Neither diver experienced performance difficulties or physiological complications during or after the dives. These two would be the first of seven sub-500 ft. dives made in *Zacaton* in a twelve month period. As the week of diving came to an end, Exley and Bowden agreed to return together to *Zacaton*, and like Hillary and Norkay, pursue the exploration of the depths of this upside down Everest. The apparent perfect site for an open circuit dive to 1000 ft. and beyond had at last been found. It was warm, there was no perceptible current, the natives were friendly, and access to the system was uncomplicated.

The goal was thus declared, that within the calendar year, a dive to obtain the bottom of *Zacaton* would be made by Bowden and Exley. Members of the Proyecto made six trips to Mexico during the ensuing twelve months. With each return, Bowden dove progressively deeper in order to prepare himself for the 1000 ft. attempt. Exley meanwhile pursued the exploration of a huge underwater cave at Bushmansgat, South Africa, diving to 863 ft. in this system. During this dive, Sheck experienced visual, somatic, and neurological symptoms of high pressure nervous syndrome (HPNS). The symptoms resolved during his ascent to his first deco stop at 400 ffw. and there were no persistent effects.



In April 1994, the Proyecto, including Exley and Mary Ellen Eckhoff assembled on the Rancho Asufrosa. Two days were spent staging the required decompression bottles at their specified depths in Zacaton and El Nacimiento. The dive would be accomplished on independent descent lines, a condition both divers favored to avoid contact and potential interference during the very rapid descent. Each effort would be solo by necessity. Exley would use Heliair 6 as his bottom mix, Bowden, Heliair 6.4. Both divers carried an assortment of tables since the exact time of descent (bottom time) and maximum depth of the dive was unknown.

Both Bowden and Exley made multiple deep air acclimation dives to prepare themselves for the 1000 ft. attempt. Early in the morning on Wednesday, April 6, 1994, all was felt to be in readiness and the divers and their support team assembled on the banks of El Nacimiento. Bowden and Exley geared up and swam together through “El Pasaje” and into Zacaton. The pre-dive mood was positive and optimistic. The men began their descent at approximately 9:50 a.m. central standard time. Bowden dove to 925 ft. and would spend nine+ hours decompressing. Exley, for reasons we will probably never know, failed to return from his dive. He had reached a maximum depth of 906 ft.

At about the same time that Exley entered the water that morning, I was in California attending a Board of Directors meeting of the National Association of Underwater Instructors (NAUI). I had been elected Chairman of the Board only moments before when a phone message was relayed to me in the meeting. The caller explained that Exley, my longtime friend and diving collaborator, was missing and presumed lost in Zacaton.

I was stunned and speechless with the loss. It just didn't seem possible to me that Sheck would not be coming back. Of all the divers I'd worked with on deep projects over nearly two decades then, Sheck was always the person whose opinion and perspective I most valued. I thought back to the reams of letters and notes we had exchanged over the years about dive plans, rigging, tables, and the analysis of fatalities of others we'd known. To hear that he was gone without a trace left me feeling like some part of me had been cut away. He was the most accomplished diver and technician I'd ever known.

Jim Bowden provides this account of that final day with Exley as they prepared for the 1000 foot dive.

*“The time between December and April had passed rapidly with preparations and planning consuming every day and night. In addition to three sub-500 ft. dives, I made over 30 dives in excess of 300 ffw. Some were done on air to acclimate and build up my narcosis tolerance. Many of these dives included skills testing at depth, primarily problem solving questions or tasks posed by a colleague on mix while I was on air. It was essential that I be comfortable with an equivalent narcosis depth (END) of 330 feet. My bottom mix of Heliair (69.5 He, 24.1 N2, 6.4 O2) called for an END of about 300 feet at 1000 feet. The bottom would demand that and more. I made one dive to 411 ffw on air, a record on air in a cave, but it was soon eclipsed by Sheck with his dive to 420 ffw on April 4<sup>th</sup> two days before our attempt for the bottom.*

*“Now was the time to fish or cut bait. The final preparations were made and the first support team left camp to put down decompression oxygen and my DiveComm full face mask that I planned to switch to at 20 feet. Shortly thereafter, we all left for the spring.”*



**Exley cutting special tables**

© Randy Bohrer

Present on the day of the dive was the team consisting of Exley, Bowden, Mary Ellen Eckhoff (Exley's ex-wife), Karen Hohle (Bowden's wife), Ann Kristovich, and Marcos Gary. Press representatives included a writer and photographer from *Sports Illustrated*, a photographer from *Destination Discovery*, and a television film crew from Channel 7 of Tampico. Also in attendance was the land owner and his family along with many of the local residents of the area.

Bowden continues, *"Sheck and I geared up and swam through the 600 foot passage, El Pasaje de Tortuga Muerte. to access our dive site. Surfacing in Zacaton, we swam slowly over to our descent lines. We commented on the beautiful day and wished each other luck. We separated at that time and went to our respective down lines. Time passed in silence as we calmed our breathing and focused our minds on what was ahead.*

*"After a time, I felt all was right and glanced over at Sheck. He seemed to sense my glance and nodded affirmation. I submerged and hesitated at 10 feet for a minute or so and then went into a free fall. I had planned a descent rate of one hundred feet per minute to 300 feet on air, then the same rate to 600 feet on Heli-air (50 He, 39.5 N<sub>2</sub>, 10.5 O<sub>2</sub>) and then switching to my bottom mix. I planned to slow my descent around 750 to 800 feet where I had first noticed the HPNS symptoms on my previous dive. All went according to plan. As I passed the 800 foot mark, I was conscious of very little tremor. I could just see Sheck's light in the distance. It was the last I saw of him."*

However, at 900 feet Bowden was shocked to find that he had breathed far more gas volume than he had planned. His bottom mix cylinders contained barely more than 1000 psi. At that depth, his regulators could not deliver if the pressure dropped less than 500 psi. This was a big problem and Bowden had to deal with it quickly.

*"I inflated my BCD wings and managed to stop my descent at 925 feet. I switched to the 80 cubic foot tank of bottom mix under my right arm and breathed that and then my travel mix back up to my first stop at 450 feet. By the time I got there they were both empty. To my horror, the regulator on my deep deco bottle free-flowed violently when I turned it on. It seemed to take a lifetime to shut it off again. I switched back to my back-mounted doubles to deal with the problem but I couldn't fix the regulator. The only solution was to open and close the valve with each breath. I had eight minutes of stops between 350 and 300 feet where my next bottle was hung."*

Bowden could breathe easier when he made it to the fresh decom bottle with a properly functioning regulator. Now would come the really long decompression and the worry about oxygen toxicity and bends. Another switch to air at 260 feet would see him to 130 feet and a 30% oxygen nitrox mix. That's when he knew something was wrong with Exley.

*"At 130 feet, I relaxed. Here I could clearly observe the line that Sheck used on descent. All of his stage bottles were still neatly packaged and unused. The sinking feeling in my heart was overcome by the confidence that he had gone deeper than I had and was probably still below me."*

But on the surface, the support team already knew that Exley was in trouble. Ann Kristovich had watched the bubble paths of both men on the initial descent. Bowden's bubbles disappeared at two minutes and Exley's vanished a few seconds later as they both reached the deep ledge at 250 feet. Only one set of bubbles re-appeared after about 15 minutes and she couldn't be sure if they were Bowden's or Exley's. Kristovich exchanged uneasy glances with Bowden's wife, Karen Hohle. As planned, she then dived to meet Bowden at the 47 minute

mark of the dive profile. She was relieved to find him but chilled to see Sheck's stage equipment still hanging with no sign of him. The grim awareness of the situation gripped the pair.

Meanwhile, Mary Ellen Eckhoff was watching from the cliffs with no knowledge of the problem. She joined Hohle at the surface and was appraised of the scenario. Concerned, but not panicked, by the situation, she grabbed an extra decom bottle to take to Exley and swam down to encounter Bowden and Kristovich. Now her worst fears were becoming reality. She hastily scrawled on a slate, *"I'm going to 250 to look for bubbles"*. Dropping over the deep ledge, she could find no sign of Sheck or any bubbles coming from the depths.

Hohle had scrambled into her gear and caught up with Eckhoff. *"I met Mary Ellen at about 100 feet on her way back up. She was crying and her mask was messed up. She wanted to go back to the surface but I grabbed her gauge and saw that it read 278 feet. I just held her. We stayed down for more than thirty minutes to get through the decompression. It was a very lonely time."*

Bowden was finally told that Sheck was lost as he reached his 60 foot stop. He felt himself grow numb from the loss and describes the remainder of his decompression as a mechanical exercise with little conscious thought. After a total of nearly ten hours, he surfaced but suffered a left shoulder DCS hit that then was treated with in-water therapy on the site. Bowden was now the first diver to successfully break the 900 foot barrier on self-contained scuba. His record depth of 925 ffw eclipsed Exley's old 881 mark.

There was no consideration given to mounting a body recovery for Sheck since it was accepted that the only man capable of effecting such a recovery was the man who was already down there. Three

days later while hoisting up the remainder of the equipment, Exley's body was found. He had apparently drifted up from the deep cave passage and become entangled in the line. One of his tanks still had gas and his computer read 906 feet, suggesting that whatever trouble he had did not occur until about nine minutes into the dive.

The best educated guess would point to an HPNS incident. Exley had experienced a bad one in Africa that resulted in uncontrollable muscular spasms and multiple vision. This may have manifested again with more violent tremors that could have triggered an oxygen convulsion or simply made it impossible to negotiate gas switches as necessary. His death will remain a mystery and a tragic loss to the cave community.

As Sheck's last dive partner, Bowden shares his thoughts, *"I've been angered by unkindness and idle speculation by arm chair quarterbacks. And I have been touched by those who seem to understand and genuinely express sympathy without the need to pull something out of my soul. Much has been written in praise of Sheck and more will come. Ultimately, he will represent even more to us as history and recognized as the pioneer he truly was."*

*"I first met Sheck in Mexico in 1988 when he was making his then world record dive to 780 feet in Mante. Sheck sought my friendship as I did his for the same reason: we were loners. He did that with other explorers in all parts of the world. He was interested, humble and supportive of projects than many of "new age" cave divers didn't even know existed. We had a common bond, an obsession, a passion... our love of exploration."*

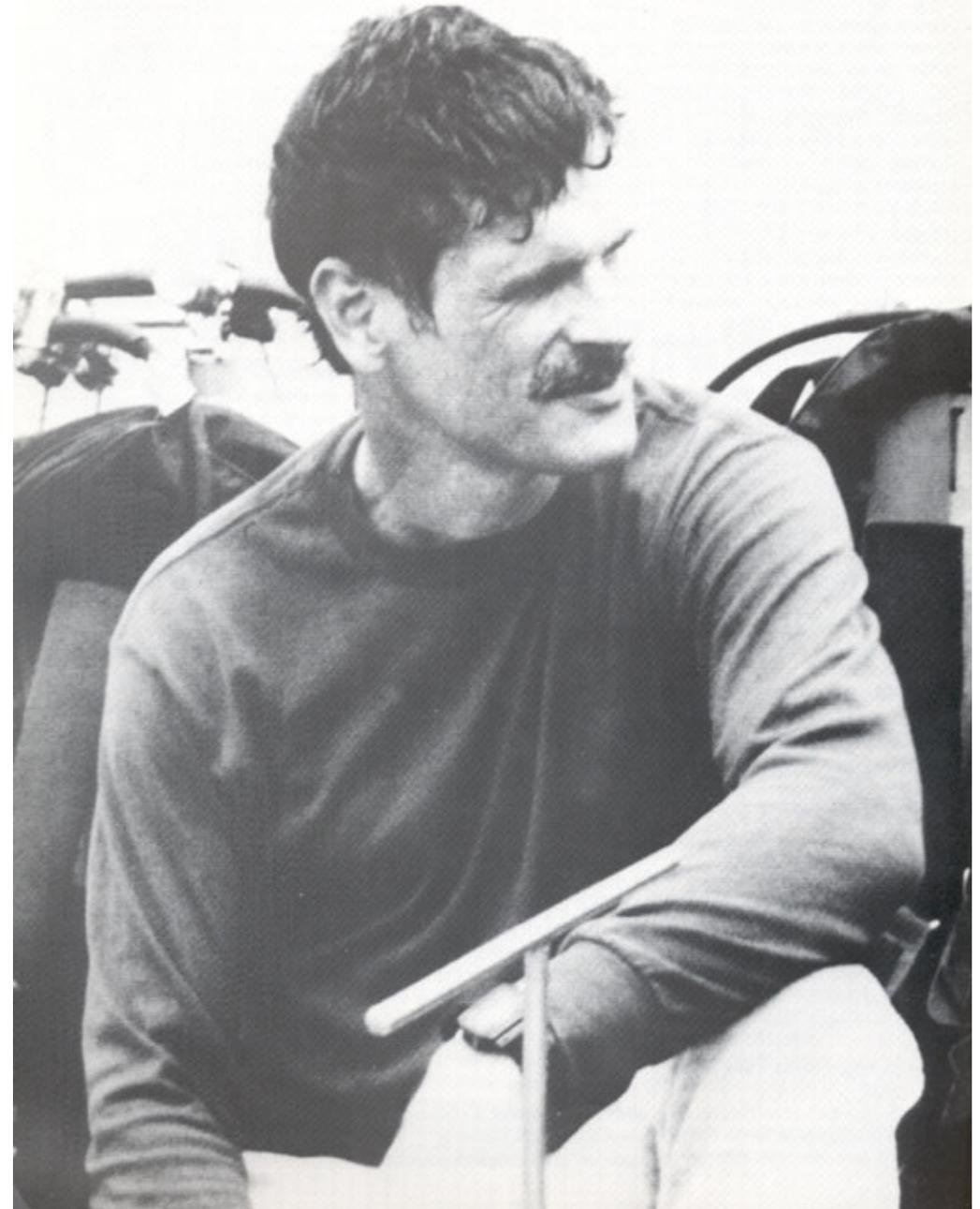
*“Exploration was a demanding mistress that got in the way of our relationships with others and I now could cause a lot of pain to those who loved us. We could spend most of day on a project without even talking to each other. Our personalities were direct opposites. He was the most disciplined man I have ever met with a brilliant calm intellect. Karen and Ann have both said that we looked like little boys who found the greatest treasure on earth when we realized that Zacaton was the ultimate world class deep system. I do believe that we both were never more alive than in those moments of trial in virgin space.*

*“Mexico loved him. He truly respected their culture and ways. The rural poor of Mexico have a remarkable ability to judge courage, honesty, and sincerity. The only time I allowed myself to succumb to emotion during those days of our loss and the recovery was when I walked to the edge of Zacaton and saw the simple cross and flowers put there by the people of El Nacimiento and Higeron.*

*“Sheck met life head on, with few misconceptions. Only death deceived him, taking him by surprise. I will miss him very much, but then we always dove alone anyway. Perhaps now he will be with me more than ever.”*

Exley’s loss shocked and saddened the entire world community of diving explorers. To this day, he is considered as the foremost leader in both cave diving and mixed gas diving techniques. He truly led the way and others followed in his footsteps.

### **Cave diving pioneer Sheck Exley**

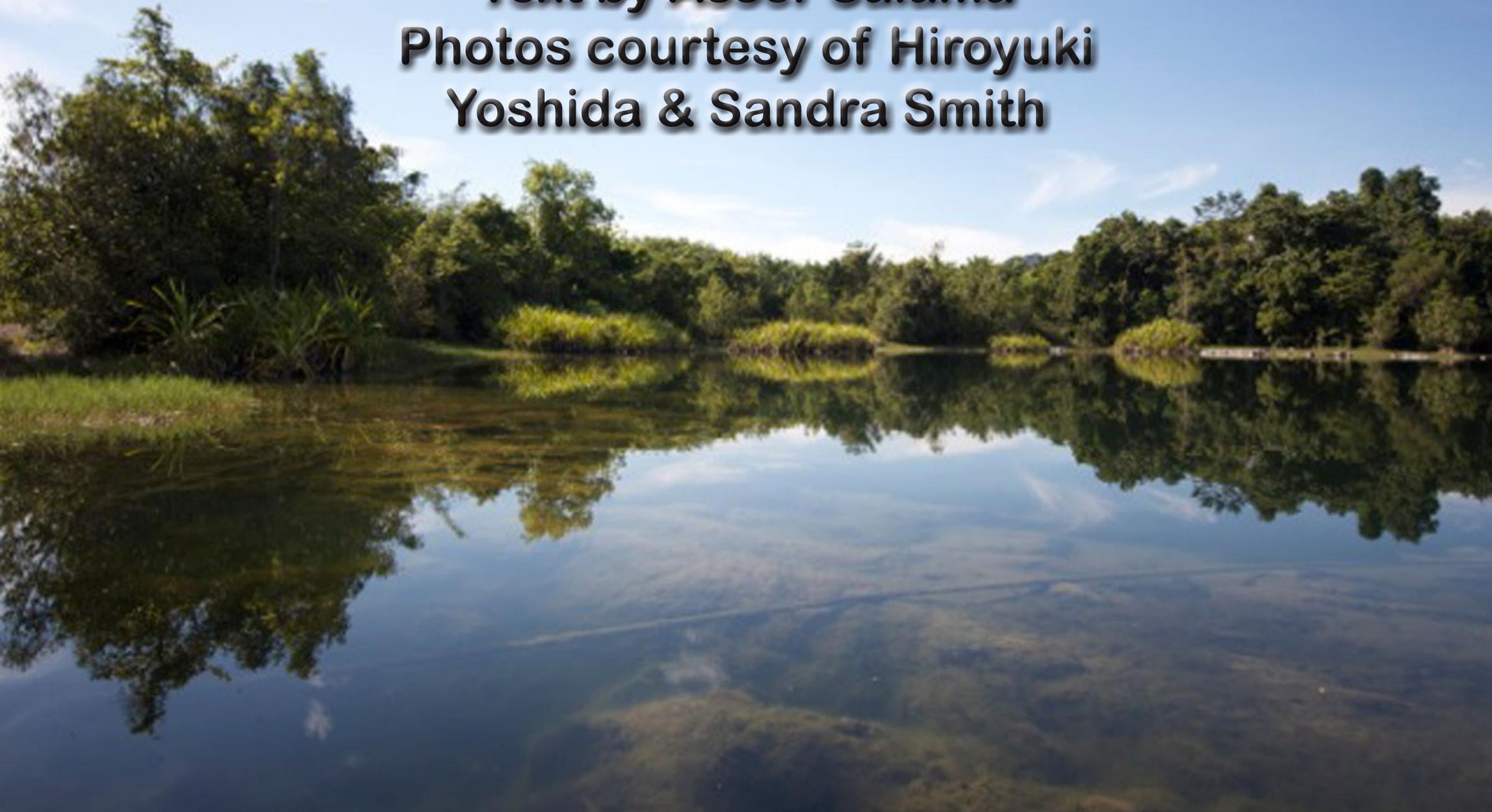


# Log of A Future Dive

Text by Asser Salama

Photos courtesy of Hiroyuki

Yoshida & Sandra Smith



**Date:** September 30, 2013

**Place:** Lake Song Hong, Thailand

**Maximum Depth:** 130 meters (427 feet)

**Type:** Cave

**Gear:** CCR – mixed gas

**Comments:** Deepest Underwater Wedding Ceremony!!!

Yes, what you've just read is true! Hiroyuki Yoshida and Sandra Smith are currently putting the final touches to their wedding, and it will be as mentioned above. As two dive enthusiasts and professionals, they're way better at planning dives than weddings!

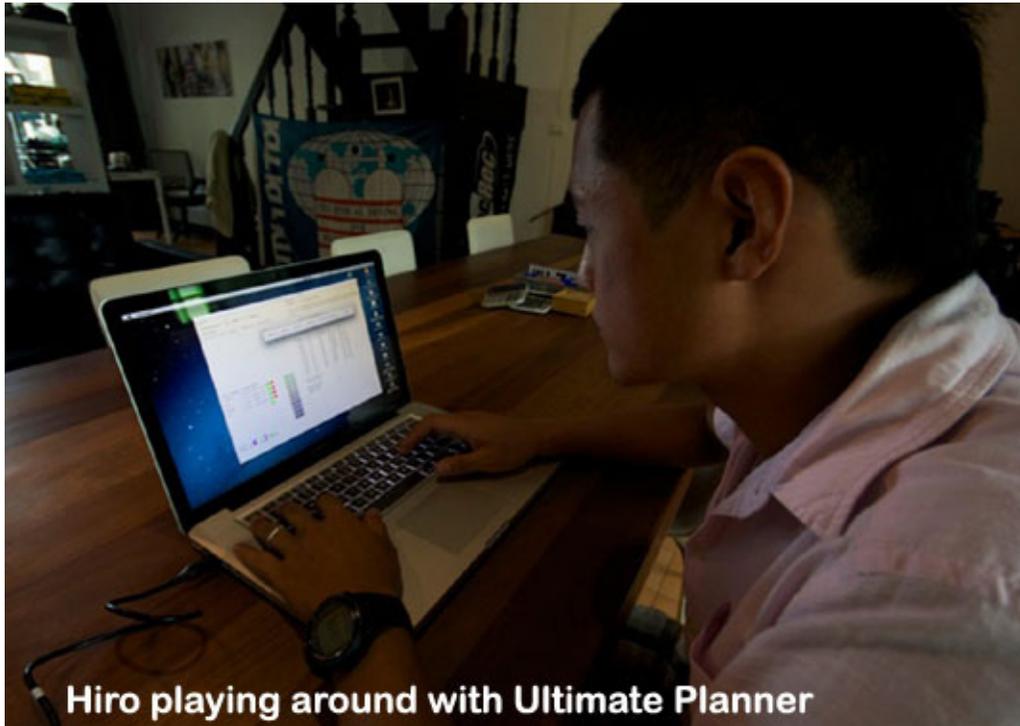
28 year old Hiro from Tokyo, Japan, diving since 2002, and 32 year old Sandy from New Jersey, USA, diving since 2005, have fallen in love with each other and with the sport of diving. Now they're both technical diving instructors. To proclaim their love for their sport, hobby and profession, they decided that instead of investing in white dresses and tuxedos, they'd rather invest in dive training, logistics and organization, which in turn will sharpen their knowledge, skills and situation awareness, both personally and professionally.

But who "on earth" is going to marry them at this depth? Since finding a minister capable of doing this sort of extreme dives is not an easy task, accomplished diver and instructor trainer Ben Reymenants has become an ordained minister. Now he legally holds the power to marry them. Ben is more than qualified for this task. His personal record is 239 meters (784 feet), and it was also in a cave! Moreover, he's the couple's instructor, and his facility, [Blue Label Diving](#), is helping with organizing the event. The dive team also includes Pekka Hartikainen, an experienced CCR instructor who will act as Hiro's Best Man.



An official category called "Deepest Underwater Wedding Ceremony" is to be initiated. For the attempt to be accepted as an achievement, Guinness World Records dictates that all divers must have two precisely-calibrated dive computers with them at the place of the ceremony in order to record the exact depth. Also video proof is needed. Hiro and Sandy, in the presence their ordained minister, must exchange vows (probably some invented coded gestures, doubled by underwater wet notes) and rings at the designated depth... on camera! The couple will be using their personal video set with the newly-bought 300 meter (1000 foot) rated housing. Hiro's Best Man will also record the event using another set.

For decompression planning, the couple is using [Ultimate Planner](#). *"Ultimate Planner considers a lot of new things that previous planning software have left out. We particularly like the conservatism a diver can add at various levels, such as the asymmetric gas algorithm and different ascent speeds."*



Hiro playing around with Ultimate Planner

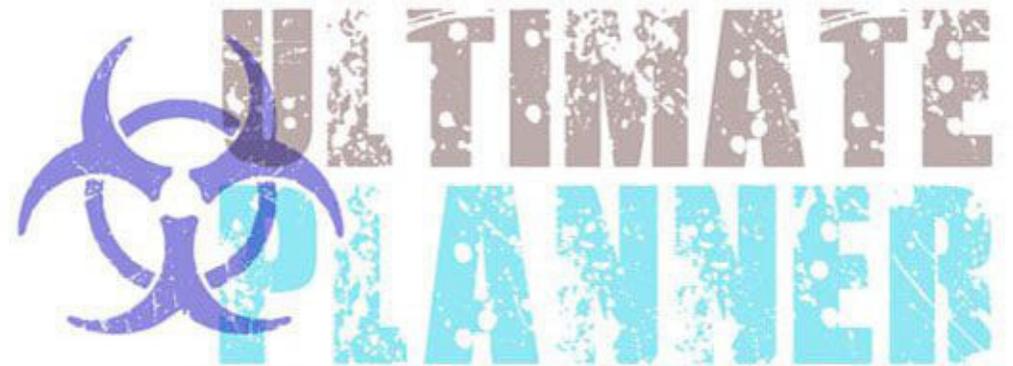
Several weeks later, Sandra adds: *“We have been using Ultimate Planner a lot this month for our big build-up dives that have been going on. We used it on a dive a couple of days ago to 132 meters (433 feet) and we were quite happy with the stop times it was giving.”*

Hiro and Sandy have finally found the perfect place to tie the knot. Sandra notes: *“We are now aiming for 130 meters (427 feet) instead of the 123 meters (404 feet) as originally planned. This past week we were diving past 100 meters (328 feet) to look for an ideal spot and found it just around 130 meters (427 feet). Off to the left side of the cave, just next to the wall there is a small piece of rock that comes up from the bottom and forms sort of a natural table. It’s gorgeous there as there is a partial bottom which is like white sand with big limestone rocks in and around. We kind of all thought it looked like a Japanese Zen garden.”*



Lake Song Hong, Thailand, where the wedding should take place

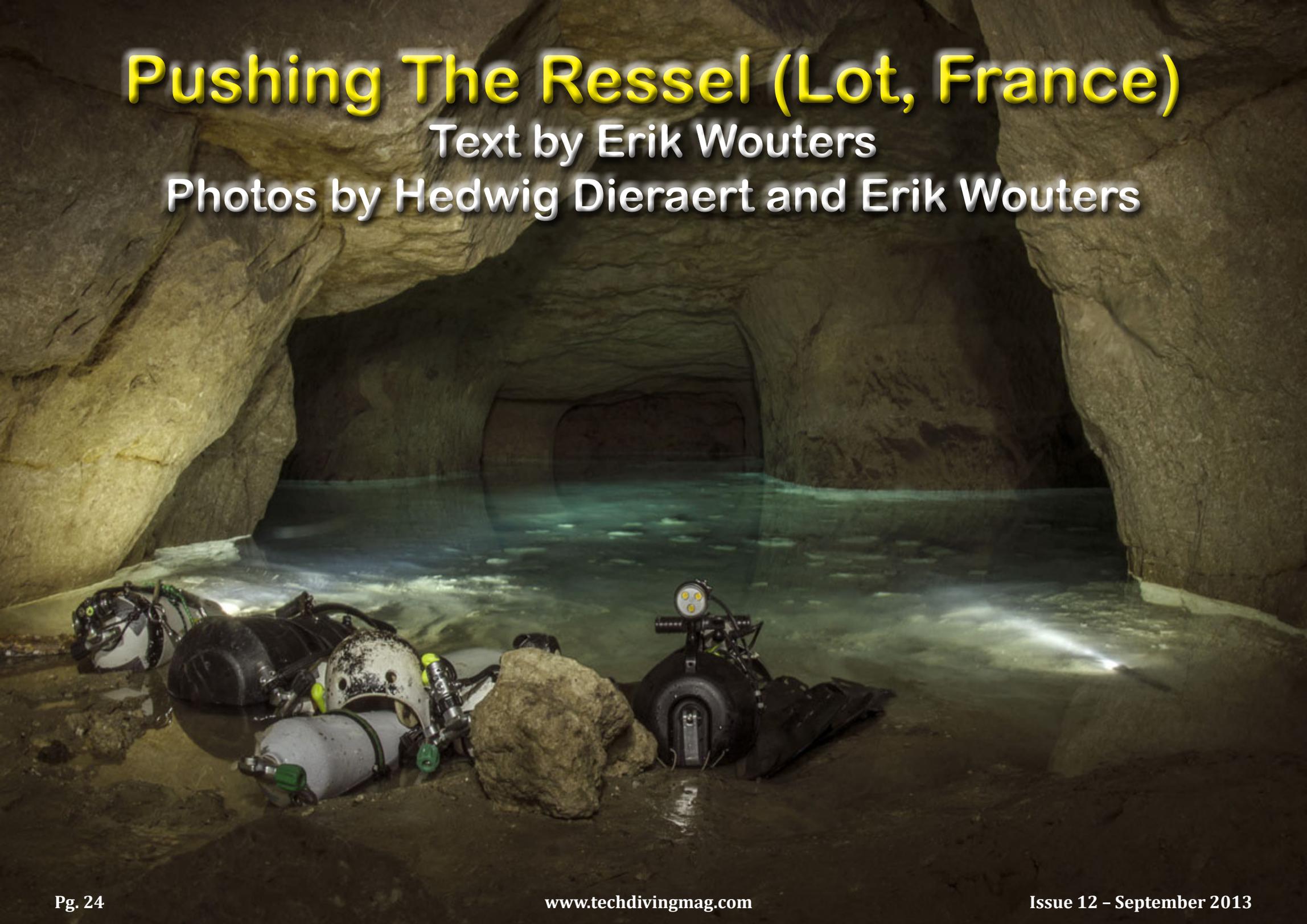
After the honeymoon, the soon-to-be newlyweds are planning further underwater exploration, particularly at Song Hong, the cave that will witness their matrimony. They’re looking forward to mapping the site. It’s a time-consuming task, but I’m sure Hiro and Sandy will still have room to write a post-marriage dive account about their experience and what it took to get ready.



# Pushing The Ressel (Lot, France)

Text by Erik Wouters

Photos by Hedwig Dieraert and Erik Wouters



Years of preparation finally paid off, and on August 3<sup>rd</sup>, 2013, the first Belgian cave diving team reached the end of the Ressel cave. This underwater cave – in the heart of the French cave diving paradise – is known to be one of the more engaged, difficult and technical cave dives. This dive is an exploration dive of several hours, with all its complications in logistics and difficulties. Some intense preparations and material testing were done by a few members of the Flemish cave exploration group, the Science Explorers and diving club Technical Diving Antwerp.

The system is a series of siphons or sumps with dry parts in between and only a limited number of people have dived beyond the first siphons.

### **Preparations**

Before engaging in a challenging dive like this, one needs to be prepared. Erik is diving in the trimix zone for years, with or without a scooter. Several dives have been done in the Ressel cave with both open circuit and rebreather. Little by little, the cave has become familiar. Progression is made step by step: the first dive to the other side of the first sump took 6 hours. In the subsequent dives, the timing could be reduced to 3 hours for the same dive. A careful but steady pace is important in cave diving as it will reduce the decompression time. Several dives were undertaken in a time span of several years and is crucial to memorize the site, reduce the time loss and increases efficiency and fluidness of the dive. The target is to get as far as possible into the cave. Physical condition of the push divers will determine how far one can go beyond sump 1. In this exploration dive, we went up to siphon 5!

### **The logistics**

Inspiration rebreathers are used to keep the volume of breathing

gasses limited. The gas mixes for the two push divers are a 10/60 diluent in three liter bottles and pure oxygen. Open circuit bale out for sump one were placed by support divers Ronny Breur and Sannie Verswyfelt and these were:

- 2 x 12L 300 bar oxygen at 6 m deep
- 1 x 20L 240 bar 50/10 at 22 m deep

At 1100 meter from the entrance, additional tanks were left behind:

- 1 x 20L 250 bar 20/40
- 1 x 12L 300 bar oxygen with two wood logs attached to it to make it float
- 1x 80 cbf with air
- 1 x 40 cbf with air
- 2 scooters for redundancy

The gear left at 1100 meter in siphon one would be picked up for the actual push through to carry out the crossing of sump one and all further siphons.

The crossing itself starts with one CCR for each diver and also one scooter and one twenty liter with 15/45. After 1100 m, the other material left behind would be picked up.

Four scooters were used: three Bonex and one Silent Submerge. What we didn't know is that one scooter would not survive and the other was used until empty. Redundancy is a must!

### **The push dive**

The start of siphon one is known to many cave divers: a lot of them have received their training there. Why? It is a relatively easy, wide entrance with good visibility. This first system is dived by most up to a distance of 400 m where the well-known deep drop is located.

The complexity of cave diving and exploration: the gas planning and bail out scenarios are challenges and are parts of the attraction of this type of diving.



The primary aim is to push through this sump and reach the end. The maximum dive depth is 75 m and the total distance is nearly two kilometers. The majority of that distance is at a depth between 50 and 78 m. Second aim is to reach the next siphons and potentially the end of the cave.

The vertical wall where the ascent starts of sump one was reached after 47 minutes. From previous experience, Erik knows this is quick. Here the deco in sump one starts.

The air and oxygen, transported through siphon one were used in the subsequent siphons and used to top up the CCR tanks. Kevin Haek was kind enough to lend a dry tube for the spare scrubbers, batteries, fill whip and oxygen cells. Drinks and food were also stored in the dry tube.



Erik Wouters during the preparations of the dive

The time to start and finish sump one was 122 minutes. On the way back, 120 minutes were spent under water in siphon one. The other siphons were dove within NDL limits. The total time to cross to siphon five and back took 12 hours. In total, 5.5 hours were spent under water, the other time was for hauling gear between the siphons. Two 15 minute breaks were built in to rest. Dive-wise, this is not too difficult, but transporting the gear between the sumps makes this dive difficult. The space between the sumps has a high CO<sub>2</sub> concentration. Fitness of the divers is the determining factor to get through all the sumps.

Despite all preparations, things go wrong. Past siphon four, one Bonex scooter was accidentally dropped and flooded as a result. It kept working until the weight became too high. Another scooter was depleted on the way back in siphon three. One high pressure hose tore apart on opening the tank; a brand new Miflex high pressure hose.

### **The challenge**

It is a serious challenge to dive the Ressel cave up to sump five. The sum of the years of training, the fitness, deco calculations, filling the tanks, the preparations and logistics makes it all complex, but also highly motivational.

And the psychological challenge is also high: it is far, deep and physically exhausting. What if one of the CCR units would fail catastrophically? A high volume lot of bail out gas was prepared just in case.

And still, the end of the cave has not been reached. The Ressel is still a challenge...

## The team

An exploration dive of this complexity is not possible without the support of a team. Half of the pleasure of this dive goes into the preparation and sharing the experience with the other team members.

The dive team members were Ronny Breeur, Sannie Versweyfelt, Kenny and Angie Vandoorne, Frédéric Vandenplas and Erik Wouters.

My buddy Frédéric is a young lion, eager, motivated and does not give up; an ideal buddy, and a name to remember.

Support divers, Ronny, Sannie, Kenny and Angie did the hard job of staging the tanks and bail outs. And the celebration dinner with lamb chops after 12 hours of diving and carrying heavy gear was exceptionally tasty. Those are the great moments to share with a team.

Also thanks to Green Force which supplied the lights for the scooters. Good illumination made the dive more comfortable.

Thanks to Hedwig Dieraert, the photographer of caving club Science Explorers, Belgium. Incredible pictures only thanks to years of expertise and superior sense to capture the spirit of the moment.

Special thanks to Rik Vandeneynde, the blender of Technical Diving Antwerp, Belgium. Years of experience and despite recent surgery to the knee; always there. Accurate blends of every tank, from the three liter CCR tanks up to the 20 liter tanks. Always correct, and filled to the maximum. It takes away part of the worries when diving.



## Epilogue

The end of the Ressel cave has not been reached, yet. No one knows what's behind sump five. There is no info, and clearly it is still a mystery. To be continued. The bail outs are already filled...

Stan Waterman

ALL PHOTOS FROM STAN WATERMAN COLLECTION EXCEPT AS NOTED

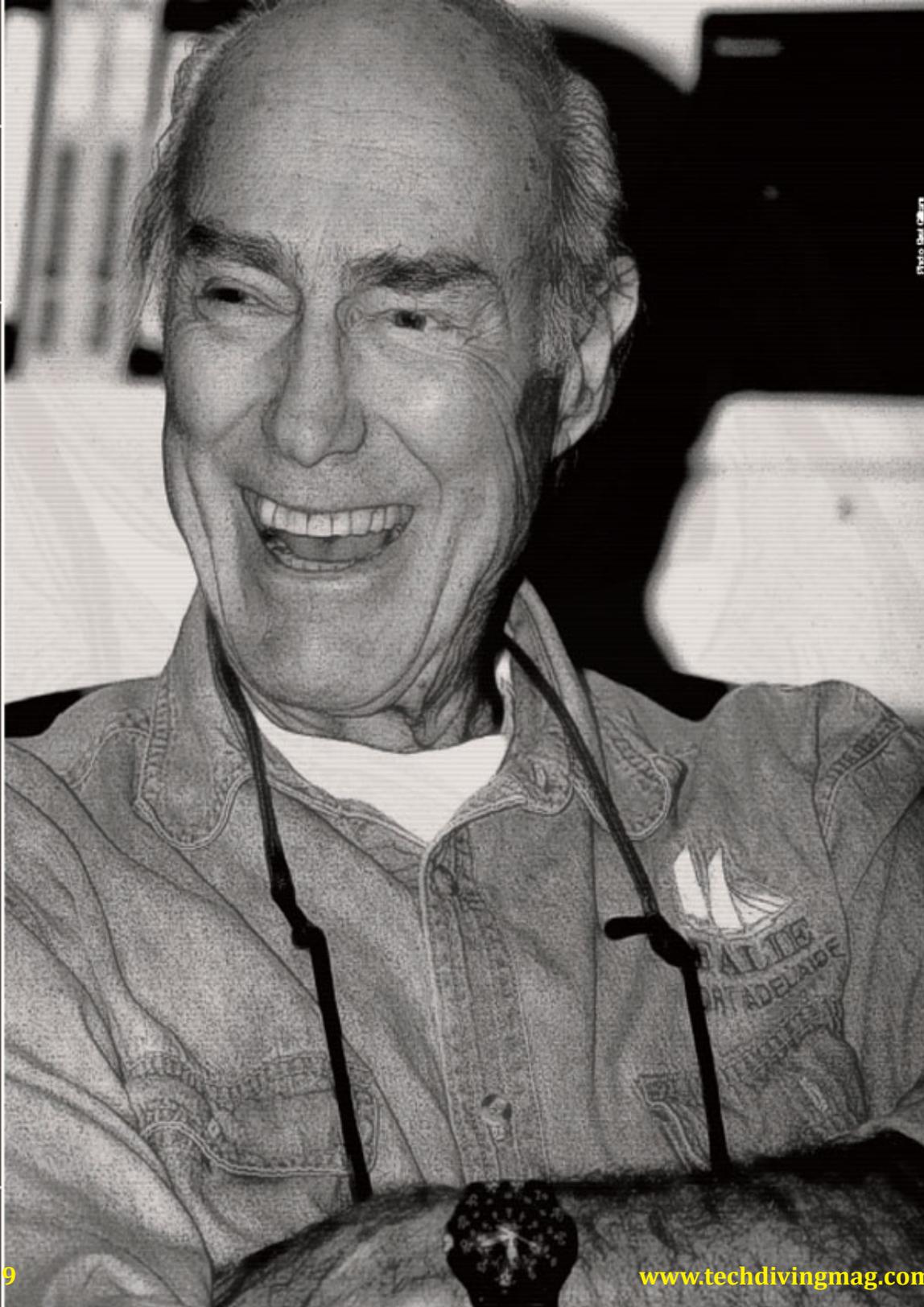


Photo: Bob Clark

# Stan Waterman

DIVING'S GRAND  
AMBASSADOR

BY BRET GILLIAM

It's a safe bet that most folks will have name recognition for the likes of Jacques Cousteau or Lloyd Bridges who brought television's diving hero Mike Nelson to life in *Sea Hunt*. But for divers, the one person most likely to hit 100 percent recognition, popular approval, and appreciation scales simultaneously is, of course, none other than diving's eloquent ambassador, Stan Waterman.

It's also worth noting that he began diving well before either Cousteau or Bridges first dipped their faces beneath the ocean. Stan's contribution to the popularity and initial recognition of scuba diving is virtually unequaled. Indeed, he has survived longer than any other diving pioneers (except Hans & Lotte Hass) and continues to spark audiences with his graceful charm and quick wit.

From a humble beginning as a blueberry farmer in coastal Maine, he was inspired to start one of the first pure diving operations in the Bahamas. Chafing at confinement to one locale, he indulged his passion for diving by teaching himself the art of motion picture photography and producing some of diving's earliest films. His first documentary in 1954, *Water World*, set the hook in the young adventurer and he widely toured the U.S. personally narrating the show to astounded viewers.

In 1959 Waterman participated in the first underwater archaeological expedition to Asia Minor to film a Bronze Age shipwreck. The resulting film, *3,000 Years Under the Sea*, was a hit. His third effort in 1963, *Man Looks to the Sea*, won numerous awards including top honors at the United Kingdom International Film Festival. Following that success, he packed his entire family off with him to Polynesia for a year working on a film that became a *National Geographic* special.

But one film was singularly most responsible for launching him into

the consciousness of divers and the generally terrified viewing public: the astonishing epic *Blue Water, White Death*. Released in theaters in late 1970 after nearly two years in filming, the movie induced a primal gut reaction for most audiences that combined horror and fear with fascination. No one before had ever left the safety of cages to swim in open water with pelagic sharks. Waterman (with Peter Gimbel and Ron & Valerie Taylor) blew everyone away by leaving the cages to swim with hundreds of feeding sharks... at night. The film's dramatic conclusion, featuring the first Great White shark footage ever presented, left an indelible impression on millions and firmly established Waterman's reputation.

Following the popularity of the movie *Jaws* release in 1975, ABC latched on to Waterman to film an *American Sportsman* segment with author Peter Benchley. A year later Hollywood came calling to ask him to co-direct the underwater unit for *The Deep*.

Over the years Stan has mentored and guided such current luminaries as Howard Hall, Marty Snyderman, and Bob Cranston while becoming a confidant and close personal friend of Benchley. They got together on the phone or in person almost weekly until Benchley passed away in early 2006. Stan will be 84 by the time this book comes off the press and still keeps to a diving and speaking schedule that would daunt persons the age of his grandchildren.

Don't miss his excellent book of essays titled *Sea Salt* (also put out by New World Publications). This fascinating book recounts his career in a series of autobiographical chapters and others that simply relate stories of great diving adventures spanning seven decades.

Stan and I have been friends for years. I stay over at his house in Maine and he visits mine. Lately I've been cruising over to his waterfront

estate near Deer Island on beautiful Eggemoggin Reach. I anchor my motor yacht *Encore* in his snug harbor known as The Punch Bowl and we get together to share strong drink and tell stories. We've shared many stages over the years as well in Chicago, New York, and Boston and I always look forward to hanging out with a true American legend. There will never be a grander or more articulate spokesperson and ambassador for diving... or a better friend.

**Everyone has to start somewhere, what led you into diving originally?»** While on Christmas holiday in Florida with my family in 1934 a lady who had just returned from Japan gave me a curiosity. The curiosity was a Japanese Ama diver's mask. The Ama were the lady divers who breath-hold dived to harvest the seabeds around Japan.

Their handcrafted full face masks preceded by many years the first appearance of face masks for divers in the Western World. I swam out with it along the breakwater in front of the Breakers Hotel in Palm Beach, dove down, opened my eyes and was hooked for the rest of my life. I was 11 years old then. That was 73 years ago. It could have been yesterday. It is still fresh in my memory.

My father was a successful cigar manufacturer. Cigars were still king in the early 1930s when I was grown enough to relate with joy to the sea. My summers were divided with half going to my divorced mother at Rehoboth Beach, Del. The other half on the Maine coast at my father's summer home. With ocean on three sides of the house, Maine was tidal pools, a first small sailboat for exploring the coast within sight of the house, and finally a tough Herreshoff sloop. I rigged a small outboard on the stern and sailed far out to the cod fishing grounds, often returning after dark. At Rehoboth Beach I body surfed every day with my gang and challenged the big waves in storm

time. We were all as agile and unafraid as seals. So the sea was with me almost from the beginning.

**You did time in the Navy?»** During the war – that's WWII – the one that would supposedly end all wars, I was stationed with a Naval Air Station in the Canal Zone. I trained as an aviation radioman gunner in SBD dive-bombers. There were California "ab" and "bug" divers in my squadron. We had acquired the new fins, masks and snorkels along with pole guns for spear fishing. The whole sport was so new that I actually corresponded with Owen Churchill. The year was 1943. He had invented the first fins for market in the U.S. They were called "frog feet". With an order that he sent he pitched in a cork-handled knife in a wooden scabbard and asked for an opinion on its use. I can't recall what I wrote to him. The knife was entirely ridiculous. But I made common cause with the California divers. We had a couple of motorcycles with sidecars and snuck off base to dive from isolated parts of the shore and spear anything that moved. We bartered the fish at the Ships Service. The local girls who worked there were delighted to take the fish home. We were delighted with free shakes and burgers.

After the war, a grateful government put me through college on the G.I. Bill of Rights. The gratitude was top-heavy on my side. I had never fired a shot in anger or faced an enemy during my four years in service. I had as fine a liberal arts education as one may have in this country. At Dartmouth I majored in English, focusing on Shakespeare. I studied with Robert Frost. I was a big enough athletic cheese (two mile and cross-country) to enjoy status. I started wooing my present wife of 58 years, a summer romance aided and abetted by her wonderful family taking me in. Both my mother and father had died early during the war. The only home I had when I emerged from college was the summer house in Maine. I wanted to live there.



Joyce Stirling and Stan on Zingaro, Bahamas, 1955

I married Susy two weeks after graduation. We took up residence in Maine, winterizing a part of the old house and I went to work as a blueberry farmer. Three economies dominate Maine (aside from tourism): lobstering, lumbering and blueberries.

**What was your first scuba gear?»** During the second year the Aqua-Lung arrived in the U.S. Two Frenchmen, Rene Bussoz and Paul Arnold had the foresighted enterprise to buy the U.S. marketing rights for the Aqua-Lung from Cousteau for \$10,000. I heard that Cousteau quickly realized his mistake and bought the company – called U.S. Divers – back, supposedly for a cool million dollars. I have always thought there was considerable hyperbole in that story. Whatever, I purchased my first Aqua-Lung from the first U.S. Divers Co.

Cornelius made the only portable compressor available then and suitable for high-pressure breathing air. They made compressors for filling airplane tires. I acquired the 25<sup>th</sup>. The Aqua-Lung was probably the first in the state of Maine. Bill Barrada, of *Skin Diver* magazine, marketed a latex rubber, back or neck entry dry suit to be worn over heavy underwear for Maine waters. It was never dry. The crotch squeeze was excruciating; but I could take to the water with it. I charged \$25 for my services, recovered scallop drags and moorings, unfouled propellers and for the grand sum of \$125, threaded cables under the hull of a big work tug that had gone down in 70 feet of water within sight of our house. I even dove from the pontoon of a seaplane that flew me into a Maine lake to search for and recover a half dozen expensive rifles that had been lost when the hunters capsized their canoe.

The adventure was supreme. My system was the only game in town. I eventually hooked up with a wholesaler in Ardmore, PA. who marketed Healthways line of equipment along with U.S. Divers scuba

gear. I retailed a half dozen full sets of equipment to adventurous friends in the area. None of them stayed with us but they all avoided death. In hindsight I realize how lucky that was.

**One of your first forays into diving as a profession led you to take a converted Maine lobster boat to the Bahamas to run dive charters. What was the market then and who were your customers?»** In 1953 I was inspired by Hans Hass and Cousteau to design a lobster boat hull especially for diving, helped to build it at a local boat yard and in 1954 took the 40-ft. *Zingaro* from Maine to Nassau. There I set up shop as the first liveaboard dive boat in business. Back then few people went to the Bahamas during the summer months.

Winter had the worst weather. Summer was the best time for diving. But the tourists did not know that. I hedged my bets, not being at all sure how this new enterprise would pan out, stored my boat each May up the New River in Fort Lauderdale and headed up to Maine to get the crew working on the blueberry land. In November, when the blueberry land was burned and put to bed for the winter, I would take the boat across the Gulf Stream, over the Little Bahama Banks and over The Tongue of the Ocean to Nassau and start the diving season. We had good friends in Nassau, all divers and spearfishermen. They were my mentors in learning about navigating reefs.

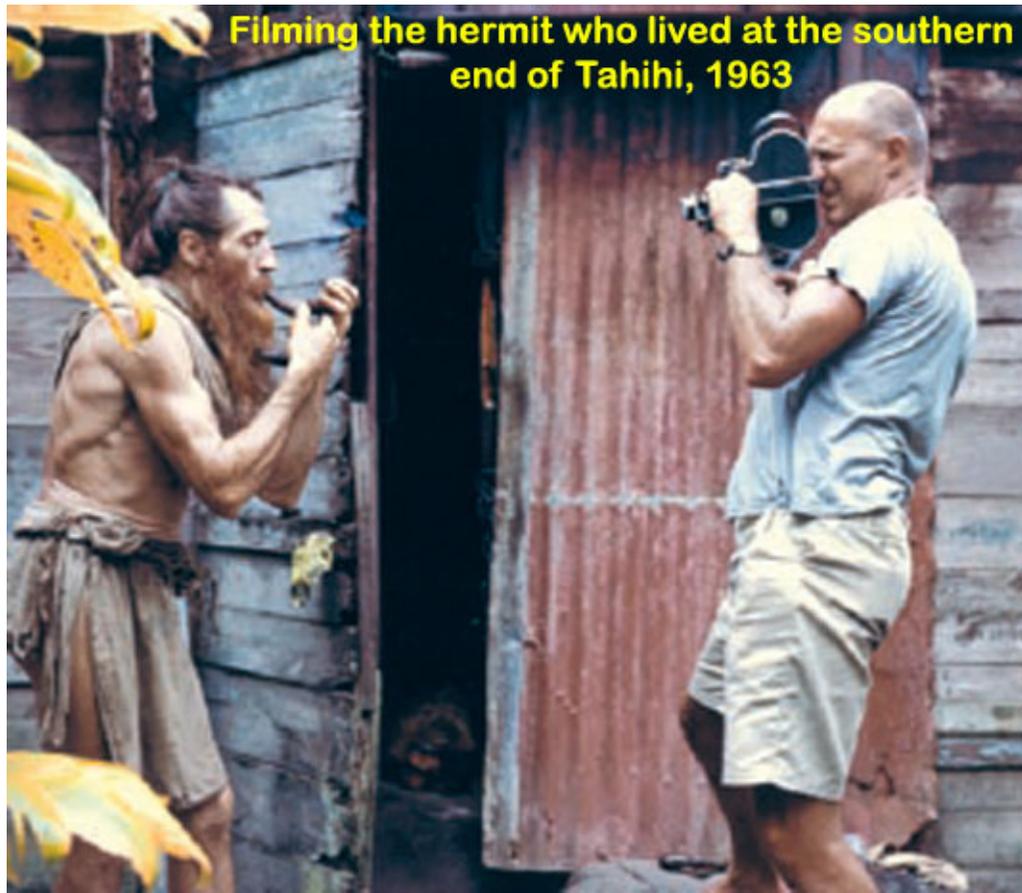
**How did you start in underwater filming?»** The diving just barely broke even. But I had started shooting 16mm film with an early Fenjohn housing, then a Rebikoff housing, then my own Plexiglas housings and commenced lecturing with my first film, *Water World* during my off-seasons at home. That led to another dimension and my own particular evolution in the business.

Guests on my boat were the genesis of my extended reach beyond the

Bahamas. I was invited to join expeditions in return for shooting and editing a 16mm documentary record. *Zingaro* circumscribed the range of my activities. I certainly could have dived the Bahamas for the rest of my life, but I wanted very much to see and dive in other parts of the world's oceans. After three years of charter boating divers in the Bahamas I sold *Zingaro* and made my move. I planned to work with expeditions in the late spring and summer. The experiences would provide fresh material for lecturing during a season that generally ran from fall to April. My first economically viable season was 1959. An agent had picked up my act. For the princely fee of \$125 per show I commenced a film lecture tour. Remember, television had not yet appeared on the scene. So called "Armchair Adventure" and – in New England – Athenium Lecture Series provided live entertainment for communities across the country. The speakers projected their films and narrated them live from the stage. I added music from a tape recorder that I cued from the podium. Three agents and three years later I was making \$350 per date, doing block bookings across the U.S. and Canada plus the Hawaiian Islands. One exhausting, peak year I did 162 speaking dates. I called it "Gum Shoeing In the Bible Belt". I was on the road for three weeks to a month at a time, one-night stands in little towns and big cities as well. Big cities might have audiences of 2,000. Little towns - like Scarlet, Nebraska might have 350, almost the total population. For many small communities the lecture series were the only game in town. Most of the shows ran along the line of *Norway: Land of Contrast, Exotic Hawaii, The Four Seasons of Scandinavia*. My underwater shows were a total anomaly. I tried to make them entertaining and exciting. The hyperbole that attended shark and moray eel footage was outrageous but gratifying.

**Sounds like you were away a lot?»** Susy was practically a single mother. We had three children then, Gordy, Susy-dell and Gar in that order. Maine was too isolated for a family with an absent father much

of the time. The schools were rated the third worst in the country. I looked for a community that had good schools, a cultural matrix for Susy's receptive mind and fine intelligence. I found it in Princeton, a university town with old friends to help us settle. More important, Susy's wonderful, supportive family lived only two and a half hours away in Pennsylvania. Important for me was a reliable major airport just an hour away. My old airport in Bangor, Maine was fogged in as often as not.



**You have always tried to include your family in your adventures. What did they think when you hauled them off to Tahiti and**

**Bora Bora for a year?»** When I decided to take my family to French Polynesia for a whole year I had already been to Tahiti twice on contract, shooting underwater footage for other documentary filmmakers. So I had some friends and connections there to help me plan the real logistics of spending a year. Susy and I both wanted to have a family adventure together while the children were still young. Kenneth Graham wrote in *The Wind In the Willows*, "...for the days pass and never return." We wanted that experience before the children were out of the nest and gone from us. They were then 10, 12, and 14. As they became full teenagers I used to take one with me each summer on whatever expedition I was documenting. One-on-one, we got to know one another. Those experiences forged a bond between Susy and me and the children that has never lost strength. The Tahiti year, as I call it, especially engendered a family esprit, the most valuable move we made in those formative years. So the children have never moved away. All three live in Connecticut about two hours away. One or more call almost daily. We share all the major holidays. Gordy is 56 this year.

**Share with us some of the other destinations and films you chose to feature in your early career.»** There were some fine adventures I lucked out with as professional contacts, new friends and acquaintances generated during my three years in the Bahamas made the new experiences available. They were the grist for my lecture mill. Essentially I evolved from charter boating to working with others' boats and facilities, expanding my range beyond the Bahamas. I hoped to produce a fresh lecture film each year, shooting in the summer and fall, then lecturing through winter and spring to amortize my costs and keep a roof over our heads. Thus my friendship with Drayton Cochran, a customer on *Zingaro* when I was still in the Bahamas, led to a trip through Europe on the rivers and canals from the North Sea to the Mediterranean in his 71-ft motor sailor,

*Little Vigilant*. For my third cruise with Drayton I did the advance planning for a trip through the Aegean Islands, finally focusing on a rough archaeological survey of wrecks along the coast of Asia Minor. Ultimately we located a wreck off the Turkish coast opposite Rhodes that proved – at that time – to be the oldest wreck found. The clue had come from scraps of bronze found by Turkish sponge divers and heard about by an amateur underwater archaeologist, Peter Throckmorton, who came with us.

The wreck was from the late Bronze Age, about 1300 BC. We raised copper ingots, bronze weapons and tools. A professor at Princeton University identified the age when I showed him a bronze dagger blade and double-bitted axe head that we had smuggled back with us. By that time I had moved my family to Princeton for better schools and a bright academic community for Susy when I was away so much. The lecture film that I edited was entitled *3000 Years Under the Sea*.

**Didn't you do some early work in South America as well?»**

Another expedition took me up the Amazon for the first attempt to capture and bring back alive the two species of fresh-water dolphins, *Innia* and *Sotalia*. The goals were achieved. The Niagara Falls Aquarium was the sponsor. We flew to Manaus, 1,000 miles up the Amazon, the last civilization, and from there went up river with a wood-burning steamboat – the last on the river – one barge for our hammocks and cuisine – another barge that we filled with water to transport the dolphins and Indian guides. It was an epic experience and totally successful. The dolphins were safely flown back to the States, introduced to three major aquaria and the first to be seen in the U.S. I have lost touch with them (that was about 45 years ago) but I believe that the originals mostly prospered and bred to start new generations.

To make up the 90-minute format required for the stand-up film lectures I produced a three-part program that I named *The Call of the Running Tide*. Part 1 was on the first women's team to go into saturation in an underwater habitat. The exercise was called *Tektite II*. Dr. Sylvia Earl was the leader. Part 2 focused on the first deep divers for black coral in the Hawaiian Islands. Part 3 was about the life and times of a New England harbor seal, Andre.

When I was shooting *3000 Years Under the Sea* I wanted some background shots of the Bay of Salamis where, in 480 BC, the Greek navy annihilated the superior fleet of the Persian king, Xerxes. I was guided by a young naval officer who assured me he knew a fine spot at the top of a long, high hill that overlooked the bay. We climbed for what seemed hours in the unrelenting Aegean sun, lugging tripod, camera case and other paraphernalia. Reaching the top we discovered no view at all. Higher hills lay between us and the historic bay. I ended up shooting one of those wonderful illustrations in *National Geographic* magazine. It showed Xerxes, himself, seated on a golden throne at the top of the right hill, watching his fleet go down the tubes.

**What was it like slogging away on the speaking tours then?»**

There were so many hilarious (in hindsight) experiences that I had during my years on the lecture circuit that I couldn't begin to recount all of them. So many of the dates were in the Midwest that I got to know the grass roots parts of the U.S. that my eastern education could never have provided. In Sioux City, Iowa my program was in a church with a complex beamed structure high above the audience. Shortly after I started my introductory talk several bats awakened and started swooping down over the heads of the audience. Some women whimpered and clutched their men. I thought to put a spin on the growing panic by alluding to Count Dracula and Transylvania.

At length I thought it best to call for lights out and get the film on the screen. I had not anticipated the result. When the bats flew in front of the projector light path they appeared on the screen as big as pterodactyls. There were screams. Some unfortunate cases of the “vapors” with an exodus by a less hardy segment of the audience. I finished the show, declined an invitation for pie and coffee at the home of a sponsor and – as S.J. Pearlman used to do – “repaired to a dark clinic with a sympathetic intern.”

**Blue Water, White Death was a stunning film for many reasons.**

**How did you get involved initially?»** I knew Peter Gimbel. We were friends. He visited with us in Maine during the summer of 1964. There, in the evenings by the fire in the living room we planned the outline for the production of *Blue Water, White Death*. It was originally planned that I would co-produce the film with Peter. However, Peter had the connections with CBS for the sponsorship and the money and time to start the physical preparations for the production. I was still on the lecture circuit and soon after (1965-'66) took my family away for the year in French Polynesia. That left Peter with the entire load. When I returned I demoted myself to Associate Producer and Underwater Cameraman. On Peter's shoulders fell the full burden of forming the team, designing the special cages and camera systems. He threw himself into the project with total dedication and personal enthusiasm. It was Peter's show. His energy and enterprise made it happen.

**How was the rest of the team selected?»** The rest of the team was composed in part of personal friends and professionals like Ron and Val Taylor, Jim Lipscomb for topside camera and Stuart Cody for electronics and equipment maintenance. Peter signed them on by their reputations.

**What were they like to work with on such an extended project?»**

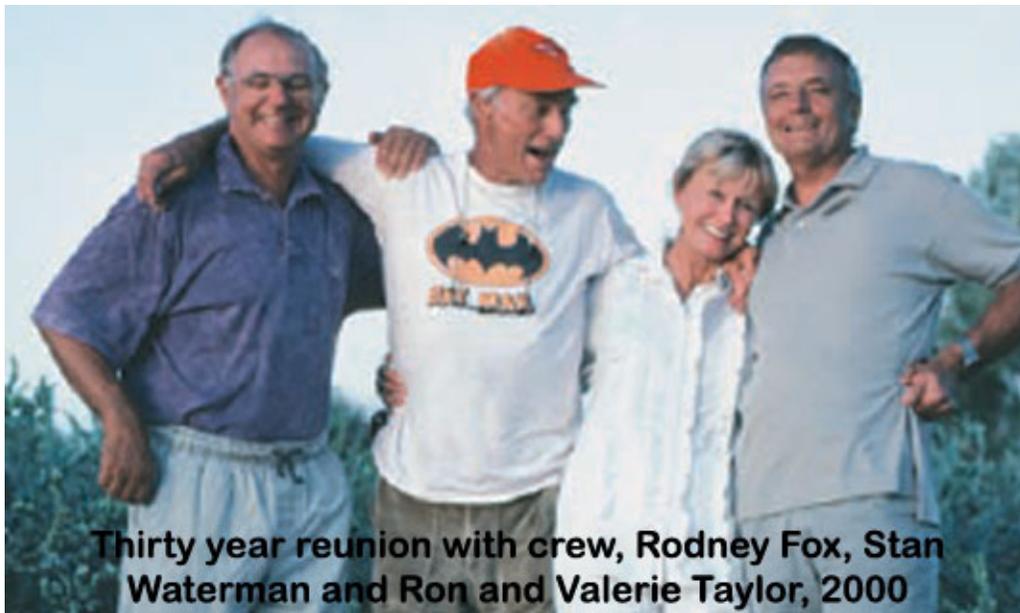
The project took almost a full year in the field and another year for preparation. The group was remarkably compatible. Of course there were some dust ups. The most benign family could hardly avoid times of lost patience and personal differences living on a small ship for weeks and months on end. I think we came off very well. Peter led by example. He was fearless at times. Most often prudent. Every member had at least some sense of humor and that is a great leavening force.



**Why did Gimbel choose to locate in South Africa instead of looking for the Great White shark in Australia as the Taylors suggested?»** I do not recall why Peter did his major reconnaissance to South Africa instead of South Australia, a known haunt for the Great White and an area of White shark encounters, pioneered by the Taylors. In South Africa he was advised by the Union Whaling Co. that their whalers encountered legions of Great White sharks that fed on the whale carcasses before they could retrieve them. The Union Whaling Co. was shore-based in Durban. They could provide a retired whale hunting ship, the *Terrier Eight*, to join their fleet,

provide a base for our team, and cooperate with us to the fullest. That looked good to Peter. One misunderstanding proved critical and only evident when we were on location there. The sharks guaranteed by the whaling company were Oceanic Whitetips, not Great Whites. As it turned out the experiences we had with the Oceanic Whitetips (*Charcrinus longimanous*) were the most dramatic and certainly the most harrowing in our months of diving.

**Valerie Taylor's diary shares some frustration at the film process and at Gimbel. What was your perspective as the oldest member of the principal crew and a producer?»** Gimbel was strong-willed, so is Valerie. I remember incidents that occasioned strong differences and tempers on edge. I would rather not reflect on them or review them. In my many years of experience and among those I most value, being a part of that splendid adventure is at the top. I would not have missed a day of it. I prefer to remember it that way and, indeed, I do.

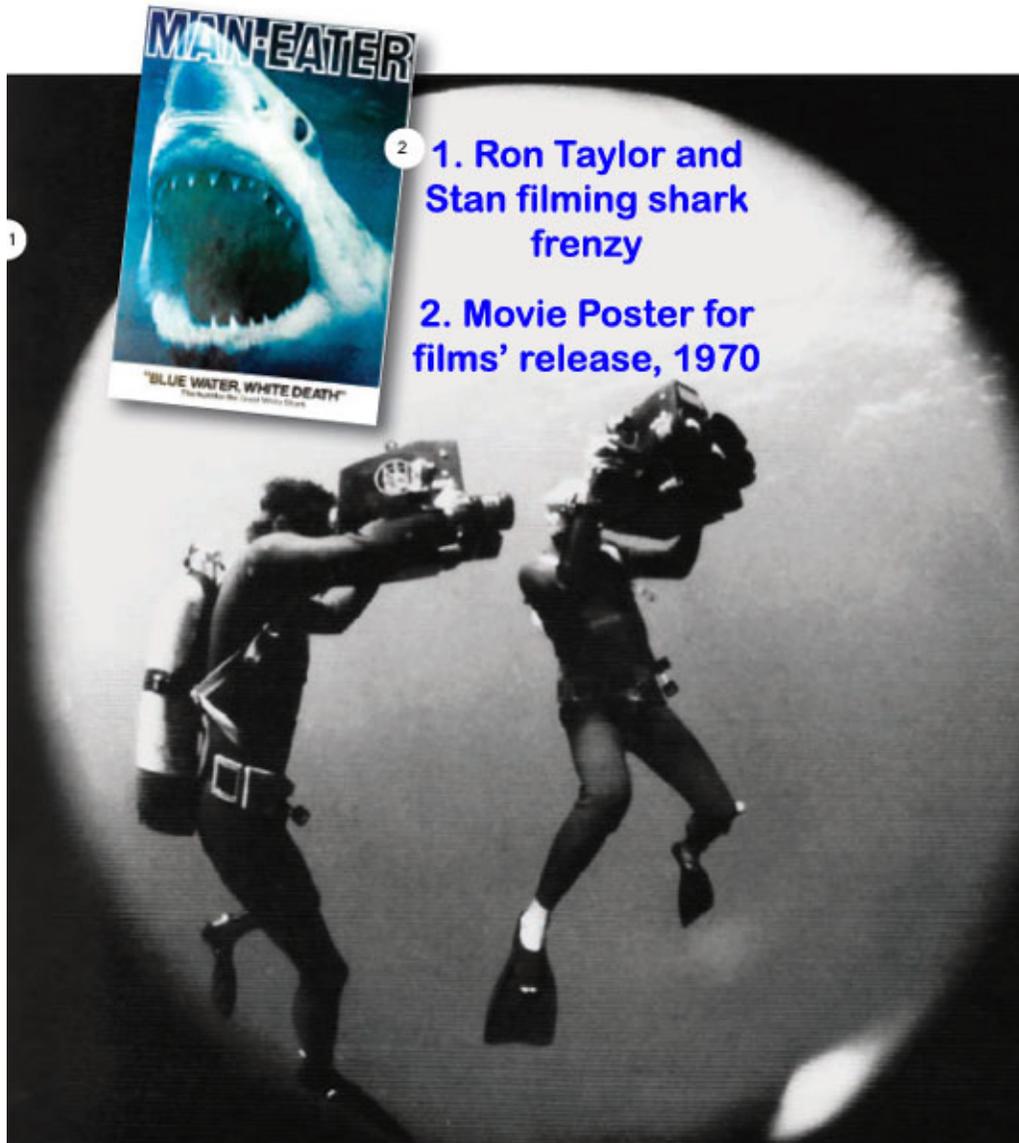


**Thirty year reunion with crew, Rodney Fox, Stan Waterman and Ron and Valerie Taylor, 2000**

**You and Gimbel actually gave up your salaries at one point to get the company to complete the film. How did that come about and did the final result make it up to you both?»** There was a clause in our contract with Cinema Center films that was, in fact, quite standard for productions. It specified – as I generally recall – that if a certain amount of the production was not completed in a time proscribed by the contract, further budget money would be withheld. Peter and I agreed to forfeit our salaries until the film was completed as a show of faith. That placated the backers. We were ultimately recompensed.

**No diver had ever left the safety of a cage with large numbers of sharks back then. You guys swam out into hundreds of feeding sharks. Who made that call and why?»** Our first day on location with the sharks next to a sperm whale carcass was spent inside the two cages. Peter and Valerie shared one cage. Ron and I were in the other. It was evident that shooting from the cages was cumbersome, the action much circumscribed. On the second day Peter exited his cage without any forewarning that he was going to do that. I thought it was dangerous for him to be so exposed in the open with a large number of the big Oceanic sharks cruising about. I exited my cage, thinking to cover him. I was, in fact, scared to death. Peter admitted later that he was, too. But it was the right thing to do. We soon discovered that we could not cover one another but must fend for ourselves, shooting toward one another as the sharks bumped and rubbed against us. They did not bite. We fended them off on frontal approaches with the cameras. But we were just as often nosed from behind. We could not keep track of their movements. There were too many. It was a mind-blowing experience. The footage was terrific. We subsequently decided that we would all exit the cages and shoot against one another. The action was just as compelling. With three cameras going and Valerie tearing about to bop sharks on the head as they were nudging us the footage proved to be even more dramatic

than our ultimate encounter with the Great Whites in South Australia, all filmed from inside the cages.



While the movie earned lavish critical praise, it has largely been unavailable since the early 1970s for the next generation of divers

to view. What happened to the rights and how can someone see it today?» *Blue Water, White Death* vanished from view and never was marketed as a video cassette. The reason: Cinema Center Films, the producer, sold their entire library to Paramount Studios. That library included a John Wayne feature, another with Dustin Hoffman, and several others that were recycled in video sales. Paramount put our feature in storage where it still remains. Efforts to buy the TV rights have come to nothing. Paramount is uninterested.

It's been over 35 years since it was first released. Has any diving film ever equaled its breakthrough sequences since in your opinion?» Hans Hass and Cousteau produced theater-released features that certainly had the impact of *Blue Water, White Death* on the public. That I know of there have been no feature productions the equal of it since for theater presentation. There have been a number of fine documentary series produced for television. The latest, *The Blue Planet*, is more than a match for anything we did. Howard and Michele Hall's marine animal series, *Secrets of the Ocean Realm*, is without peer.

What would you have done to make it better today?» The action and the range of the story make it unique both then and now. Cameras and optics have advanced, of course, and there are exciting marine life subjects that have emerged since our time. Had we known about the Great White shark scene in South Africa off Cape Town we would certainly have included that. But we were breaking ground, bringing that magnificent, supreme predator to the public eye for the first time. That perspective would be hard to beat today. Incidentally, we were on the island of Grand Comoro off the east coast of Africa in 1969 when we heard that the U.S. had put a man on the moon. That certainly beat any scenario we could come up with.



Out of the cage for the first time and filming Oceanic Whitetips feeding on dead whale carcass above, off South Africa, 1969

**Moving to another subject, I noticed that you supplied many of the photos for the book about the orphaned harbor seal, Andre. How did you come to meet Harry Goodrich and Andre?»** Harry Goodrich lived in Rockport, Maine. I lived diagonally eastward across Penobscot Bay. I had a fast boat. With easy weather I could make it to Rockport in a little over an hour. Harry and I were among the very few who had Aqua-Lungs in Maine. I can't recall how we met. I am sure I sought Harry out. We became good friends, dove together, and had family visits. Harry's wife, Thalys, made pies that caused strong men to sob aloud. I would shamelessly telephone that I was going to run over by boat and thought I would be there in time for lunch. I was with Harry when he caught Andre, in a long-handled crab net by the ledges off Rockport. Andre was raised with the family, actually had his pad on the kitchen floor during the winter months while he was still a pup. The whole scene was so compellingly charming that I shot a segment of one of my magazine format lecture films about Andre and the Goodrich family. Andre not only made Harry famous but also provided him with satisfying, compelling purpose and self-esteem that his profession as a tree surgeon could not provide. With Andre, Harry achieved celebrity status. Hollywood some years later made a film about the Andre story and shot it on the West Coast with a sea lion. Andre was, of course, an honest New England harbor seal. I never saw the movie but I know that the publicity afforded great pleasure to the Goodrich family.

**When Hollywood took on the daunting project of making Peter Benchley's *The Deep* into a movie, how did you get involved?»** Peter and I became good friends when he moved to Princeton after the publishing of *Jaws*. Our houses were within a few blocks of each other and we had many adventures working together for *ABC*, *The American Sportsman* show. So it was natural that Peter would introduce me to Peter Guber, the producer of *The Deep* and urge I

be contracted to do the underwater camera work. I was accepted and brought Al Giddings in with me and he accepted on the condition that we equally share the credits.

**You and Al Giddings were designated as co-underwater directors. Did that work?»** Al was an old friend with whom I had stayed many times in Berkeley when I was lecturing in the San Francisco area. I knew his capabilities. He was far better qualified for bringing together a support team and preparing the cameras, lights and diving equipment than I was. He took charge of the logistical preparation for the shoot, designing the housings for the 35mm cameras as well as the lights. Al, with enterprise, initiative, creative energy and a capacity for taking charge way beyond my range, did – indeed – take over. Chuck Nicklin and I in effect became second cameramen. Of course, I was personally injured and humiliated (laughing). At the same time there is no question that the better man for the job seized the reins. My input hardly justified sharing the same credits with Al.

**Peter Yates, the movie's director, had made such action films as *Bullitt* with Steve McQueen that became the standard for action films and car chases. How did a non-diver get on with you two when he couldn't actually direct or even see the film's most exciting sequences as they occurred underwater?»** Peter Yates was an excellent director. And became a good friend. He quickly learned to dive and very soon into the production was personally present on the underwater sets. He was hard-wired for communication to the surface with his directions relayed to us through a transponder. Thus he extended his direction into the underwater second unit. Only when we went to Australia and on to the Coral Sea to shoot the shark sequence with doubles were we on our own. Al, of course, took over direction.



**Jackie Bissett and some of the other actors were not divers before filming began. How did you get around that obstacle?»** Lou Gosset was an experienced diver and had a fine time diving with a local dive operator when he was not scheduled to be on-camera. In fact it was Lou who returned from a day of diving on the wreck of the *Constellation* and showed us a bag full of morphine ampoules he had fanned out of the sand. Nick was certified already and athletic enough to be easy in the water. Jackie had never dived, was not athletic at all or into that sort of macho sport. But she did not lack for determination. We gave her a quick course with the vital essentials. Then on every dive with her we used two safely divers to watch her closely. To her great credit and the benefit of the production she took to the water like a beautiful swan, began to enjoy the experience. We had to insist that her double, Jackie Kilbride, do some of the heavy scenes (i.e. being slammed into the wreck by the giant eel).

**Robert Shaw was a notorious character that never hid his love for whiskey, on and off the set. What was it like to work with him?»** Robert Shaw came to the production with the largest celebrity status. No one begrudged his special housing. That comes with stardom. He was certainly an alcoholic and we were aware of delays in the shooting because of that. We only encountered his temper once. He had his own trailer on the set and used it during the day. My son Gordy, was an underwater grip, making more money on the Hollywood budget than he had ever dreamed of. At the same time he was reluctant to use the very liberal room and board per diem that enabled most of us to stay at the South Hampton Princess Hotel. So he eyeballed Robert Shaw's empty trailer, discovered he had access to it after dark and so nested down there. I had no idea he was doing that or later how long he gotten away with it. One morning he overslept and was discovered by the great man. Shaw would have the cheeky grip fired from the production. Cooler heads prevailed. A bit of nepotism also helped.

**How did you like filming on the 1867 wreck of the Rhone in the British Virgin Islands?»** I knew the *Rhone* well, having dived and filmed there previously. Parts of it were wonderfully photogenic and readily accessible. All other divers and commercial dive operations were restricted from diving on the *Rhone* while we were working there. Since our production there lasted over three weeks you may imagine the local divers would have liked to nuke us all.

**Dealing with currents and varying visibility conditions must have been a challenge?»** The *Rhone* is so popular as a dive sight that it is hard-worn today, not just by the legions of divers but by storms as well. When we were on it we generally had excellent visibility and calm seas. The forward part of the wreck which provided our interior takes was deeper than we might have wished, requiring long decompression times that found us hanging off after dark. All the close action interior takes were, of course, done in the underwater set at Bermuda.

**Did you find the underwater set built in Bermuda to be as easy to work as it looked?»** The underwater set in Bermuda provided the only physical structure in which we could light, prepare and shoot the complicated scenes. Toward the finish of the shooting, which lasted almost a month, the plastic composition used to seal the walls of the million-gallon tank that had been created started to disintegrate. The marine life that had been introduced as props began to die. The water became so toxic, despite renewal from the sea, that we all developed ear infections. Our second unit part of the production was a “wrap” just in time before the set totally deteriorated.

**Howard Hall credits you with getting him started in professional underwater filming. Who mentored and influenced you?»** I was certainly influenced by Hans Hass and Jacques Cousteau. I picked

up Hass’s book, *Diving To Adventure*, right after I mustered out of the Navy in 1946 and was much fired by it. That was the opening shot. But it was Cousteau’s Red Sea article in *National Geographic* that was the catalyst for me to try the sea and diving as a vocation. I was a farmer in Maine at the time. The year was 1953. I was bored with farming and still too young to spend the long winters making birdhouses in my workshop. That article started me thinking about taking a chance, making a move. Shakespeare had something to do with it too. In *Hamlet* he wrote, “There is a tide in the affairs of men that taken at the flood leads on to fortune. Omitted, all the journeys of their lives are bound in shallows and in miseries. You must take the current when it serves or lose the venture”. So I re-mortgaged, shot my wad on building a boat that I designed for diving and set up in the Bahamas. The Bahamas years (from 1954 to ’59) hardly broke even. But they were the foundation for a vocation that I have never regretted.

**There have been many evolutions in diving equipment over the last 50 years. What do you consider to be some of the most important innovations?»** Way back when it was the lowly o-ring that was a major advance in equipment. It enabled us to make our own Plexiglas housings with watertight control lever into the sides of the housings. Hi-8 emancipated me from 16mm film. It was not broadcast quality but was a dream for the small non-broadcast videos that I produced. Then along came digital as well as better optics for the housings and big improvements in lights and batteries. Howard Hall is now shooting high definition; very wisely building his stock footage for the near future when top broadcast productions will demand that quality. Being long of tooth and no longer in the market for broadcast level shooting contracts, I will never reach the high-definition level. That market has been pre-empted by a younger generation, all old friends who have come into their own. That is the way it should be.



Stan and best friend Peter Benchly on location, 1993

**Do you dive with nitrox or rebreathers now?»** All the dive boats I work with now have nitrox. I subscribe to it entirely and only return to air if I want to go deeper for some reason. The reasons seldom appear. I use the standard Dräger rebreather only occasionally. I am certified for it and will use it when I return to Cocos Island. I should use it more, especially since animal behavior is my major focus. I probably will in the future.

**When you started the Nikonos had never been released. And underwater motion picture systems were both primitive and bulky. Share some perspective on the benefits of modern cameras and the advent of digital imaging.»** When I started 16mm film was the medium for sports and documentary productions. Film stocks had such low ASA levels that big lights were required. That meant 1,000-watt lights with cables to a surface generator. The cameras at best carried 400-ft. magazines that provided 12 minutes of shooting. Light values were meter read; f-stops and focus were manually adjusted. When all the variables were right the Eastman Color Negative stock produced a beautiful finished print. Hi-8 could not compete for quality but fit into a housing perhaps a 2/3 smaller than the 16mm housings. So little light was required that cables were no longer necessary. Lights and batteries mounted on the housing. Settings were electronically automated with manual options. But Hi-8 tape stock was vulnerable to drop outs and abrasion from too much reuse. Digital cameras again reduced the size of the housing, increased the effectiveness of the electronic controls, and produced an image with better color balance and definition. There is, of course, a difference in the finished product from a one-chip camera and a three-chip camera. Even at the consumer level the three-chip can turn out a broadcast quality video.

**You are still actively diving and sharing the experience with**

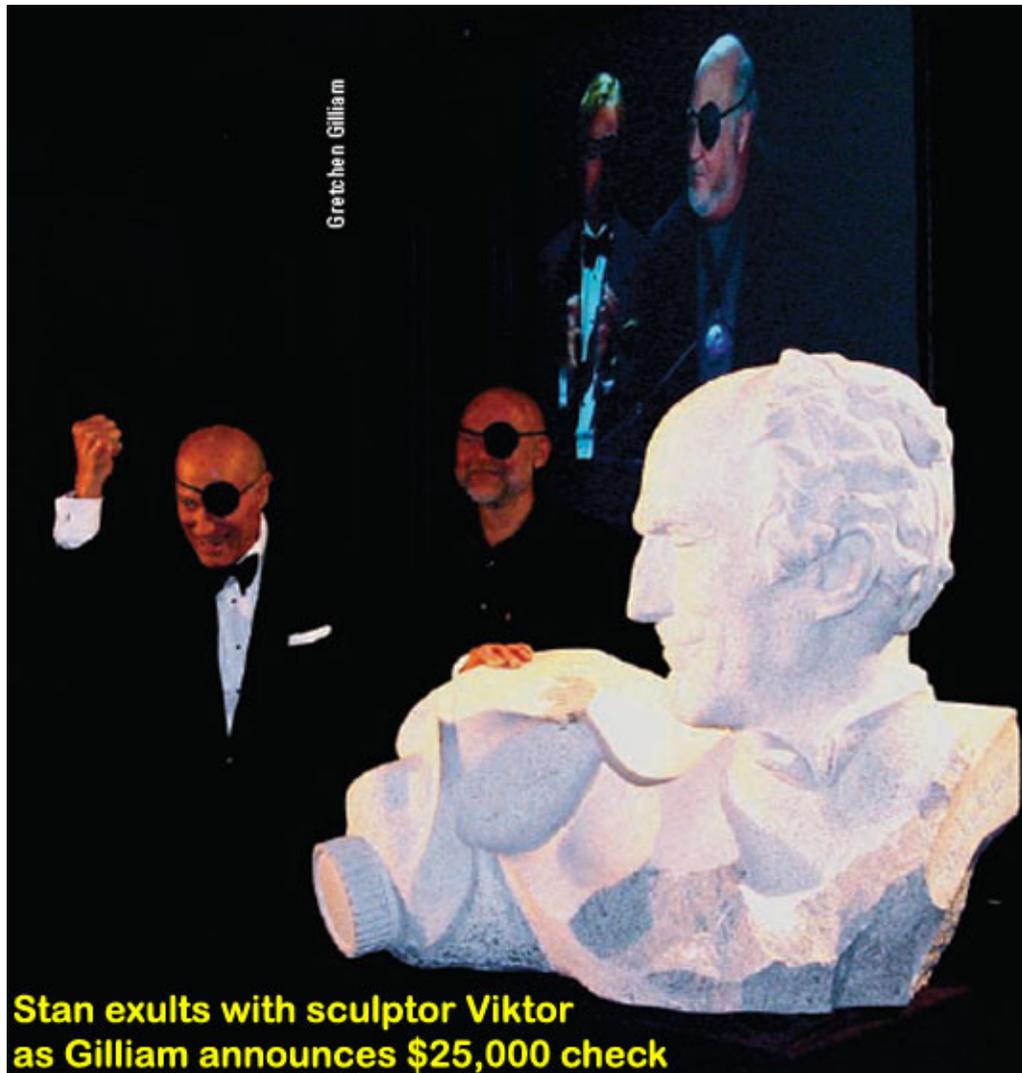
**fellow divers by leading custom tours. Where are your favorite dive locations and what are your favorite liveboards?»** My favorite dive areas are New Guinea, Malaysia, Indonesia and Fiji. I also return almost every year to Palau and love diving there. Those areas have yielded the most exciting macro encounters, and macro is my favorite subject these days. The Lembeh Strait at the northeast end of Sulawesi in Indonesia and the Kungkungan Bay Resort that serves it is the most exciting dive location I have encountered. I will decline rating liveboard dive boats with which I work. They are all excellent with fine crews. The locations vary in their appeal to me but I am pleased with all the boats I work with.

**You'll be 84 years old in early 2007. Any plans to slow down or take up golf?»** I will give up diving when I no longer enjoy it. It will almost surely be when I am no longer physically able to dive comfortably and safely. Leni Riefenstahl, the “super woman” survivor of the Third Reich was diving at the age of 91. If I start main-lining Geritol I may make it. When the oldest living human with a certified birth certificate died in France at the age of 124 the press had interviewed her the previous year. When asked what she had to say about her future, she said, “Not much!”

If a shark eats me on my next round I will be sorry to pack it up but grateful for what the sea has given me during a long, productive and satisfying career. Tennyson wrote of *Ulysses*, “How dull it is to pause, to rust unburnished, not to shine in use as though to breathe were life.”

*In March of 2007 at the Beneath the Sea diving show, Stan was honored as a “Diving Legend” with the entire weekend devoted to a celebration of his astounding career. In addition to those honors, I was privileged to present him with the Pioneer Award from the Diving*

*Legacy Foundation. Along with Selection Board members (Jim Clark, Sylvia Earle, Phil Nuytten, and Douglas Seifert) we took the stage for the Saturday evening program and presented him with a trophy and an 1800-lb. granite statue depicting him with his movie camera. The award was accompanied by a \$25,000 honorarium check, the largest ever presented in the diving industry. Stan received two standing ovations from the audience during the ceremony, justly fitting as diving's grand ambassador.*



## **Sea Salt - Reviewed by Bret Gilliam**

For anyone lucky enough to catch one of Stan Waterman's personal appearances, you undoubtedly came away with a lasting impression of his wonderful speaking presence and gift for oration. I remember my own feelings after seeing him for the first time some thirty-five years ago: it was like listening to Lincoln or Churchill... but with a better vocabulary. And Stan talked about diving, my passion, in a way that no one else could.

Stan, of course, is the U.S.'s first pioneer of diving. Someone once suggested that he was the "Jacques Cousteau of American diving" and was promptly corrected by an observer to note that "Cousteau was actually more like the Stan Waterman of France." It's a fair statement.

Over the years, Stan has been a prolific filmmaker winning multiple Emmys and gaining his first international fame in the iconic 1971 release of *Blue Water, White Death*. Collaborating with Peter Gimbel, he co-produced, filmed and starred in this groundbreaking documentary about their quest to find and film the Great White shark in its natural element. Five years later he joined Al Giddings as co-director of underwater photography on the Hollywood blockbuster hit *The Deep*. In 1994 the Discovery Channel honored him with a feature two-hour special aptly named *The Man Who Loves Sharks*. The September 12, 2005 issue of *Sports Illustrated* has a profile of Stan remembering his first appearance in the magazine on its cover in January 1958. It's hard to find a serious diver who has not been touched in some way by this gentle and eloquent man's creative works.

But Stan is truly in his element when you discover him through his writings. That's not hard to believe when you consider that he actually studied under Robert Frost at Dartmouth. Throughout his lengthy

career, he has carefully chronicled his underwater rites of passage in a widely published series of articles, features, anecdotal musings, and interviews. Now for the first time, a nearly complete body of that work is available in one book spanning his earliest youth to the present.

For years, Stan's friends have urged him to release just such a collection and I'm glad to note that he finally capitulated. New World Publications, the brainchild of Ned DeLoach and Paul Humann, made their reputation with the superb series of marine life and coral identification books. *Sea Salt* is their first offering in this genre.

Opening with forewords by Peter Benchley and Howard Hall, the reader is treated to a series of chapters in the book's first half that unveil Waterman's earliest development as his interest in diving and the sea awakens. The second half of the book contains the essay series originally begun with *Ocean Realm* magazine in the 1980s and that I continued with *Fathoms*.

I consider myself something of a Waterman aficionado and still was surprised to discover original works contained here that I had missed over the years. At 288 pages with 72 photos, the hardback tome has a rich treasure of adventure, opinions, shared observations on interesting friends and companions, the thrills of behind the scenes happenings on film and dive projects, as well as soul-baring reflections on his family and the strains that he sometimes brought them due his globetrotting zeal in pursuit of his diving muse.

References are often made to the skill of master photographers who "paint with light." Waterman goes far beyond that. He paints a richly diverse canvass of life experiences with only words. One of the most poignant memories he shares describes an outing off Corsica in 1950

when the motivation for many early underwater explorers was to hunt fish:

"I entered the Mediterranean with mask, fins, snorkel and Arbalete speargun, my first dive on the old world side of the Atlantic. The recollection is so clear that it might have been yesterday. I was immediately surrounded by a great school of silver jacks. They flashed in the sun as they turned in unison, circling around me. They were friendly, curious, beautiful ambassadors of the Mediterranean world. And how did I greet them? I fired into the middle of the school, wounding one and frightening away the entire lot. And such was my fear of sharks and the unknown in the deep blue water beyond my reach that I nervously swam for the jetty and scrambled out of the water, happy to have escaped alive from this daring adventure. There was no shame in having violated that peaceful world into which I had intruded. I was rather proud of myself for having at least winged a fish. Yet the memory of that violent, thoughtless act still evokes an unpleasant sense of shame today."

*Sea Salt* is a magnificent volume. It will excite, sadden, thrill and mesmerize the reader with tales of a singular life by an extraordinary man who has emerged as diving's most articulate and sensitive spokesperson.

You can obtain yours by contacting: New World Publications 904-737-6558 or by ordering direct from their web site: [www.fishid.com](http://www.fishid.com)

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**Editor's note: There are about 40 copies of *Diving Pioneers & Innovators* still in Bret Gilliam's personal inventory. They are available as a Signed/Numbered Limited Edition personalized to each buyer by Gilliam at \$200 each, including shipping. He can be contacted for purchase at [bretgilliam@gmail.com](mailto:bretgilliam@gmail.com).**

A vibrant red fish with a large eye swimming in a dark, rocky underwater environment. The fish is the central focus, positioned in the lower half of the frame. The background is filled with dark, textured rocks and some greenish-brown algae or coral. The lighting is dramatic, highlighting the fish's scales and the texture of the surrounding environment.

# NEXT ISSUE

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