Edited by
Peter Symes

POINT & CLICK ON BOLD LINKS

Equipment

Wingman

This practical bag for a bailout tank keeps your hoses tidy and regulator handy with no need for bungees and straps. Simply put the tank in the bag, close the zipper and place the regulator inside the strap. The bag is made from a mesh of ballistic nylon, which protects the tank while allowing water to drain away easily. Comes in 5-liter (40 cu ft) and 7-liter (80 cu ft) sizes. Available in black. **Poseidon.com**

HDC Tech Dry

BARE writes that this suit is the toughest they have ever made. By combining three stretchy fabrics, the designers have created a suit that is both lightweight yet rugged enough to sustain heavy use in demanding environments with abrasive surfaces. The patented Automatic Torso Recoil system controls torso length and eliminates the need for a crotch strap. The suit comes in 16 standard sizes but can also be made to measure. Technical and cave divers can opt for an Expedition model that comes with a slim cut, crotch strap, big pockets, Tech boots and a new Sealtek dry hood. **Baresports.com**

SMS75

The Hollis SMS75 side-mount system fills the gap between the sturdy SMS100 and the minimalist SMS50 lightweight siblings making it a hybrid that combines the best of the two into this new harness. Hollis states that it was designed with all environments in mind, with a wing optimised for horizontal diving with increased lift around the hips. The SMS75 also supports rear-mounted tanks and reversible inflator positions. **Hollis.com**

Trimix mixer

Spotted at the recent TekDiveUSA conference, Nardi Compressori's TT-Mixing panel (photo at right shows near identical N-Mix) produces ready trimix gases simply by keying the blend on the touchscreen. According to the presentation, the panel can even analyse leftover gases in used tanks and calculate how to top them off with a new blend according to specs, minimising the loss of expensive gases while calculating the price for the fill. The panel, which can be remotedly controlled with an app, weighs 13kg and comes with brackets for easy mounting on a wall. **NardiCompressori.com**

Cobalt 2

The Atomic Cobalt 2 is a hose integrated recreational dive computer capable of supporting up to six gas mixes, each up to 99% oxygen. The display has been updated and now the Cobalt 2 benefits from a bright, full colour, high contrast LCD screen. Atomic has also upgraded the processor, making the Cobalt 2 more reactive. Atomic states that the 'soft touch' magnetic button navigation on the built-in compass is easy to use. The Cobalt 2 is powered by a built-in lithium ion battery that provides 40 to 60 hours of dive time, with two options for charging. A fast charge via a mains socket or a slower charge when you use a powered USB port. **AtomicAquatics.com**

Review

Watershed Chattooga Drybag

Text by Matthew Meier

The Chattooga Drybag is a top-loading duffel sealed with a ZipDry waterproof closure. Created and patented by Watershed, the closure resembles a large ziplock seal and is both air and watertight. The bag is made of backpack-grade nylon coated sheets of polyurethane film making it incredibly durable. Upon completion each and every bag is inspected to ensure that it is 100% leakproof.

The Chattooga comes with a pair of rugged yet comfortable, padded handles, numerous hard lash points and various compressions straps. The bag weighs in at less than 2lbs and measures 12 x 20 x 10 inches, with a capacity of 1,800 cubic inches (30 liters). Optional accessories include a shoulder strap, a padded liner and a padded divider set.

As an underwater photographer, I spend a lot of time on boats and like to bring along my topside camera for shooting between dives. However, I have never found the perfect bag to keep the camera protected and dry. The Chattooga performed beautifully on both counts. The large 17in opening at the top of the bag made it easy to get gear in and out, while the padded liner gave me piece of mind when the bag was placed along the floorboards of a small skiff. For different shooting scenarios, the padded dividers allowed me to travel with multiple lenses, plus a flash. The top closure was simple to operate and sealed airtight.

While no bag is perfect, the Chattooga worked incredibly well and my gear came home safe and dry.

For more information on the Chattooga DryBag and the rest of the Watershed line, please visit: **Drybags.com**

Bring your iPad down under

iDive and Watershot have unveiled the first fully functional underwater touchscreen for smart devices. The team built the housing with a flexible membrane with the key component called the "Balance Module", which automatically manages a positive pressure supply and enables the full functionality of the touchscreen. The diver can choose between supplying air via a CO_2 cartridge or the first stage regulator or pony bottle. The iDive currently has a recommended depth rating of 40 meters for CO_2 supply and 100 meters for the first stage supply. **idive-and-watershot**

HOG Zenith

The Zenith second stage from HOG is a pneumatically balanced second stage. All good second stages use a venturi effect to assist in maintaining flow, but the venturi performance is less critical if the second stage is pneumatically balanced. The center portion utilizes a durable soft touch silicone to make purging easier. According to manufacturer the new design also helps controlling a free flow in a current. **Edge-gear.com**

AP Diving announces additional oxygen cell supply for their Inspiration range CCRs

Due to interruptions in oxygen cell supply this year, AP Diving has taken steps to secure a second supplier. The cell from the new supplier, the same supplier as the Narked @ 90 cell, will have the designation APD16 and has a white label (shown left). AP Diving points out, while the APD16 has an unfortunate trait in that once the Inspiration scrubber warms up, the cells read 0.05 bar higher than the actual PO_2 this trait is repeatable and reliable and so is easily compensated for. **APDiving.com**

Interviewing

Wreckers

— *Four Pioneering Wreck Divers*

Author's note: Though for the most part, the cave diving community was the first to pioneer mixed gas sport diving, beginning with Dale Sweet's successful 1980 Heliox dive to 110m (360ft) at Diepolder II in Hernando County, Florida, USA, leading shipwreck divers were not far behind. By 1995, numerous groups of wreck divers in the United States, United Kingdom and Europe were using Trimix to improve the safety and performance of their dives. That year I interviewed some of the vanguard to get their perspectives on mix and how it was impacting exploration. Here are the original interviews as they appeared in aquaCORPS Journal #9: Wreckers, *August 1995.*

— Michael Menduno

Text by Michael Menduno
Photos courtesy of aquaCORPS, Leigh Bishop, John Chatterton, Joe Pass and Joel Silverstein

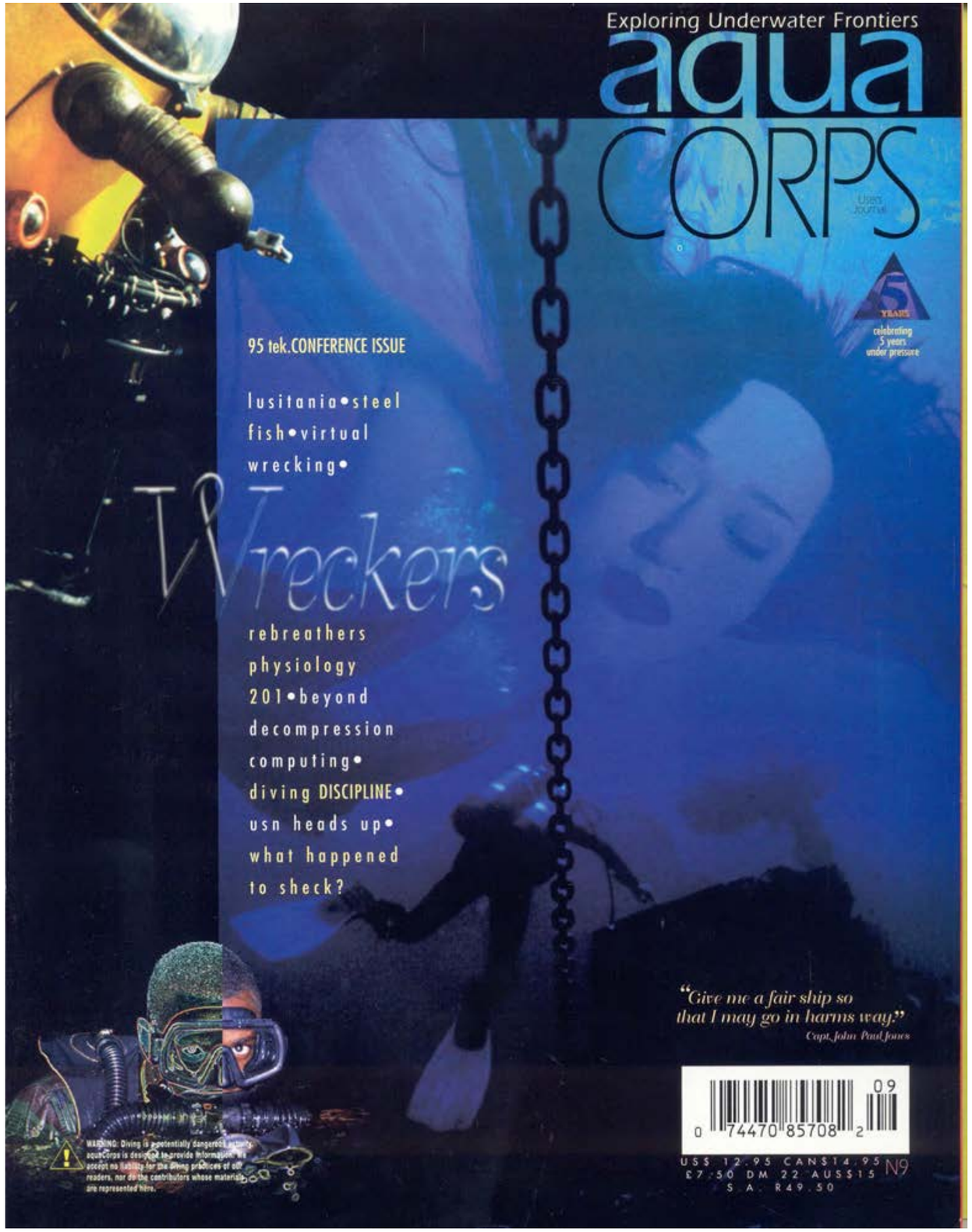
August 1995—Today, shipwrecks are at the heart of a technological revolution that is redefining the limits of what is possible. Within the last year, a leading team of tekkies mounted the first mix expedition on the *Lusitania* to 90m (300ft), long thought out of the practical reach of scuba aficionados, and racked up over 120 dives. Other tech divers opted for the safety of a hose and commercial cutting tools to liberate the artifacts of their dreams.

And to further stir the soup, grand daddy wrecker, Oceaneering International, the global commercial diving contractor whose crews dived the *Lusitania* over a decade ago, recently completed salvaging treasure—five tons of silver and gold coins from the Spanish Brig of War, *El Cazador*, sunk in 1784 in the Gulf of Mexico—using their WASP Atmospheric Diving Systems (ADS) fleet to limit their ambient exposure. This after the technical diving team led by Captain Billy Deans were found in violation of the Occupational Safety and Heath Administration (OSHA) standards prohibiting deep self-contained diving the prior year and was thrown off the job. "It's a mental barrier, not a technological one," explained commercial diving supervisor and wrecker John Chatterton.

Although underwater limits are being redefined, the painfully learned maxim of diving still applies, maybe more than ever: SAFETY COMES FIRST. Though the rewards of shipwreck diving are great, a diver can easily end up paying the ultimate price if all the parameters of the dive (and diver) are not taken fully into account. And when this happens, the entire community suffers. Training and experience are critical. Particularly today, when competition for new wrecks has driven the cutting edge ever deeper and more remote, increasing the operational and safety requirements for the dives, as well as the costs.

What is it about shipwrecks that inspire us to invest time and ingenuity and put our human frailties on the line? Is it simply the knowledge that these failed human outposts may yield up potent treasures, or is it some complex piece of genetic code that compels us to seek out our remaining remnants in the vastness of the sea?

Better go and ask a wrecker, if she'll tell you. Or better yet, go ask two of three.



JOEL SILVERSTEIN

THIS PAGE: Captain Billy Deans in action

Captain Billy Deans

Owner of Key West Diver Technical Training Center and Deep Sea Technologies, 38-year-old Captain Billy Deans is recognized as one of the pioneers of technical diving.

MM: Billy you've been involved in technical diving since the beginning. What would you say are the differences with recreational diving?

BD: We still do a lot of recreational diving. It's fun and it's easy. You put your equipment in a bag, sniff your air, throw your equipment on, jump in, and swim around in 25m (80ft)of water. Technical diving is totally different. It's a philosophy, a mindset. Everything you do is based on making that dive absolutely perfect because if you don't account for all of the parameters of the dive you could get killed. It's a constant vigilance that wears on a human being. To do it well you have to live, eat and breathe technical diving.

That's the negative side—it's so demanding. It has put bags under my eyes, gray hair on my head and led to fights with my girlfriend. But I won't compromise on safety because once you do, you become complacent and you get killed. That's the thing that bothers me; it's like a black cloud on the horizon. The technical diving market expanding and I have an uneasy feeling that we're going to have an increase in fatalities. That's what we're trying to avoid.

MM: Because of the new people coming in?

BD: New people coming in who do not have the proper training. That's one of the reasons we're so adamant about having tiered levels of training and broad base of experience. Experience is critical.

In the early days, there was a small cadre of technical divers. These people were highly trained, and committed to diver safety. I

remember when Parker [Turner] got killed. It sent a shiver up my back, because they were doing everything right, right down to the last minute, and he still died.

People need to understand this. They can still have fun but they need to approach technical diving with the idea that it is very dangerous. You learn to be very, very cautious in this type of diving. The positive rewards are great but on the negative side you can end up paying the ultimate price. And when divers die, we all pay.

MM: What are the limits of open circuit gas diving?

BD: Sport diving has become much more reliable and safer. The technology and equipment that we have today has essentially doubled our working depth from 40m (130ft) to about 80m (250ft) . That's our playground and I consider it to be a reliable working range. Outside of those limits, it's a little more dangerous. It can be done, but it's not for the people that are just getting into technical diving.

MM: I understand that your focus has shifted over the last two years from technical training to the commercial aspects of diving.

BD: It's an aspect of the diving that has been a natural evolution for us. Karl Shreeves (PADI's Technical Diving Liaison) once said that he was so excited to be in on the next evolution in sport diving. And I guess that I'm excited to be involved in one offshoot of technical diving and that is, work for pay. There are definite, viable opportunities there. The commercial market sees it. And with closed circuit equipment coming on stream, I believe there are going to be a lot of opportunities opening up.

PHOTO COURTESY OF AQUACORPS

MM: For self-contained diving in a commercial setting?

BD: That's correct.

MM: Commercial diving today is based around surface supplied technology. What kind of tasks can better be accomplished with self-contained equipment?

BD: Reconnaissance. You can put a team of self-contained divers on site with a minimal amount of equipment. They can survey an area, a wreck site, you name it, come back and look at the data. And it's actually very, very cost effective to do that. We're talking a 1 to 5 ratio. Then if there's work to do, you can bring in a surface-supplied gear.

MM: How about just sending down a ROV?

BD: Our experience is that the two go hand in hand. On the Cazador project we called it "hunter-gatherer" mode. An ROV was sent down to sniff out a possible target site, in this case, to find coins. Then the diver would navigate out the ROV cable and survey and work the area.

Of course, putting a diver in the water is very, very inefficient; I don't care if it's on a hose, closed circuit, or open-circuit. The advantage is that diver on site can make rational decisions. It's easier to mobilize an open-circuit team then it is to bring in an ROV. But I think that the best combination is to use them both.

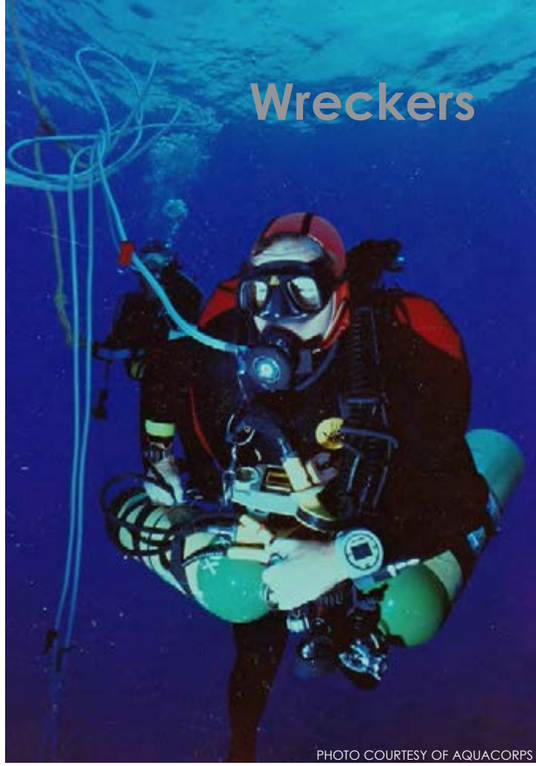


PHOTO COURTESY OF AQUACORPS

MM: The Cazador was such an interesting project. Your team found the booty and then Oceaneering came in with their fleet of WASPs and…

BD: ...and picked up five tons of silver. Yeah, it was great @#?#!!

MM: It would take a team of open-circuit divers a long time to pick up five tons of silver.

BD: I agree with you, particularly at the 90m (295ft) depths we were working. My only regret was that I wish we could have had another five manned dives. It would have been nice to see what our capability was, but if you look at it, putting a guy down for four to six hours in a WASP is really the way to go. But you also have to look at the cost. We fulfilled our contractual obligation. We went down. We found the coins and we were able to bring a few up. That is the limitation of open-circuit diving.

MM: Do you think that commercial regulations are going to evolve to the point of allowing self-contained equipment for


JOEL SILVERSTEIN

Captain Billy Deans in action (left and below)

Polly Tapson all kitted up


LEIGH BISHOP

Wreckers

certain types of activities?

BD: I truly hope so. The guys in the commercial industry are smart. They see what's going on and a number of them are turned on by it. They'll take advantage of the technology and eventually there will be changes in the Code of Federal Regulations (CFR). That would be the smart thing to do.

MM: What do you see today as the frontiers of wreck diving?

BD: Discovering new wrecks. When we first started planning to diver the *Doria* ten years ago the *Lusitania* seemed unreachable—nobody thought it was possible. Now you can charter a boat to it. Even diving the *Doria* has changed. In the early days the big thing was going down on the outside of the wreck and getting windows. Now everyone is making penetration dives and looking for artifacts.

MM: And the dives are getting longer.

BD: Fifteen minutes used to be a long dive. Now people are doing 25, 30, and 35 minute dives at 61-77m (220-250ft). That's what I see happening in wreck diving.

MM: What are your personal goals for the next 18 months?

BD: What I'm trying to do, is stay focused. We're one of the very few dive centers that are trying to make a living at technical diving. It's very difficult to make a living in the dive industry. You can drop your safety standards and make a lot of money and kill somebody. But we won't do that. We're trying to make a comparable living at our type of diving through qualified teaching, keeping our standards up, and doing these projects. But we also want to have fun at it.

We get a lot of neat offers to dive wrecks and we could spend the whole year traveling and doing all these dives. There just isn't enough time. That's why I'm targeting the wrecks here locally. There is a tremendous amount of history from in the Florida Keys. We have a number of targets off the Tortugas including a German U-boat.

We're also looking at wrecks from the perspective of coming in as a professional team and helping people get set up, for a fee. It has consistently been shown that it's better to pay a profession to come in and set it up right as opposed to making all the mistakes and possibly hurt someone. In the long run, it's more cost effective to pay professionals. So that's what we're targeting, wrecks that could possibly turn some revenue for us.

We have three real interesting projects coming up in 1995 that will probably take us away for a month of two. We're talking 17th century shipwrecks that are well into the technical diving range outside the U.S.


JOEL SILVERSTEIN

Polly Tapson

Thirty-one-year old filmmaker and British wrecker, Polly Tapson, led the first technical diving expedition to the *Lusitania* in June 1994.

MM: How long did it take to plan and train for the expedition?

PT: I began to ask people if they would commit to the training and the cost of the expedition about 18 months to two years before we dived. That was more than enough lead-time to actually set up the expedition. One factor was that the U.K. members of the team were not trained in the use of Trimix and had very little knowledge of gas mixing and the implication of this kind of technical diving at that time. Four months out, I knew exactly what we were going to do and what contingencies were available. We were meeting on a regular basis to discuss how to improve what had been planned.

MM: How many dives did you do in preparation for the dive?

PT: We scheduled 49 dives in preparation for the *Lusitania*. We were going out every other weekend last winter. We conducted a lot of the deep training in a close controlled environmental quarry in North Wales. The U.K. team trained in excess of 90m (293ft) because we didn't want the *Lusitania* to be the team's deepest dive when we arrived in Ireland. We needed to test everything.

MM: How important was diver safety in your planning?

PT: A great deal of thought went into our 'what ifs' and 'what thens.' I would stay up until 3:00 in the morning contemplating what could happen and how we would deal with it. We agreed as a team to ban any form of competitiveness and encourage discussion. As a result our post dive briefings became incredibly honest.

MM: Did the expedition come out as you had planned?

PT: Yes, in every way. It was a perfect execution of our plan, right down to the number of vegetarian meals in the packed lunches. We could have spent more money to hire assistants to help with the gas mixing or to help with unloading the boat, but we decided not to. It was hard work. We got up early. We worked through the morning setting everything up. Everyone had a designated task. We worked very well as a team. Of course, I didn't really have a great sense of relief until after the last day's diving when I knew that it had been an incident-free trip.

MM: Technical diving appears to be predominantly a male bastion. Did you find that being a woman was ever an issue?

PT: I don't have anything to say on that subject. The answer is no. It was never an issue. I have encountered sexist attitudes from some men along the way but

Lusitania dive team

LEIGH BISHOP

nothing I couldn't handle. Most of the *Lusitania* team was intelligent enough to be above it.

MM: It seems that technical diving has a lot fewer women than recreational diving as a whole (about 37% female according to PADI statistics). Our surveys suggest it's 5% or less. Can you offer any insights as to why that is?

PT: It has more to do with perception more than reality. Men probably find the sport easier than women because of the equipment and intensive nature of technical diving. However, having said that, I've seen men who are not particularly strong who are able to wheel some heavy equipment. I believe that women can overcome what might be perceived to be a physical lack of strength if it's something that they really want to do.

MM: I understand that you got "bent" on a practice run a week prior to the expedition. That must have been a very difficult personal decision for you to decide to carry on anyway. Are you comfortable talking about it?

PT: I don't like talking about it or discussing it in much detail for a very obvious reason. People are going to read this and there is no guarantee of how they're going to interpret what I have to say. What I don't want to do is to be an example of someone who acted irresponsibly and got away with it. And then have someone else do the same thing and subsequently ends up in a wheelchair for life. It is very difficult for me to talk about it for that reason.

MM: It was obviously a very personal decision on your part. You had worked on the project for two years.

PT: Yes, of course it was a personal decision. I believed that my recovery was totally satisfactory in so much that I was not going to cancel that trip. That's not to say that I intended to dive. I reserved that decision for the trip. However, I definitely was not going to let it stop the wheels that were in motion, the imminent arrival of the American divers and everything that had been planned.

MM: Cave divers have a saying, "Take only pictures, leave only bubbles." I know that doesn't really apply to a lot of shipwreck diving, but your team decided not to take artifacts off the *Lusitania*. What was your motivation?

PT: It's very simple really. There is a man who claims he owns the *Lusitania* and told us that we weren't allowed to visit the shipwreck. His claim has yet to be proven. But the maritime and merchant marine laws were such that I felt that no laws were being broken in visiting the shipwreck, which is why we were able to proceed unhindered. In addition, we were visited by the Irish Customs and Excise people and informed that if we recovered anything the *Lusitania*, we would have to hand it over to Customs. As a result, we felt that there was a certain risk in recovering anything from the ship and so we decided not to take that risk.

MM: What would you say are the frontiers today in shipwreck diving?

PT: I don't think there are really any frontiers.

MM: What do you mean by that?

PT: The limits are more a matter of economics than anything else. Unless there is a promise of great gain, progress will be relatively slow. I see the most potential for progress being made in commercial and scientific diving. Recreational divers will hang onto their coat tails as far as they can go. It's an expensive sport.

MM: How much did it cost to mount the expedition, the training, planning the whole thing?

PT: By the time I had finished pulling in "deals", the financial costs were viable for everyone who I wanted to be involved, but the indirect costs of our time and relationships were higher than anticipated. Everyone agrees that their contribution in man-hours was excessive and cannot be adequately quantified. This was largely due to the learning curve we had to climb as a team and taking the "what if/what then" approach to planning. One of our team reckoned it personally cost him in the range of GB£10,000 (about US$15,000 in 1994) hard cash to prepare and participate in the expedition.

MM: What are your personal exploration goals over the next 18 months?

PT: My goals are to identify several virgin wrecks beyond the 70m (228fT) off the southwest coast of England. We have the coordinates and we'll be diving on mix. Another member of the team is handling the organizational side of the expedition because of the time involved. I have professional commitments and other affairs, which are my priority for the time being.

PHOTO COURTESY OF JOHN CHATTERTON

John Chatterton

Hardhat wrecker, John Chatterton, 42, is an avid deep wreck explorer and works as a commercial diving supervisor. He and Richie Kohler identified the "U-Who" as the U-869, later heralded in the New York Times best seller, *Shadow Divers*.

MM: You're a commercial dive supervisor as well as a wreck diver. Why do you dive scuba?

JC: I started wreck diving the same time I got involved in commercial diving. To me, scuba is just another technology. Philosophically, surface supplied diving is a group project. The diver is just a cog in a big machine. Scuba is freedom. Independence. It's the difference between the guy driving down the road in his Lincoln Continental with a house, mortgage payments, and responsibilities which can be really good compared to the guy hitchhiking down the road who's totally free. That can be a good thing too. Remember, in commercial diving, nobody pays you to dive. They pay you to do something that happens to be under water and the way to get there is to dive.

MM: There seems to be considerable fear and trepidation about scuba in commercial circles.

John Chatterton

PHOTO COURTESY OF JOHN CHATTERTON

John Chatterton diving the *Britannic* (left); near the wreck site of the *Lusitania* (right) 18km (11mi) south of Kinsale lighthouse in Ireland; and kitted up for a dive (below)

PHOTO COURTESY OF JOHN CHATTERTON

JC: Most of the people in commercial circles view scuba as a toy that's good to about 9m (30ft). I find scuba a very interesting technology and technical diving has added another dimension.

MM: How has technical diving changed shipwreck diving over the last five years?

JC: Two major things have happened. Number one, the surface area of the ocean floor that we're able to claim has been dramatically increased. You could draw a line and say, here's our 40m (130ft) limit, but today, more and more guys are going out and diving 60m (200ft) and 60m (200ft) plus. 'We're down to where?' Technical diving has come along and nobody's sure where the line is. And with things like rebreathers on the horizon, if you draw a line, you better draw it in pencil. It's probably not going to stay there long.

The second thing is productivity. The technically-oriented diver is a more productive diver. He's much more goal oriented and in a better position to accomplish the goals he sets. Setting up goals for each particular dive is the way to make progress. That's the way to be productive. We used to do a lot of 60m (200ft), 60m (200ft) plus dives, scare the shit out of ourselves, and be glad to get up alive. That wouldn't wash anymore.

MM: When you say tech diving in that context, are you really referring to mix?

JC: It's a little more subtle. Not everyone is using mix or taking full advantage of the technology. But even air divers using an accelerated decompression on oxygen or nitrox are seeing an advantage in terms of increased bottom time. Increased bottom time is going to give the diver increased productivity.

MM: What are the practical working limits of open circuit wreck diving?

JC: For a while, I was really into asking people, 'Where is this going to stop?' I went to Billy Deans, I went to this guy and that guy, and just about everybody said, "The limits are right about where my feet are." We're limited by the technology to some degree, but I also think we are limited by our vision…

MM: Of what's possible?

JC: Yeah. And looking at the limits of technology, I don't think we have enough insight to say where the absolute limits are. There are still a lot of things to be done with open circuit and it seems like there's always a new formula, a new recipe being cooked up in somebody's kitchen.

MM: Do you feel a lot safer when you're diving a surface supplied system?

JC: No. It's different. I don't feel a greater degree of safety. There are assets and liabilities to using either technology on a particular site. If I'm diving scuba, I'm diving solo. I'm not in direct contact with the surface. That's a disadvantage, and I have to take into consideration important aspects of my dive, like navigation, gas management, things like that. When I'm on surface-supplies, those issues are much less important, but I've got to deal with other aspects, my umbilical, for instance. The umbilical could actually end up tethering me to the wreck. Generally, I prefer to rely on myself over a machine top-side. Maybe that's why I like scuba as much as I do.

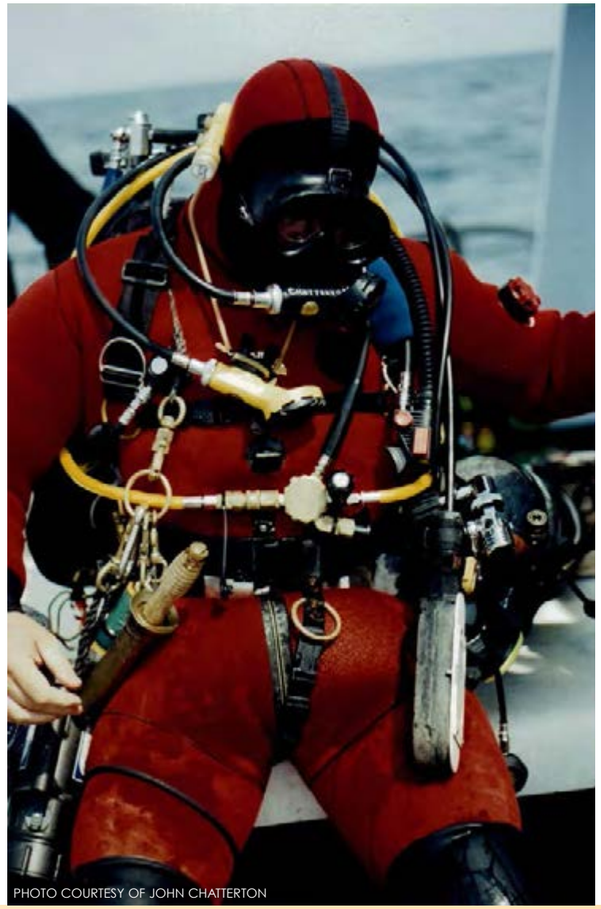


PHOTO COURTESY OF JOHN CHATTERTON

MM: What would you say are today's frontiers in self-contained ship wreck diving?

JC: Shipwreck diving is becoming a more global activity. The oceans are getting smaller. When I first thought about the *Lusitania*, my reaction was "Wow. The *Lusitania*. It's a shame that it's too deep." Well, depth is subjective. The *Lusitania* was a lot deeper on my first dive than it was on my last dive. People are beginning to look at wreck that they haven't considered diving before and saying, "Hey, wait a minute. We can go there. We can do that. We can make it happen." It's a mental barrier; it's not a technology barrier.

MM: What are your personal exploration goals over the next year?

JC: I want to focus on locating some specific wrecks. One is the U-550. Another is a liner called the *Carolina* that's off the New Jersey coast. I'm very interested in the wrecks in my area that have been beyond sport diving until now.

MM: Are both in deep water?

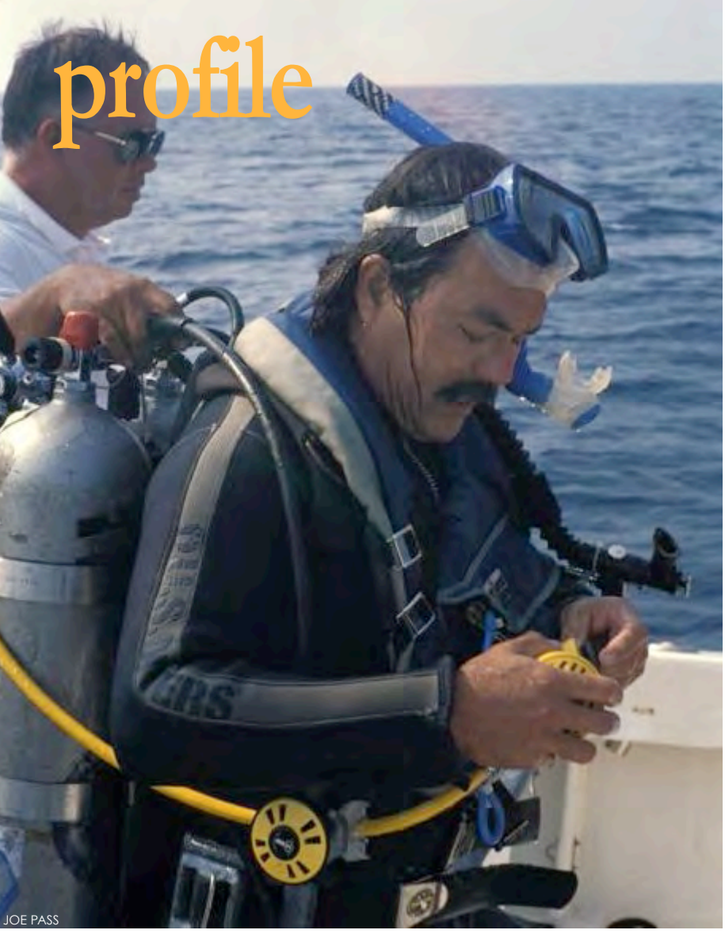
JC: The U-550 is probably going to be about 100m (325ft) and it's 125 miles (201km) offshore. I'm not certain about the *Carolina*. The problem is that is has been reported in several areas, but I believe it's going to be as deep as 80m (260ft), something like that.

MM: I understand you recently made a positive I.D. on the U-Who? That sounds exciting.

JC: I believe we have positively identified the wreck as the U-869, but I'm more interested in finding out exactly how it got off the coast of New Jersey. The sub was not supposed to be there.

MM: Wasn't it supposedly lost off the coast of Africa?

JC: Right. I've been to London, to the Ministry of Defense and worked in their foreign documents section, and I have been to Germany and talked with a bunch of the U-boaters and examined their archives. It's amazing how much of history is just somebody's reasonable guess. We have this boat that was supposed to be in Gibraltar, but it seems to



JOE PASS

Roderick "Rod" Farb in action (left and below)

Historical painting of CSS *Alabama*

US NAVY'S NAVAL HISTORICAL CENTER / WIKIMEDIA COMMONS

be lying off the New Jersey coast. WWII wrecks are really fascinating because the first hand history, the people who were there, are disappearing. A lot of what wreck diving is about is understanding the historical aspect of the wrecks. That kind of information tells us who we all are.

MM: It puts our culture in context?

JC: History isn't always what you've been told.

MM: There's a huge interest in rebreathers right now. What will the impact of rebreather technology be on wreck diving?

JC: We are going to see nitrox rebreathers moving in to the recreational area but deeper exploration is not going to benefit for that for a while.

MM: Why's that?

JC: It's going to take time before the people who are doing deep wreck exploration are comfortable with rebreathers. It's going to go the same way the air-closed circuit diving went, starting off in shallow water. "I went a little deeper today than yesterday. Maybe I will go a little deeper tomorrow."

Roderick Farb

Photographer and filmmaker Roderick ("Rod") Farb, 43, recently filmed the CSS *Alabama* off the coast of France for *National Geographic*. Farb's team was the first group of sport divers to get permission to dive the USS *Monitor* in 1991.

MM: How has shipwreck diving changed over the last five years?

RF: Judging from the divers I see, and the questions posted on the Internet, I'd say that the big changes are the volume of gas that divers are carrying. They're going to bigger systems. Twin 80's used to be the standard. Then there were twin 100's. And now twin pumped-up 120's from Europe, and the big titanium tanks that have been imported from Russia. There has also been a blossoming of support equipment for wreck diving, like uplines, reels, lights.

MM: Has it made wreck diving safer?

RF: I believe it has, but it also has opened access to areas that were inaccessible, for example, the degree of penetrations divers are attempting, which of course increases the risk. So I think it works both ways.

MM: What are the practical working limits of open circuit scuba these days as far as wreck diving is concerned?

RF: A practical limit that most people use is 74m (240ft). You could probably go deeper. I worked in Europe and divers there routinely dive 61m (200ft) with open circuit on air. There is also an active technical diving community that uses mixed gas at those depths and beyond, but quite frankly, from my experience 72m (240ft) is about the deepest most wreck divers regularly go. And most of it is still being done on air.

MM: What impact has mix had?

RF: The impact has been rather limited to a small group. It's obviously growing, but locating sources of gas, or getting the equipment to mix it yourself is still a problem. It's still beyond the average wreck diver. In Europe, for example, I've been involved with a club on the coast of France with several hundred avid deep-water wreck divers, and none of them dive mix at all because it is too expensive. They don't have equipment. They all dive on air, and they do very well. If you look at the overall number of shipwreck divers here in the States, the percentage using mix gas is relatively low.

JOE PASS

MM: I understand you were recently in Europe filming the CSS Alabama*?*

RF: Right, I was on assignment for *Geographic* for six weeks during the summer. It was one of the most difficult projects I've ever done diving-wise. The *Alabama* lies at 61m (200ft) 61m in the English Channel in extremely dark 9°C (49°F) water. And though the wreck's not extraordinarily deep, there is a narrow window of time when you can actually make the dive because of very strong currents. It's only about a one-hour window twice a day, and that's decompression, bottom time the whole nine yards. It is an extremely, technically difficult dive.

MM: Is it a closed site?

RF: The site is not opened to sport diving. The Ministry of Culture and the United States government regulate it by treaty. The ship belongs to the U.S., but the French have the authority to do archeological excavations. There's a Franco-American committee that oversees the work on the site, and a group of volunteers screened from a local wreck diving club are participating.

MM: What are today's frontiers in shipwreck diving?

RF: Most technical divers want to reach deeper wrecks because they have been out of the reach of most divers and have a lot of artifacts. But as the wrecks get deeper and deeper the technology required gets more sophisticated. The result is a point of diminishing return. The cost, the expense to go and collect ordinary artifacts from a shipwreck is going to far outweigh the value, unless they have some monetary value. The ordinary tech diver will have a limit on what they're willing to spend to mount an expedition. Of course there will always be a very small group of people out there looking for the rare wrecks that haven't been visited or found. Their work will continue, limited by their imagination and the equipment available to them to reach those sites.

MM: You recently purchased a Biomarine


US NAVY'S NAVAL HISTORICAL CENTER / WIKIMEDIA COMMONS

Historical painting of USS *Monitor* in action against CSS *Virginia* by Julian Oliver Davidson (1853-1894)

155 rebreather. Are rebreathers the enabling technology to allow wreck divers to explore more?

RF: Absolutely. Rebreathers are going to be extraordinarily useful for a limited number of people. They aren't going to have a high appeal for recreational divers because of all the equipment and support required. They are going to be useful only to people with a specific need that could bring a return on a financial investment. The ordinary technical diver is not going to go out and get a rebreather. But for a small group of explorers, it's going to be a very useful piece of equipment.

MM: What are your personal exploration goals over the next 18 months?

RF: I'm hoping to do a documentary on a new shipwreck in another part of the world. One that is very historically important.

MM: Are you going to tell me the name of it or…

RF: No. I can't. It's an unexpected shipwreck that's quite important in American history and it's in a country where access is very difficult. I have permission from the respective governments and so it's a matter of doing the work.

MM: Your exploits have forced you to negotiate with a number of governments. There was the Monitor *project with NOAA, the* Alabama *with the French. Do you see this as an increasing activity on your part?*

RF: It is, and getting more difficult because of the sheer number of wreck sites falling under government jurisdiction. Access is difficult. Governments are run by bureaucrats who are human beings; and human beings, being what they are, are inherently suspicious and proprietary of their territory. The problem becomes what I perceive as a matter of trust. They want to know "why you want to do it." In many instances, unique sites should be protected. However sites should allow diving access so that at the very least, people can be educated about them.

A shipwreck is a unique thing; it's not like a car or train wreck on land that gets cleaned up. It's a time capsule and historically important wrecks should be preserved. Unfortunately, bureaucrats tend to get carried away with being proprietary over their sites. I see that increasing. I'm fighting to get my foot in the door, establish trust that I'm not going to pillage and rape the wreck. I'm going to be doing something useful and valuable to the agency. It takes a long time.

MM: You mentioned the Internet. How important is it to your work?

RF: The Internet might be an old part of the information super highway, but in terms of technical diving it's very young. I use Mosaic, a user friendly graphical based internet interface as a vehicle to get into the literature, the libraries, the journals. It provides a lot of information for my research. It's invaluable from that point of view. In terms of getting information from fellow divers, I haven't found it to be that valuable thus far.

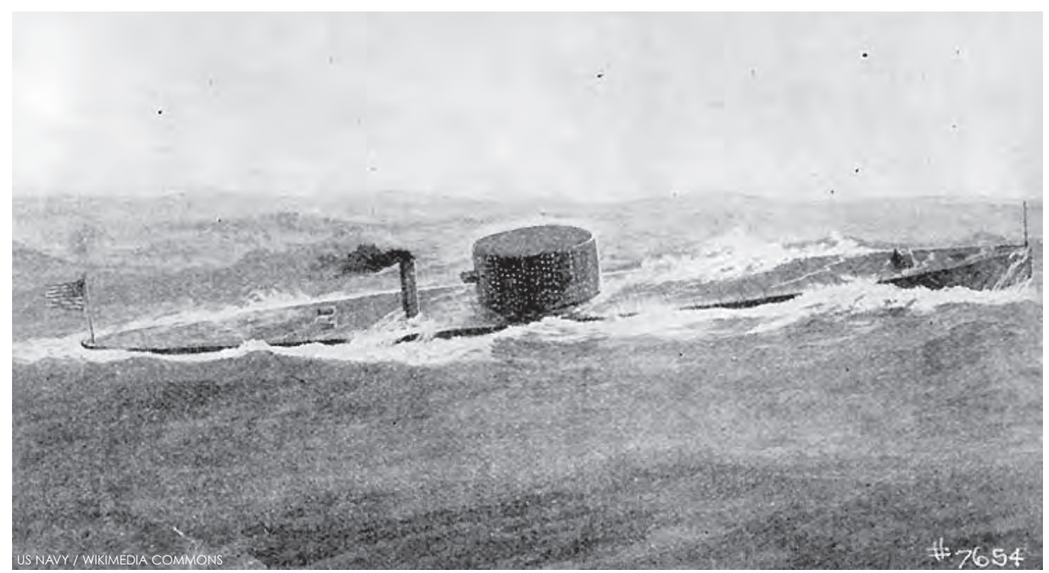
MM: Do you have a favorite online hang out?

RF: I use the Techdiver list, but I am becoming increasingly unhappy with the amount of useless information that's posted.

Where they are today?

Billy Deans is retired from diving and is a registered nurse and helicopter medic with LifeNet Key West, Key West, Florida. John Chatterton remains an active wreck diver and resides in Ft. Lauderdale, Florida. He is a partner with Underwater Archaeology & Exploration Corp, an underwater survey and salvage company, and continues as the owner of Last Breath Productions, which develops underwater projects for television. Polly Tapson and Rod Farb both passed away from non-diving related causes in 2000 and 2003 respectively. □

Writer and technologist Michael Menduno published and edited aquaCorps: The Journal for Technical Diving *(1990-1996), which helped usher tech diving into the mainstream of sports diving, and coined the term "technical diving." He also organized the first Tek, EuroTek and AsiaTek conferences, and Rebreather Forums 1.0 and 2.0. Menduno, who is based in California, USA, remains an avid diver.*


US NAVY / WIKIMEDIA COMMONS

Historical illustration of USS *Monitor* at sea

The Drowned Lands of Doggerland

Text by Peter Symes
Photos courtesy of Cor Kuyvenhoven,
Jesca Zweijtzer and St. Andrews University

COR KUYVENHOVEN

Doggerland

Once upon a time there was a land... Doggerland—a huge area of dry land that once stretched from Scotland to Denmark—was slowly submerged by water between 18,000 BC and 5,500 BC. Today it is a shallow bank and productive fishing ground in the middle of the North Sea.


WIKIMEDIA COMMONS

COR KUYVENHOVEN

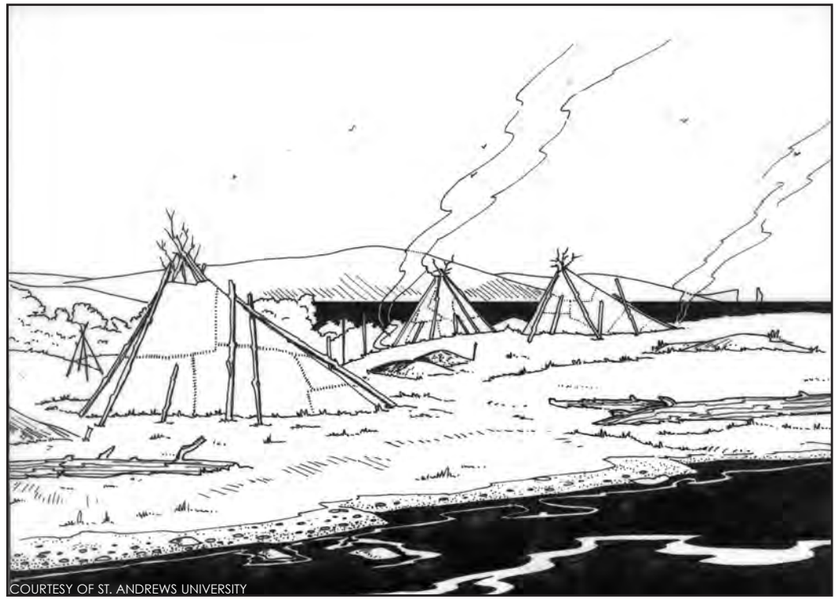
Doggerland, or Dogger Bank as it is called today, is located in the middle of the North Sea between the countries of Great Britain and Denmark; Diver at offshore drilling rig ((left)

PREVIOUS PAGE: Sunken fishing vessel with nets

Doggerland

An Agent Based model, a virtual visualisation, of life in the Mesolithic Age in Doggerland (right); Illustration of settlement (below); Fossil of mammouth remains found at Dogger Bank (below inset)

"Doggerland was the real heartland of Europe until sea levels rose to give us the U.K. coastline of today."
— Dr Richard Bates, geophysicist, St Andrews University


COURTESY OF ST. ANDREWS UNIVERSITY


DR EUGENE CH'NG, UNIVERSITY OF BIRMINGHAM / COURTESY OF ST. ANDREWS UNIVERSITY

Glancing at a map of Europe, the North Sea appears to be quite an expanse of featureless open sea separating Scandinavia and the European mainland from the British Isles. The North Sea is, however, not an oceanic abyss but a shallow sea flooding a low-lying part of the continent. During the last Ice Age when sea levels were much lower, Britain was connected to mainland Europe by a big landmass called Doggerland. Geological surveys have suggested that it stretched from Britain's east coast to the Netherlands and the western coasts of Germany and Denmark and down the English Channel as far as the Channel Islands. Research suggests that it was a rich habitat sustaining a human population numbered in the tens of thousands during the Stone Age. It had its maximum extent about 20,000 years ago although part of this area would have been covered with ice.


COURTESY OF ST. ANDREWS UNIVERSITY

Excavation site at Lepe Country Park, United Kingdom

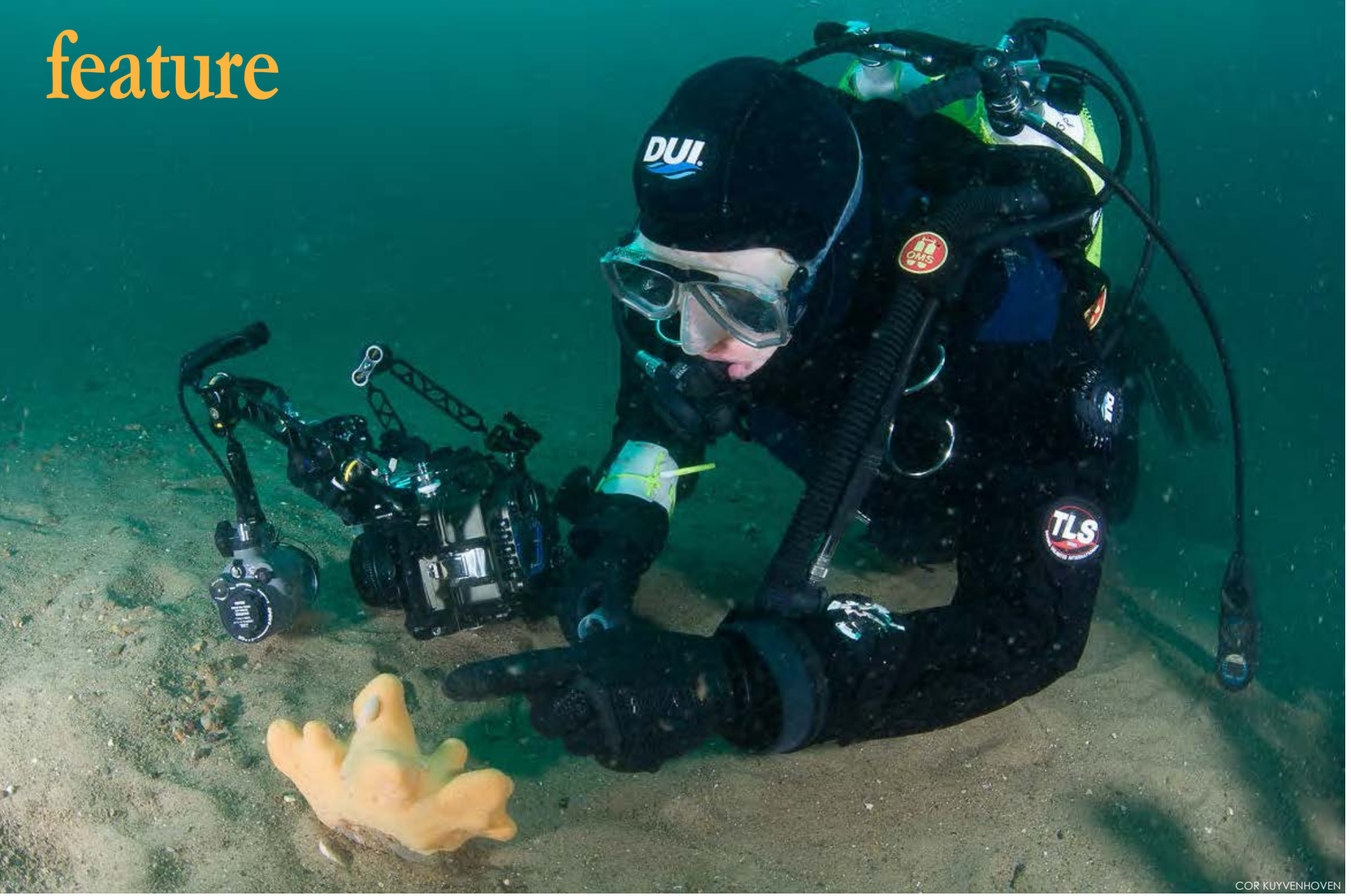

COURTESY OF ST. ANDREWS UNIVERSITY

When the ice melted, more land was revealed, but the sea level also rose.

For over 100 years, fishing boats and dredgers have recovered bones, ancient tree stumps, flint used by humans and the fossilized remains of a mammoth and rhinoceros. Interest in the area intensified in the 1930s when commercial trawlers dragged up a number of prehistoric tools and weapons dating to an era when the area was tundra. But it was only when oil companies started doing extensive surveys and geophysical modeling that researchers were able to re-create what this lost land looked like. Findings suggested a picture of a land with hills and valleys, large swamps and lakes with major rivers dissecting a convoluted coastline. As the sea rose, the hills would have become an isolated archipelago of low islands.

At about 8000 BC, the north-facing coastal area of Doggerland had a coastline of lagoons, saltmarshes, mudflats, and beaches, and inland streams and rivers and marshes, and sometimes lakes. A large freshwater basin occupied the centre of Doggerland, fed by the River Thames from the west and by the Rhine in the east. It may have been the richest hunting, fowling and fishing ground in Europe in the Mesolithic period. From about 6500 BC it gradually became flooded by rising sea levels, reducing the lands to low-lying islands which was probably abandoned for good after being devastated by a catastrophic tsunami.

The wave was generated by



COR KUYVENHOVEN

THIS PAGE: Expedition team members document marine life thriving on Dogger Bank or caught in nets; Biologist Arjan Gittenberger (left) with sea snal on coral

Doggerland

a catastrophic subsea landslide off the coast of Norway. The last of the three so-called Storegga landslides happened underwater in the Norwegian Sea, during which an estimated 290km (180mi) length of Norway's continental shelf collapsed. The slide, which according to carbon dating occurred between 6225-6170 BC, involved the collapse of some 3,500 cubic km of sediment, enough to cover Scotland in a layer 45 meters thick. Given that the majority of Doggerland was by this time less than 5m in height, it would have experienced widespread flooding. Analysis suggests the tsunami over-ran Doggerland that has since vanished beneath the waves.

Dr Jon Hill from Imperial College London and one of the many researchers who has been analyzing this event told BBC News: "The impact on anyone who was living on Doggerland at the time would have been massive—comparable to the Japanese tsunami of 2011.

The area today

The Dogger bank, as it is called today, is a large sandbank about 260km (160mi) long and up to 97km (60mi) broad located approximately right in the middle of the North Sea. The bank which is now a productive fishing ground extends over approximately 17,600 sq km (6,800 sq mi) with a depth range from 15 to 36 meters (49 to 118 feet) which puts most of this extensive area well within recreational diving range.

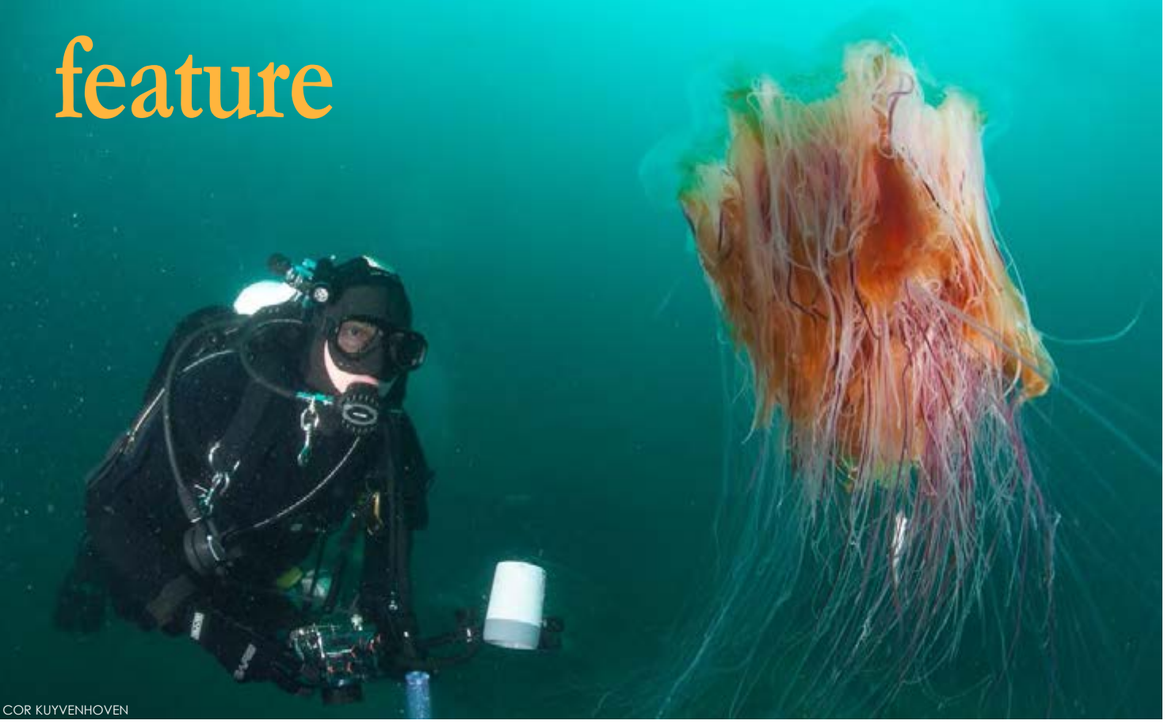
Atlantic water enters the North


JESCA ZWEIJTZER


COR KUYVENHOVEN


COR KUYVENHOVEN

Monkfish (above); Biologists busy with samples (right)


COR KUYVENHOVEN


JESCA ZWEIJTZER

COURTESY OF ST. ANDREWS UNIVERSITY


COURTESY OF ST. ANDREWS UNIVERSITY


COR KUYVENHOVEN

THIS PAGE: Scenes from expeditions to Dogger Bank to document marine life and archeological sites as well as remove fishing nets; Diving this remote area requires a larger vessel suitable for weather conditions on open sea such as the Old Begium marineship *Cdt.Fourcault* (left)


JESCA ZWEIJTZER

Sea mainly from the north. The topography produces an counter-clockwise circulation. Water entering from the Channel moves eastward along the Belgian and Dutch coast. In the Skagerrak, the North Sea water mixes with less saline water from the Baltic, and is transported north along the Norwegian west coast.

With the North Sea being criss-crossed by some of the busiest shipping routes in the world and having been the stage of several epic navy battles, the area is also home to many good dive-able wrecks whose misfortunes seem to have been strewn generously across the banks.

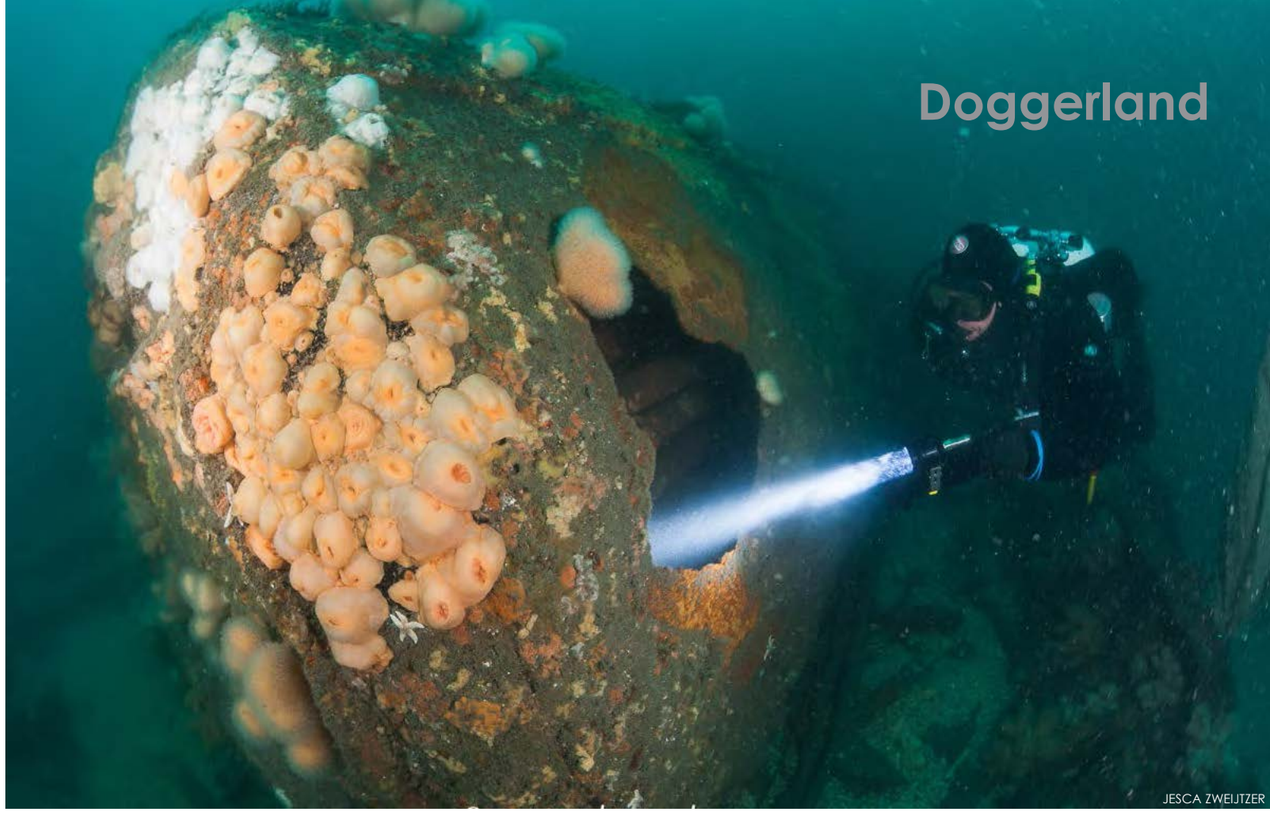
But it is its natural resources that are its prime asset. The North Sea is one of the world's most productive areas for fish, and a large number of commercially important species are caught in this area. The German federal agency for nature conservation calls it a "fascinating gem of European marine life" and a world of reefs and sandbanks that "offer a rich home to exceptionally rare and vulnerable species".

Being located in the middle of the North Sea, Dogger Bank constitutes a bio-geographical divide with cold-adapted benthic (living on or in sea bottoms -- ed.) species to the north and life forms preferring more temperate waters to the south. A 1986 survey, covering the whole of the main North Sea basin, showed clear north-south differences in diversity, abundance, biomass and average individual weight of the soft-bottom fauna. The deeper northern regions had higher diversity, lower biomass, and lower individual weights than the shallow southern regions.

Most of the seabed in the North Sea hosts soft-bottom communities. On the rocky bottom, kelp forests are widespread, and many species of flora and fauna find shelter, food and surfaces for attachment on the kelp and the surrounding rocky substrate. The benthos consists of the organisms living near, on or in the seabed. A wide variety of animals belong to the benthic community: crustaceans, molluscs, annelids, echinoderms and others.

As the North Sea is shallow, there is a strong coupling between benthic and pelagic


JESCA ZWEIJTZER

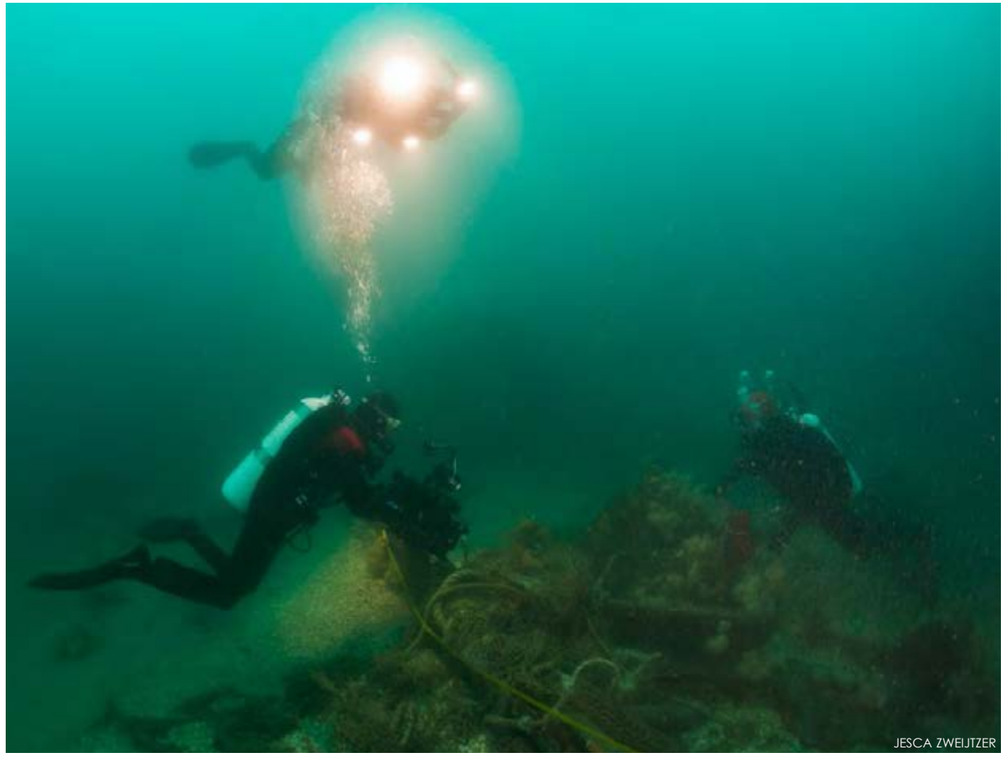

JESCA ZWEIJTZER

processes, making the region extremely productive. The diversity of the offshore benthic communities is high, except in areas of direct industrial impact, such as offshore oil fields.

There are also only a few areas of the North Sea that are not fished or left undamaged by trawling. In particular the beam trawl -- which virtually ploughed up the seabed -- can cause damage to substrates and benthic habitats by altering sediment structure and destroying benthic organisms. These structural changes may have long-term negative effects on the structure and productivity of the benthic community.

Diving

With its location far out to sea, diving on the Dogger Bank requires the support of a larger vessel suitable for the conditions in the open sea, as weather can be unpredictable. Due to its remoteness and the logistical challenges, the area is largely unexplored by divers and with that comes a unique sense of exploration and adventure that is otherwise hard to find in the middle of Europe. Since 2011 a Dutch team, Duik de Noordzee Schoon (Dive Our North Sea Clean), has been organizing expeditions to the Dogger Bank with the aim of both documenting the nature in these remote areas and to remove lost fishing gear. The removal of the ghost-fishing nets have previously been described by Peter Verhoog in *X-RAY MAG #40*: **www.xray-mag.com/content/ghostfishing.** □


JESCA ZWEIJTZER


JESCA ZWEIJTZER

THIS PAGE: Expedition members explore wreckage, marine life, documenting findings on film

For more information on the Dutch expeditions, visit: ***www.expeditiedoggersbank.nl****.*
For more information on the photographer, Cor Kuyvenhoven, visit: ***www.corkuyvenhoven.com****.*

Scuba Confidential

How Did That Get in There?

—*Water in the Tank Mystery*

Text by Simon Pridmore

Anna's story: "I was on my eighth or ninth dive, about five minutes in and at a depth of around 13 metres when I realized that my air was not coming out smoothly. I couldn't think why this should be. I had checked my pressure gauge on descent and it had shown 190 bar. I switched to my octopus, but there was no difference. Soon the air became very thin. I tried to stay calm and thought for a few seconds. Everyone was going deeper and nobody was looking at me. By now the air had completely stopped and I was holding my breath. I knew something was very wrong.

Then my husband looked around and saw that I was not following. He came back to me, gave me his regulator and took me up to the surface with him."

Anna's husband, an experienced instructor, takes up the story. "I had checked my wife's set up as usual pre-dive. The pressure gauge was showing 190 bar on the surface. I had a habit of checking on Anna frequently because she was still quite new to diving. A few minutes into the dive, I saw her hovering away from the reef in mid water, sensed something was wrong and swam towards her. She gave me a wide-eyed look and pointed at her regulator. I glanced at her gauge and saw it was at zero so I gave her my octopus and we went up together.

"I was puzzled as to how a full tank could become empty so quickly. It was definitely no more than ten minutes into the dive that the incident took place and there had been no O-ring blow out. I removed the regulator from her tank after the dive then turned the valve on fully. Nothing came out. Some instinct made me turn the tank upside down and, to my surprise, and to the surprise of everyone around us, water started flowing out of the valve—fresh water!"

An incredible story?

It seems incredible that a standard size scuba cylinder should be so full of water that a diver would only get a few minutes of air. Some might interpret the story simply as a mistake or a misunderstanding on the part of a new diver with a supportive husband.

However, when I heard the story, it brought to mind something that I came across when I ran my dive store in Guam a few years ago. We used to conduct annual visual inspections on cylinders owned by local residents and were surprised to often find a few centimetres of water in the bottom of the cylinder. This was always fresh water, not seawater. We made some enquiries and found that this is fairly common and comes from the almost universal practice in dive stores around the world of filling scuba cylinders while they are standing in a bucket or a trough of water.

The fill whips, hoses that are clamped onto the valves of scuba cylinders to fill them, sometimes drop into the water trough between cylinder fills. When they are then attached to the valve of the next cylinder and the airflow is turned on, the pressure of the air in the fill whip is higher than the pressure of the air in the cylinder and the water droplets are driven into the cylinder.

Fill the cylinder several times and the amount of water inside accumulates until you have little pools forming in the bottom. The moisture inside causes corrosion inside the cylinder, too.

Bear in mind that we were in Guam, part of the United States where a stringent system of cylinder inspections applies and is enforced by dive operators. The maximum length of time between inspections is 12 months, so inside the cylinders we were opening, several centimetres of fresh water had built up in less than a year.

In many places in the world where people dive, including the island nation where Anna's dive took place, there are no regulations governing cylinder inspection, so it is not impossible that a cylinder could go for many years without anyone examining the interior.

So apparently Anna's story is not far-fetched after all. With her cylinder containing a large amount of fresh water, the volume of air in the cylinder was quite small, so once she started her dive, she used it up very quickly. The reading on her pressure gauge must have been dropping fast during those first few minutes of her dive, but she did not notice.

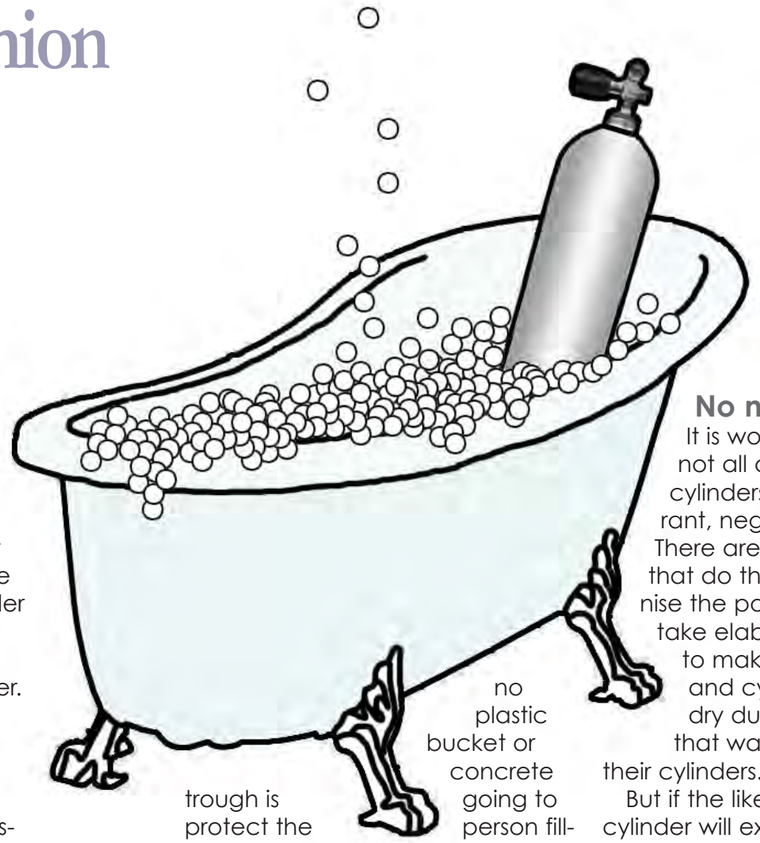
Fuzzy thinking

Why do dive centres fill cylinders while they are standing in water? They do it for three reasons:

1. To keep the cylinder cool so they can fill it faster and the air pressure inside will not drop so much when it cools. (Divers object if they don't get a "full" tank!)

2. As a convenient way to wash salt off the cylinder post dive

3. To protect the filler from harm if the cylinder explodes during filling



All three of these reasons are the product of fuzzy thinking.

1. Filling the cylinder in water has very little impact on the cylinder temperature, partly because the water around it gets warmer. Fast filling still causes the cylinder to get hot, and it has to be filled to 20 bar or so beyond its rated pressure, so that when it cools, the pressure of the air inside will be 200 bar. (The only effective way to stop a cylinder getting too hot while it is being filled is to fill it slowly and from a bank of large cool high-pressure air cylinders rather than directly from the compressor.)

2. Using the fill bucket to wash the salt off the cylinder is ineffective as all that happens is that the water the cylinder stands becomes a little salty. A quick blast with a hose before the cylinder is taken into the compressor room does a much better job.

3. Aluminium cylinders have exploded during the filling process in the past, and when this happened, the consequences have often been fatal. However, an exploding cylinder is a bomb, and no plastic bucket or concrete trough is going to protect the person filling it. Instead, it might just contribute more shrapnel to the explosion.

Having said this, those aluminium cylinders that exploded were made from a 6351 alloy containing lead, and it was the presence of lead in the alloy that created the problems that caused them to explode. Since 1988, no aluminium scuba cylinders have been made using this alloy or with any alloy containing lead. The vast majority of scuba cylinders in service today worldwide (including all cylinders made by Luxfer and Catalina—the top two manufacturers) are made from an alloy called 6061.

Although during annual inspections, cracks have occasionally been found in 6061 cylinders, none has exploded—ever! And there are hundreds of millions out there.

No need for a bath?

It is worth noting here that not all dive centres that fill cylinders in water are ignorant, negligent and unsafe. There are many dive centres that do this but fully recognise the potential issues and take elaborate precautions to make sure the fill whips and cylinder valves stay dry during the process so that water does not get into their cylinders.

But if the likelihood that a scuba cylinder will explode during filling is so remote, if a water trough will not protect a filler if it does happen, if the water is not really an effective way of removing salt or reducing the cylinder's temperature, and, crucially, if the practice of wet-filling can lead to an incident such as Anna's, why do it at all?

Ironic, isn't it, that, from day one, divers are constantly told always to leave some air in their cylinder at the end of a dive so that no water can get in! And yet... □

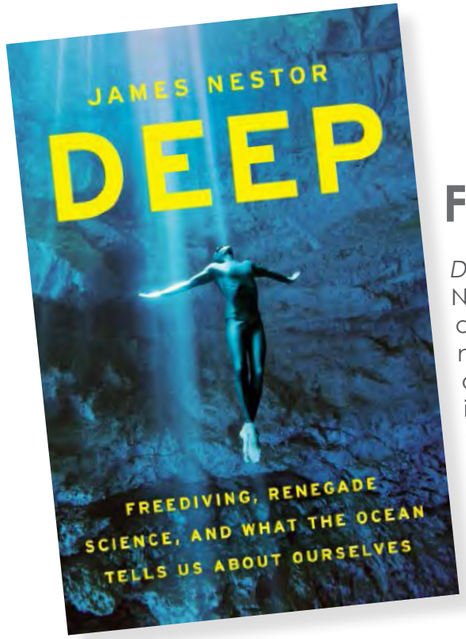
Simon Pridmore has been part of the scuba diving scene in Asia, Europe and the USA (well, Guam) for the past 20 years or so. His latest book, also called Scuba Confidential, *is available in paperback and e-Book on Amazon.*

media

Truk Lagoon

Dive Truk Lagoon: The Japanese WWII Pacific Shipwrecks, by Rod Macdonald. Everything you wanted to know and more about one of the greatest wreck diving locations in the world, all here in one book. Held in secret and fortified by the Japanese during the 1930s, this hidden lagoon in the central Pacific served as a forward anchorage for the Japanese fleet. Around 1944, the U.S. and Allied forces discovered this haven and attacked. Many ships were sunk, which are now grown over with rich marine life. Mostly forgotten since the end of the war in the Pacific, the many underwater treasures of this lagoon came to world-wide attention after Jacques Cousteau filmed several of the wrecks for a television documentary in 1969. Many of the wrecks were untouched since WWII. Today, thousands of divers flock to Truk to see the wrecks for themselves, from Japanese Navy battleships to U.S. carriers, laden with war cargoes.

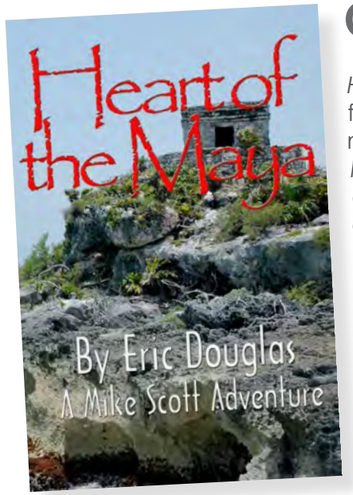
Hardcover: 288 pages
Publisher: Whittles Publishing
Date: 31 July 2014
ISBN-10: 1849951314
ISBN-13: 978-1849951319



Freediving

Deep, by James Nestor. Follow the author as he journeys into the world of freediving, inspired by the extreme athletes in the field and renegade scientists investigating the limits of the human body and mind. He addresses other secrets of the underwater world, little known abilities of marine life, how whales can communicate with each other over huge distances, how sharks can swim straight lines through areas of ocean where no light reaches, and how seals can dive for up to 80 minutes to depths previously thought impossible. He shares his own experience in freediving, as he trains with the pioneers.

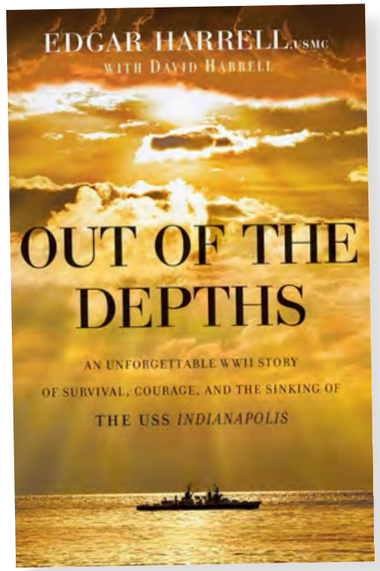
Hardcover: 272 pages
Publisher: Eamon Dolan/Houghton Mifflin Harcourt
Date: 24 June 2014
ISBN-10: 0547985525
ISBN-13: 978-0547985527



Cenote Adventure

Heart of the Maya, by Eric Douglas. The fifth book in the Mike Scott Adventure series evolves around the theft of an ancient Mayan statue as well as a kidnapping and a murder, leading the story's protagonist, Mike Scott, on a diving adventure in the cenotes of the Mayan Riviera. By chance he finds out that the death of a friend 25 years ago was not an accident. To solve this murder mystery, Mike sets out in pursuit of a missing Mayan statue containing the "heart of the Maya" while a deranged drug dealer murders a friend and sows corruption among the Mayan people.

Paperback: 220 pages
Publisher: CreateSpace Independent Publishing Platform; 1st ed.
Date: 13 May 2014
ISBN-10: 1499544367
ISBN-13: 978-1499544367



USS *Indianapolis*

Out of the Depths: An Unforgettable WWII Story of Survival, Courage, and the Sinking of the USS Indianapolis, by Edgar USMC Harrell, David Harrell, Oliver North. The authors delve into a tale of one of the worst naval disasters in U.S. history. On 30 July 1945, the USS *Indianapolis*, in the South Pacific with 1196 souls aboard and a secret cargo of uranium for atomic bombs, was hit by six torpedoes in the middle of the night. The ship sank and the crew faced five terrible days fending for themselves in open ocean. Dehydration, exposure, shark attacks and saltwater poisoning plagued the crew, many of whom perished by the time they were miraculously rescued.

Hardcover: 192 pages
Publisher: Bethany House Publishers
Date: 6 May 2014
ISBN-10: 0764212605
ISBN-13: 978-0764212604