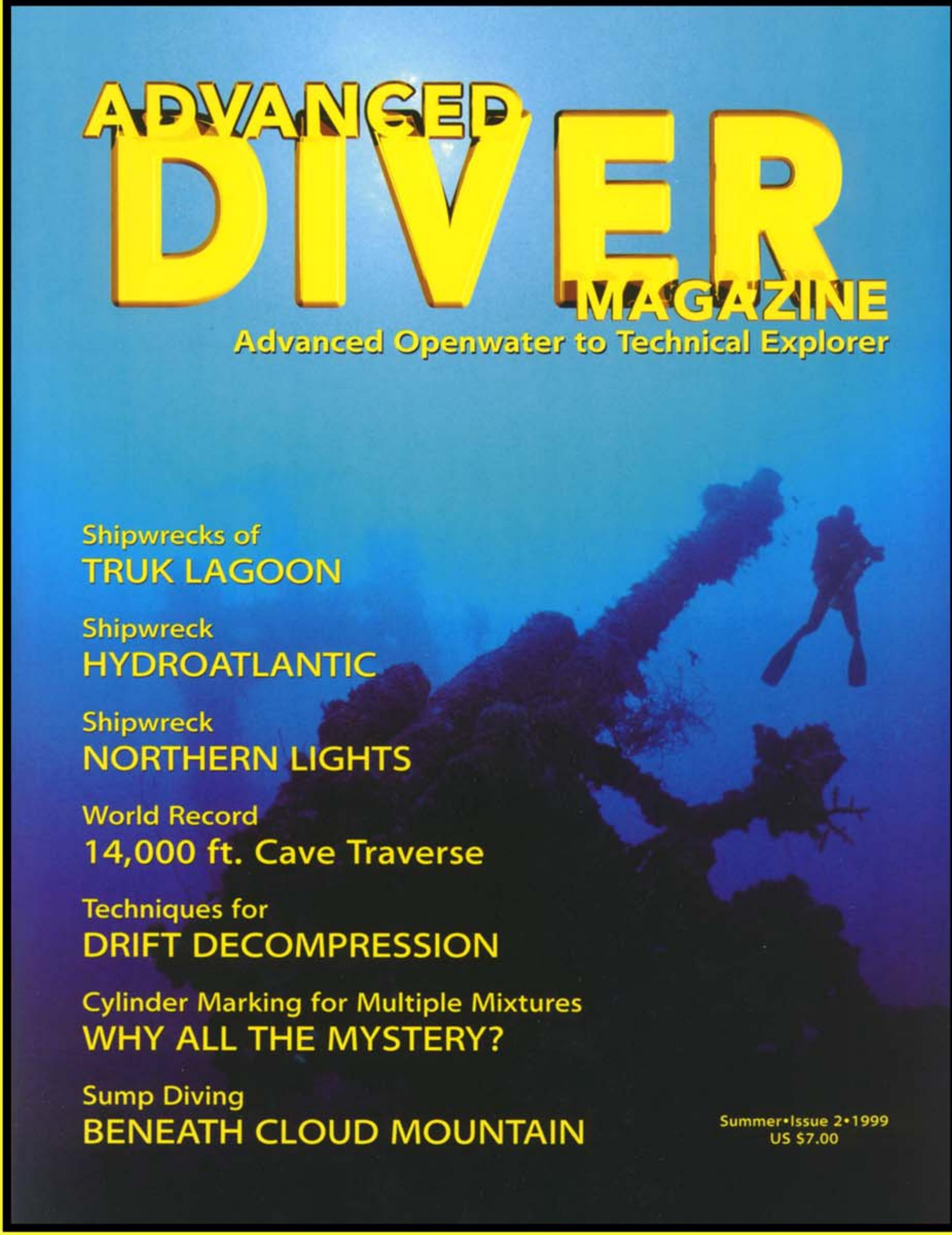
ADVANCED DIVER MAGAZINE

Advanced Openwater to Technical Explorer



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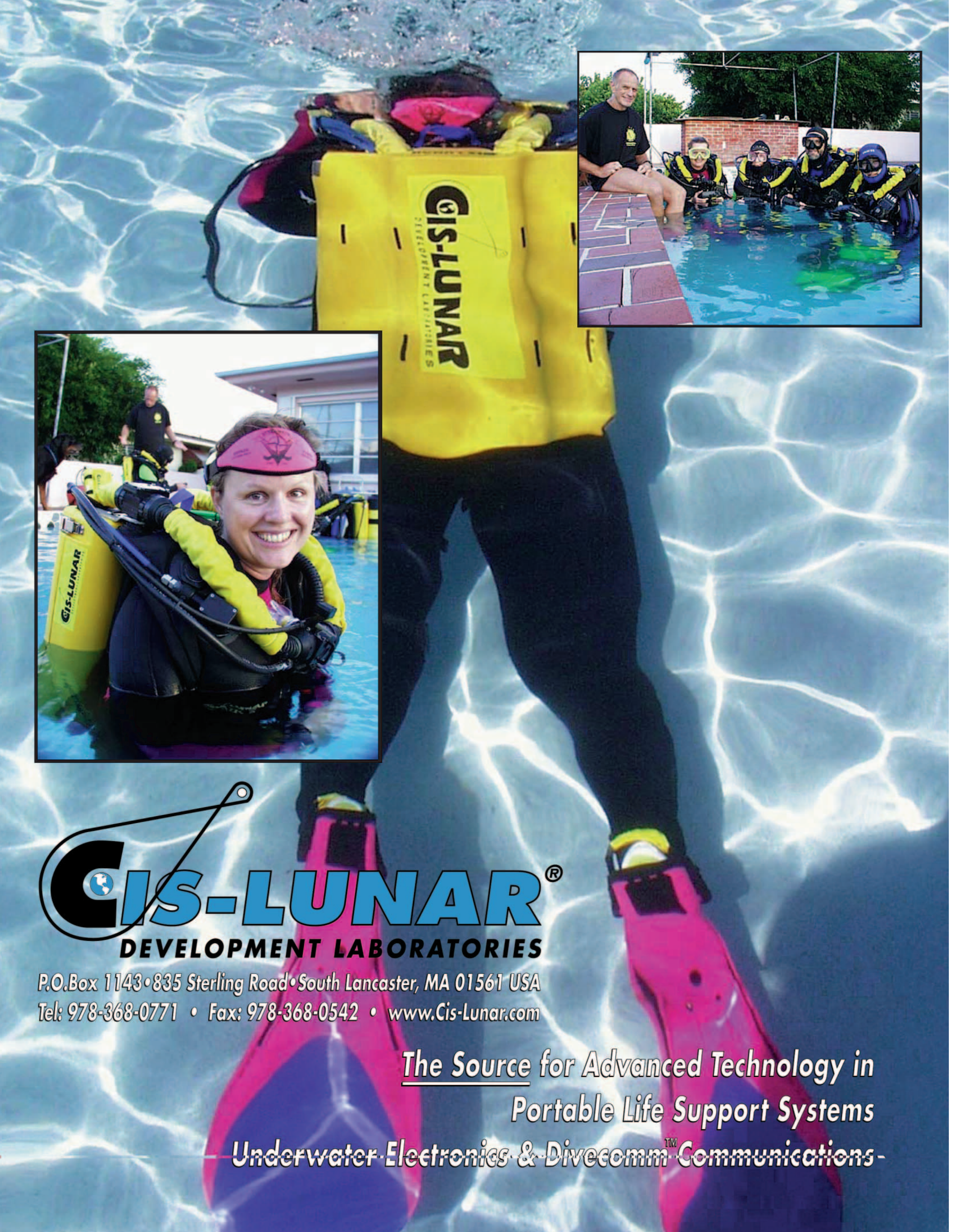
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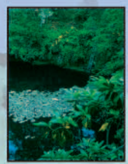


Cover: Diver examines the Aikoku Maru's stern antiaircraft gun
Photographer: Wynn McCloskey

When I started deep diving 13 years ago it was considered taboo. Anyone diving below the recreational limit of 130 feet was considered precarious, and ludicrous. Only small groups, such as some deep Florida cavers, the Great Lakes explorers, and northeast wreckers dared to venture below this limit, keeping most of their discoveries to themselves.

Barely older than a decade, technical diving for recreation is considered still in its infancy. But with the introduction of "Aquacorps," the first technical diving magazine, everything seemed to take off. This publication dared to print material about divers exceeding recreational limits while somehow keeping their noodle from imploding.

Suddenly, many of the deep rogues who seemed to be hiding in their closets emerged. It started with those who dared "deep air," followed by the new breathing gas nitrox, or "snake oil" as coined by some recreational training agencies. Just when you thought we were all going to hell in a hand basket trimix jumped into the picture, along with new accelerated decompression schedules which used 100% oxygen and high percentage nitrox blends.

Bang!! A whole new market opened up with tons of new equipment designed specifically for the technical diver, and the masses were eating it up. New training agencies emerged with extended range standards and procedures. Amazingly enough, the same agencies who had previously criticized technical diving were now firmly entrenched on the bandwagon, selling "snake oil" as a good thing and are now teaching safe nitrox procedures to openwater divers with ease.

More divers than ever before are now experiencing the thrill of technical diving, but as these relatively new techniques become available to the masses we must use the utmost caution and experience in training.

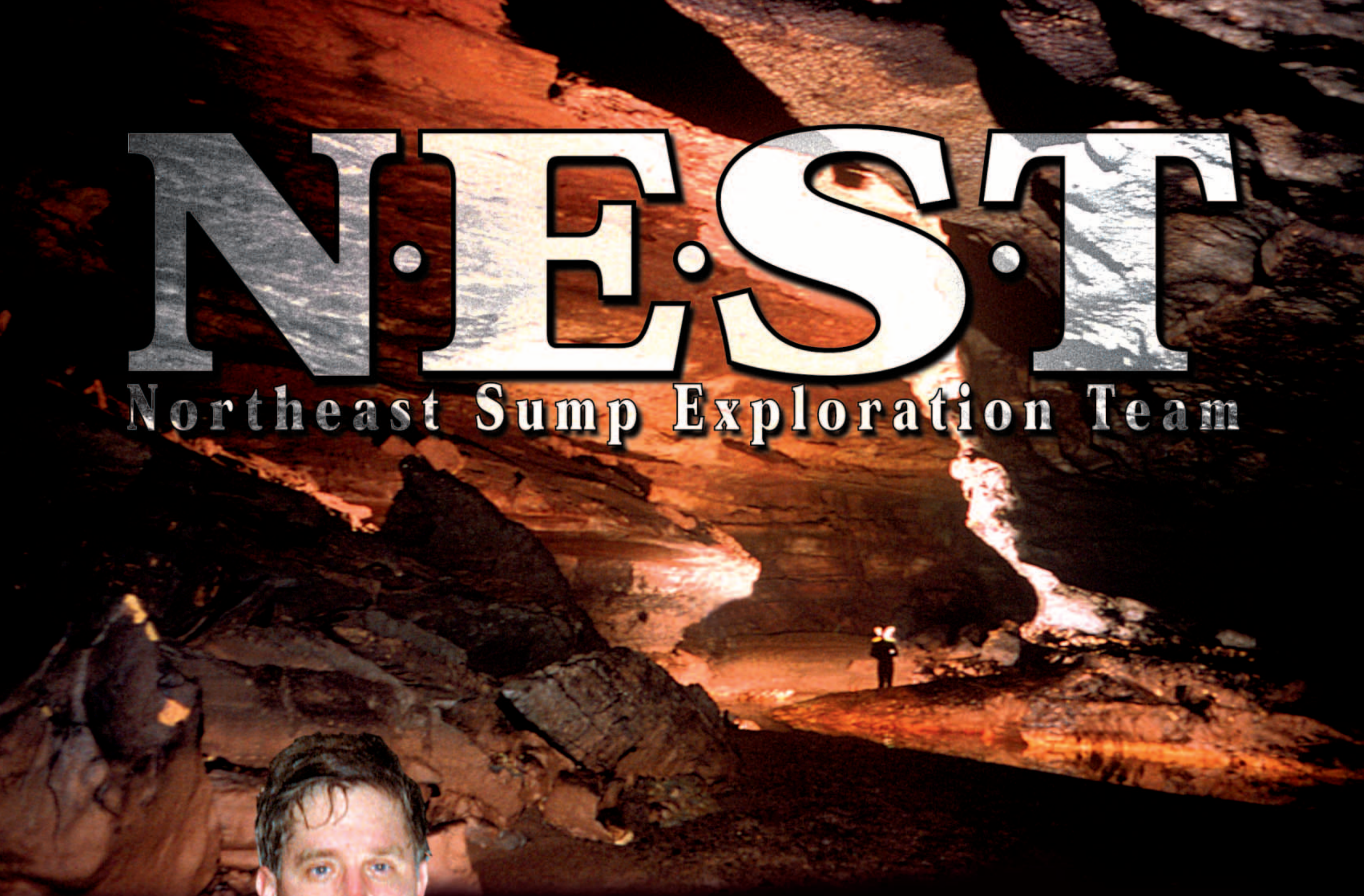
ADM is excited to announce two new outstanding members to our professional staff. Andrew White, assistant editor and Jim Bowden, ADM's international editor in charge of covering foreign dive projects and exploration updates.

Curt Bowen
Publisher

ADM STAFF

N·E·S·T

Northeast Sump Exploration Team



Photos: Joseph Kaffl

By: Joseph Kaffl

On June 12, 1999 NEST (Northeast Sump Exploration Team) members Eric Tensau and myself returned to the Locust Creek cave system in West Virginia to continue our exploration efforts. NEST is a formally recognized project of the NSS consisting of a team of sump divers and support personnel who pursue explorations at cave systems in the PA, VA, and WV areas. We at NEST survey and document these sites with still and video techniques and also engage in biological surveys, and water sampling.

Upon our return to Locust Creek, we found effects of a recent drought were evident with the water running low and very clear. The path we had cleared to the entrance on our last push the year before had since grown up and it took a bit of bushwhacking through the briars to reach the entrance. Several trips carrying our gear soon produced a reasonable trail.

Photo: Joseph Kaffl and Eric Tesnau exploring the main trunk passage beyond Locust Creek sumps.

Once geared up, our first objective was to clear the debris field at the entrance where winter floods had rearranged some of the smaller boulders, a testament to the vast quantities of water this cave can pump out. The first sump was open but we opted to dive it to verify the line and test our gear. At the end of the first sump is a pool that leads to 200ft of breakdown floored passage. With fins and packs in hand we set out for the second sump. The passage starts out as a small crawl way then turns into walking passage. This leads to a section of angled floor that forms a V in the center, the result of a ceiling collapse. The angle and slippery surface require extreme caution here.

The pathway opens into a pool that had led to the final sump, but a major ceiling collapse two winters ago dropped tons of rock that filled most of the area. A dry traverse is now required over slippery, mud covered limestone. Silence is golden in this section as the stability of the new ceiling is still in question. The passage ends at a pool that leads to the second sump. On this trip we found that floods from the past winter had doubled the size of this area.

Despite the dry conditions, the visibility in the second sump was only 5 feet. Eric and I followed the line carefully through this shallow, but wide sump. It ended on a sandy slope that we followed to the surface. I was surprised to see how much the landscape had changed. A large sandbar now connected the shore where once had been a wide open river. The passage continues for a few hundred feet as a wet stream before a climb through a section of breakdown is required. At the top of the climb is a large room that echoes with the sound of two waterfalls. We climbed down the left waterfall and followed a beautiful limestone sculpted passage that led us to three thousand feet of flat, sand floored river divided by deep pools.

After walking for 45 minutes we reached a new section that Jeff Mott and I discovered a few years ago. This was one of our objectives as we had not yet captured this section on slide film. After traversing the entrance pit, we were in "The Kitchen," one of several areas where we stored supplies. Maintaining energy levels on a cave expedition is vital. If you wait until you are hungry or thirsty it is probably too late.

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Eric Tesnau holding camera strobes beyond Locust Creek sumps.

Dave Holick and Bill Scheely transporting gear into cave.

Photos: Joseph Kaffl

Above: Eric Tesnau and Joseph Kaffl in the main river of Alexanders Cave performing final gear checks.
Below: To light several large sections of a cave, Eric Tesnau flashes his strobe in separate locations while Joseph Kaffl keeps his camera shutter open, a technique known as cave painting.


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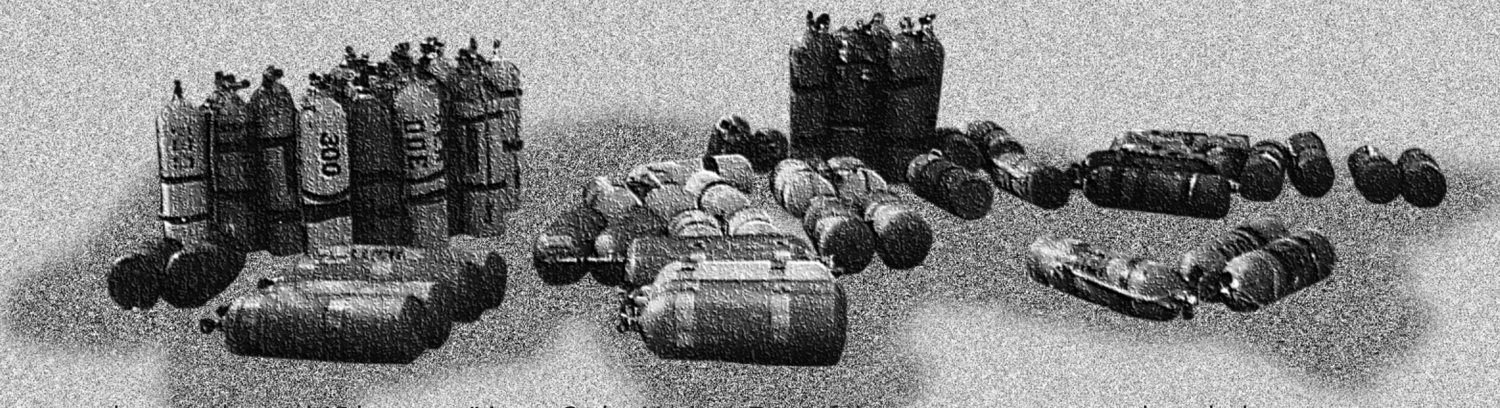
XLACAH EXPLORATION

By: Jesse Armantrout

"We're 1000 feet out, the tunnel is big bore, headed for the coast and it's turned deep," said the e-mail from Brett Dobson." Do you think a couple of the guys from the WKPP could help us push this thing?" Brett, a graduate student, some would teasingly say a "professional student", in marine biology under Dr. Thomas Illiffe of Texas A&M, Galveston, had come to know the WKPP in a way familiar to many of us. He had been hammered on the net by project director George Irvine. Fortunately, Brett was able to realize that the "hammering" was a result of Irvine's passion for safety in diving and, instead of being offended, decided to listen to the message. Knowing my name from when I had lived in Texas, Brett began asking me dozens of questions about how the WKPP does things.

After several months, Brett began telling me a little about the diving he was doing. As cave divers tend to be, he was somewhat vague and elusive. As our friendship grew and trust was established, be finally let me in on a secret. He and Dr. Illiffe had been diving Dzibilchaltun near the city of Merida in the state of Yucatan, Mexico. I was supposed to be impressed, but at the time was busy with my own dives in a little cave just south of Tallahassee known to the locals as Wakulla springs. Perhaps it was my lack of interest that made it easier for Brett to confide in me. When he got around to the good parts, like "big" and "virgin" and, most of all, "want to see it?" my curiosity began to grow. "Sure," I said when the invitation was offered . "I think I can get a couple of guys together." I sent out an e-mail message to a dozen or so of my dive buddies. Within 30 minutes I had five firm commitments. Within 24 hours, I had nine. Apparently they, too, were curious.

Merida is a bustling international city of just over one million and a major gateway to South America. Although Dr. Illiffe had kindly offered to allow us to ride with him in the University's vans on the 3 day 1500 mile drive down to Merida from Galveston, we chose the two hour airline flight from Miami instead. The enormous amount of gear we would need was sent to Galveston over the weeks preceding the trip. Team member Chuck Noe of Houston was invaluable in his coordination of this aspect of the trip. Dzibilchaltun is an ancient Mayan archeological site centered around the Cenote X'lacah. In the early stages of planning, Dr. Illiffe had described the cenote as "consisting of a 70 to 100 ft. wide by 30 to 40 ft. high phreatic tube running horizontally at a depth of 150 to 170 ft. We have explored back 1000 ft. with no side passages and no end in sight. The cave is heading toward



the coast located 15 km away." It was quickly decided that to safely conduct these dives, WKPP standards for gear configuration and gas management would be followed and the "leap frog" technique of each team setting up the following team while simultaneously performing their dive would be employed.

Approximately 100 pre-filled stage and deco bottles, 13 sets of doubles, nine Gavin Super scooters, dozens of regs, lights, and other assorted cave dive gear as well as a lab full of scientific equipment was loaded into the two university vans. Even though the water temp was reported to be in the upper 70's, a few dry suits and argon bottles were thrown in for the longer dives that we hoped for. Each item was meticulously accounted for and documented. Copies of this manifest were sent to officials of the Mexican government for their approval to expedite crossing of the U.S. - Mexican border.

Arrangements were made in advance to procure additional Helium and Oxygen while in Merida by Roberto Hashimoto of the Asociacion Yucateca De Espeleobuceo, and Roberto was kind enough to allow storage of the gas in his warehouse. Air fills were made available to the project by Mike Dutton at what may be the only air fill station in the city. Local transportation and assistance was to be provided by Merida cave diving pioneer Fernando Rosada, president of the Asociacion Yucateca De Espeleobuceo and by Carlos Varquez Evan of the Secretaria de Ecologia. Rounding out the four man Texas A&M team were Dave Sweetin, project videographer and Michael Loeffler. The WKPP contingent included myself, George Irvine, Brent Scarabine, Bill Mee, John Rose, Ken Sallot, Derek Hagler, Chuck Noe and the general herself, Dawn Kernagis. Amazingly, all of the personnel and all of the gear made it to the right place at the right time and on Saturday morning March 13 diving began.

Dzibilchaltun in general and the Cenote X'lacah specifically are magical and mystical places. The area has been amazingly well preserved and protected under the direction of Mexican National Archaeological Institute (INAH). Visitors to the site stand in respectful awe of the ruins and are drawn to the cool cobalt waters of the cenote. Permission to dive this cenote is rarely given and would not have been possible without the help of Roger Medina of the Department of Ecology at the University of Yucatan. For quite some time, the team simply stood and stared and this spectacular scene. Then suddenly we remembered why we were there and the work began. Gear was unloaded and sorted and dive teams and tasks were assigned. First up were George and Brent on a reconnaissance dive while the A&M guys began setting up the science dives. The second team of Chuck, Derek and Ken began setting in the deco bottles while the third team of Bill, John and myself began setting up to do deco support. Dawn quickly assumed her role as surface manager. Just as the fog was burning off and the cool morning was quickly being replaced by what would become a hot and humid afternoon, team 1 was off. Just over a half hour later, team 3 met the returning team who handed off an almost empty 1400 foot reel and a note for team two. The note said "we tied off at a restriction." Crushing disappointment settled on

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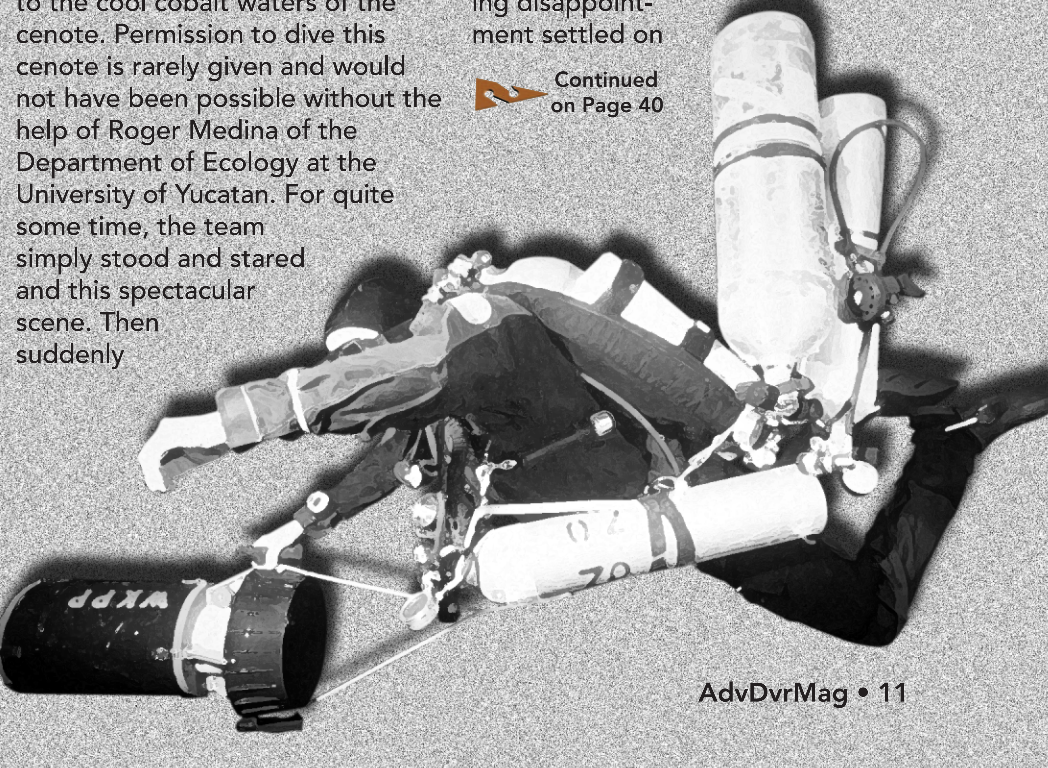


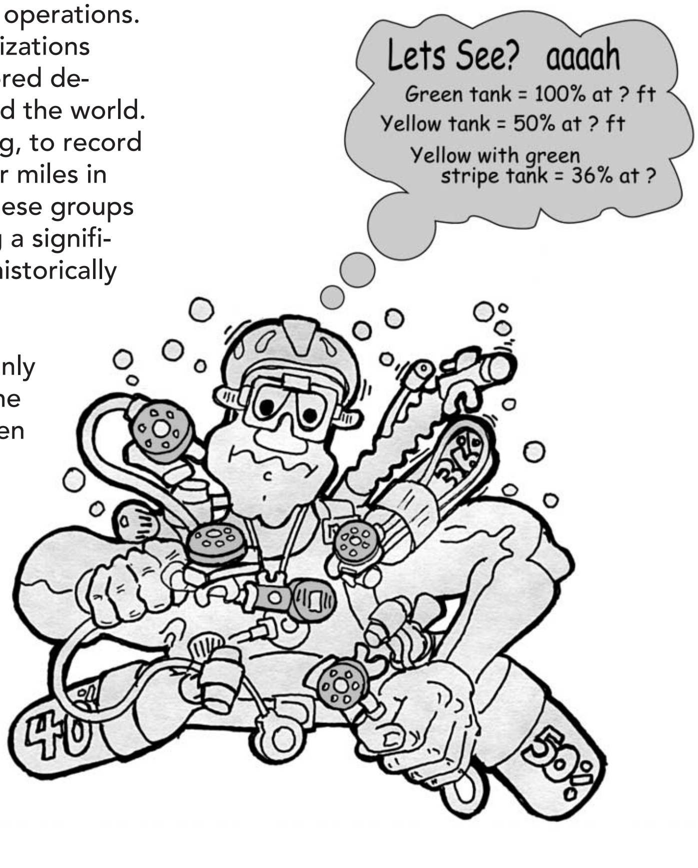
Tank Marking for Multiple Mixtures
WHY ALL THE MYSTERY?

©Jarrod Jablonski and George Irvine

When individuals think of underwater fatalities they typically envision some extraordinary situation. However, fatalities very rarely result from an equipment failure or other dramatic situation. In fact, open water accidents are most common in seemingly innocuous scenarios such as in a panic while at the surface. Ironically, despite the longer training and additional equipment, subtle and unnecessary problems also plague technical diving fatalities. For example, in cave diving, failure to maintain a continuous guideline from the open water is the second most common reason for fatalities. Improper or nonexistent guideline use is second only to excessive depth in statistical risk. Consider the shear ridiculousness of losing your life for failure to spin out a measly couple feet of line. Or imagine the senseless fatalities that result from remaining resistant to helium based mixtures while deep diving. Now consider the technical diver using multiple hyperoxic mixtures who breathes the wrong mix at the wrong depth. One minute enjoying the memories of a great dive and the next moment- dead.

These harsh realities tend to generate significant debate over who is to blame (outside the obvious culpability of the diver). For example, do bottle marking, deployment procedures, or training have a significant impact on the likelihood of this error? Several years ago many exploratory divers recognized that breathing the wrong mix at depth was the most significant risk to diving with multiple mixtures. Faced with the task of keeping a wide range of divers safe in highly variable settings, project leaders were forced to develop very simple and effective procedures. Directing an international effort that would grow into Global Underwater Explorers, (www.gue.com), Jarrod Jablonski worked with Woodville Karst Plain Project (www.wkpp.org) Director George Irvine to refine a set of foolproof procedures for deep mixed gas diving operations. As a result these organizations have successfully explored demanding regions around the world. From deep ocean diving, to record explorations nearly four miles in 300-foot deep caves these groups have managed to bring a significant level of safety to historically dangerous activities.

Members of these organizations were keenly aware that breathing the wrong mixture had taken the life of several very experienced technical divers and therefore presented a significant risk to team safety. Reviewing these fatalities indicated that most divers had not clearly marked their cylinders and/or did not follow an effective procedure for switching gas sources. For example, tank marking systems that rely on regulator markings, require divers to evaluate color differences, make underwater mental calculations, or identify bottles by touch are dependant on a series of unpredictable variables. Regulators can break and need on site replacement or be inadvertently placed on the wrong bottle. Furthermore, color is usually impossible to reliably identify during a dive; while under water calculations (i.e. 35% marking and left to calculate



Cylinder Marking- The Fine Points

1. *Cylinders should be stripped of all stickers (VIP on bottom), nitrox banners or other nonessential markings. Numerous markings create dangerous confusion.*
2. *Each cylinder should be marked horizontally with large three inch high numbers identifying its MOD (Max Operating Depth).*
3. *Oxygen cylinders should be marked with the word oxygen written horizontally along the tank, preventing divers from mistaking "20" with "70".*
4. *The diver's name should also be marked on the cylinders to simplify identification.*
5. *No gas percentages should be placed on the cylinder for identification purposes, as they require divers to make underwater calculations. Any content information is the result of analysis and should be placed near the neck of the bottle. - A 15% oxygen and 60 percent helium mixture when analyzed might read 15.2/60. - A 35% nitrox mixture when analyzed might read 35.1%. - The date analyzed and tester's initials would be included with the percentage marking.*

the MOD) are dangerously unacceptable. Meanwhile the use of touch identification is often unavailable (gloves) and always unreliable. The clear danger associated with these variable markings is that divers become accustomed to their use and rarely refer back to the certainty of their bottle contents. Any reliable marking system must be highly flexible and thoroughly dependable despite small changes in equipment utilized. Marking the cylinder in a clear and easily identifiable manner and utilizing only this information prevents divers from becoming accustomed to unreliable identification procedures.

Large diving projects like those conducted by GUE or the WKPP typically result in the use of approximately 100 cylinders with varying mixtures. Given the high risk and serious consequences of mistakenly breathing the wrong bottle these organizations were forced to develop simple and foolproof systems for cylinder use and marking. In order to prevent bottles from being breathed outside their operational limit, clear three-inch high numbers are placed on the bottle, indicating the MOD (Max Operating Depth). For example, a 35% mixture would have a depth limitation of 120 feet (1.6po2 for resting decompression purposes only). Cylinders should have this depth limit clearly marked along the bottle and a small tag near the neck, indicating final percentage analyzed.

Any truly reliable tank identification system must work in concert with a dependable gas switching procedure. Divers that are not attentive and do not exercise caution while using different gas mixtures will inevitably use the wrong mixture at depth, possibly resulting in a fatality.

A sensible marking and deployment system is capable of ensuring divers do not breathe the wrong bottle but this process should be supported by rational gas selection and mixing criterion. For example, mixtures should never exceed 1.4 PO2 unless the divers are in a static, resting state during decompression. Narcotic depths should be limited to 100 feet for diving activity and no greater than 130 feet for decompression purposes. As with all limits divers should adjust these limits in the direction of conservation whenever applicable. Careless or overly aggressive oxygen limits/narcosis levels unnecessarily increase the risk of diving activity. Furthermore, divers with extensive decompression experience have used personal experience and Doppler study to settle upon the efficiency of standardized mixtures. For decompression purposes 100% oxygen is used from 20 feet, 50% oxygen from 70 feet, 35% oxygen from 120 feet, and 18% oxygen from 240 feet. When not in use all cylinders should be turned off and the

Gas Switching Procedures

1. Divers should operate as a team verifying proper mixture and depth.
2. Arrive at the desired switching depth, retrieve and attach the cylinder if required (i.e. in a cave dive where bottles are left behind).
3. Locate the properly marked cylinder and deploy its second stage (regulator is stored in an elastic band on the cylinder). Open the valve slightly.
4. Each diver should double-check their buddy's cylinder depth and second stage used.
5. Remove regulator from your mouth and replace with stage regulator.
6. Try to breathe in and the regulator should deliver gas.
7. Briefly turn the valve down to verify an interruption of air supply and confirm the correct regulator is in your mouth. Open the valve completely.
8. Grab the second stage hose and retrace it back to the stage cylinder. Double check cylinder marking.
9. Start decompression time.

regulator stored in the retaining band. If you can not see the cylinder, and can not properly identify the gas, DON'T BREATHE IT! The risk associated with breathing the wrong mixture is far greater than the minimal danger from reducing decompression efficiency.

Following a dive where bottles remain unused, the stages or doubles must be reanalyzed and retaped for travel and storage. Many smart people have been killed by failing to observe common respect for the risk of multiple gas mixtures. Be sure to maintain simple procedures and never dive anything that does not display a current analysis. When in doubt, analyze the mixture. If any doubt remains do not use the mixture. Hopefully divers can appreciate that the risk associated with confusing bottle marking or imprecise procedures create an unacceptable risk. Divers must realize that the irresponsible use of multiple mixtures places the entire team at risk. A diver breathing the wrong mix at depth may experience oxygen seizures, forcing team members to place themselves at risk to attempt a rescue. Trying to ID a tanks proper operational depth through a range of labels, stickers or nitrox banners can be confusing and a potential danger to the entire team.

Nearly all diver fatalities relate to an error on the part of the individual and/or team. As with most situations there is simply no reason for fatalities that result from the use of an incorrect mixture. Yet, nearly every year several fatalities are attributed to simple miss identification procedures. Certainly if these individuals were afforded a second chance they would never again approach the use of multiple mixtures with a confusing system or careless attitude. Many recreational divers and laymen think of technical diving as a very dangerous activity. However, the true irony of this risk is that in almost all situations it is a risk created by the diver themselves. Carefully consider how much risk you wish to create in your diving activities. All divers should do the community, themselves, and their loved ones a favor and strive to eliminate any unnecessary levels of risk. The penalty for breathing the wrong mixtures at depth is severe and unfortunately there are rarely any second chances. Best wishes and safe diving.

Jarrod Jablonski is an avid cave explorer, researcher and instructor teaching and diving predominately in the North Florida area. His diving excursions frequently take him to some of the most remote reaches of the planet, including cave explorations to nearly three miles (18,000 feet) at a depth of 300 feet. Trained academically as a geologist, Jarrod has founded Global Underwater Explorers an elite diver training agency that is also heavily involved in international research and exploration projects.

George Irvine is a very active cave explorer with thousands of hours of extreme diving activity, including a world record penetration to more than 18,000 feet at 300 feet. He lives in Ft. Lauderdale, FL and enjoys both cave and wreck diving on a regular basis. George is the project director of the Woodville Karst Plain Project

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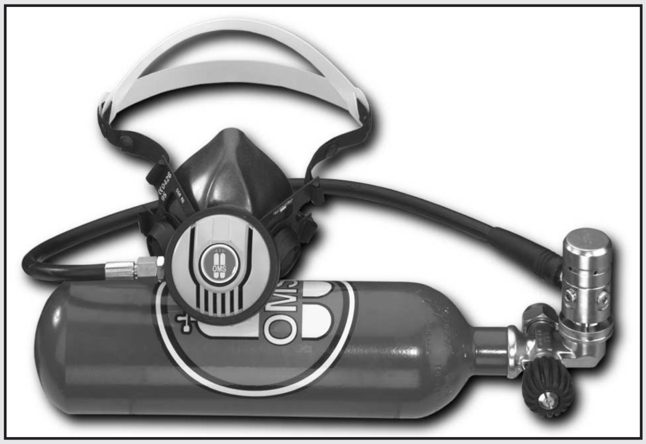

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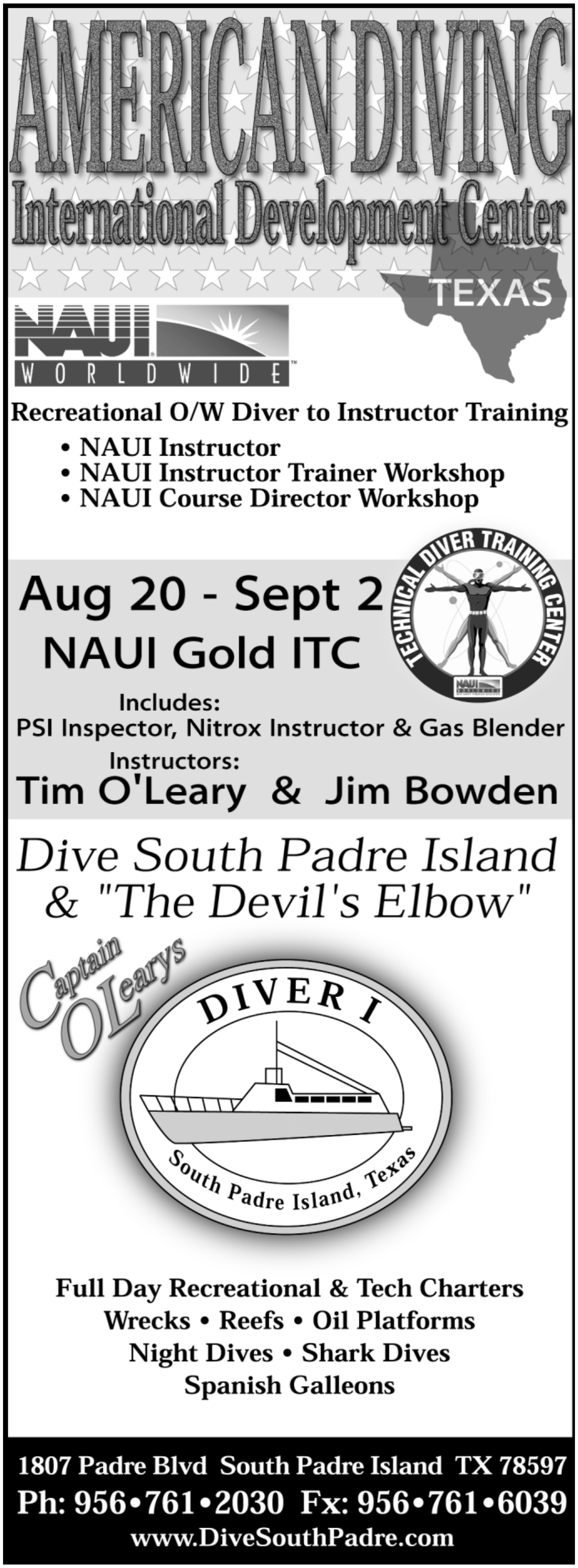

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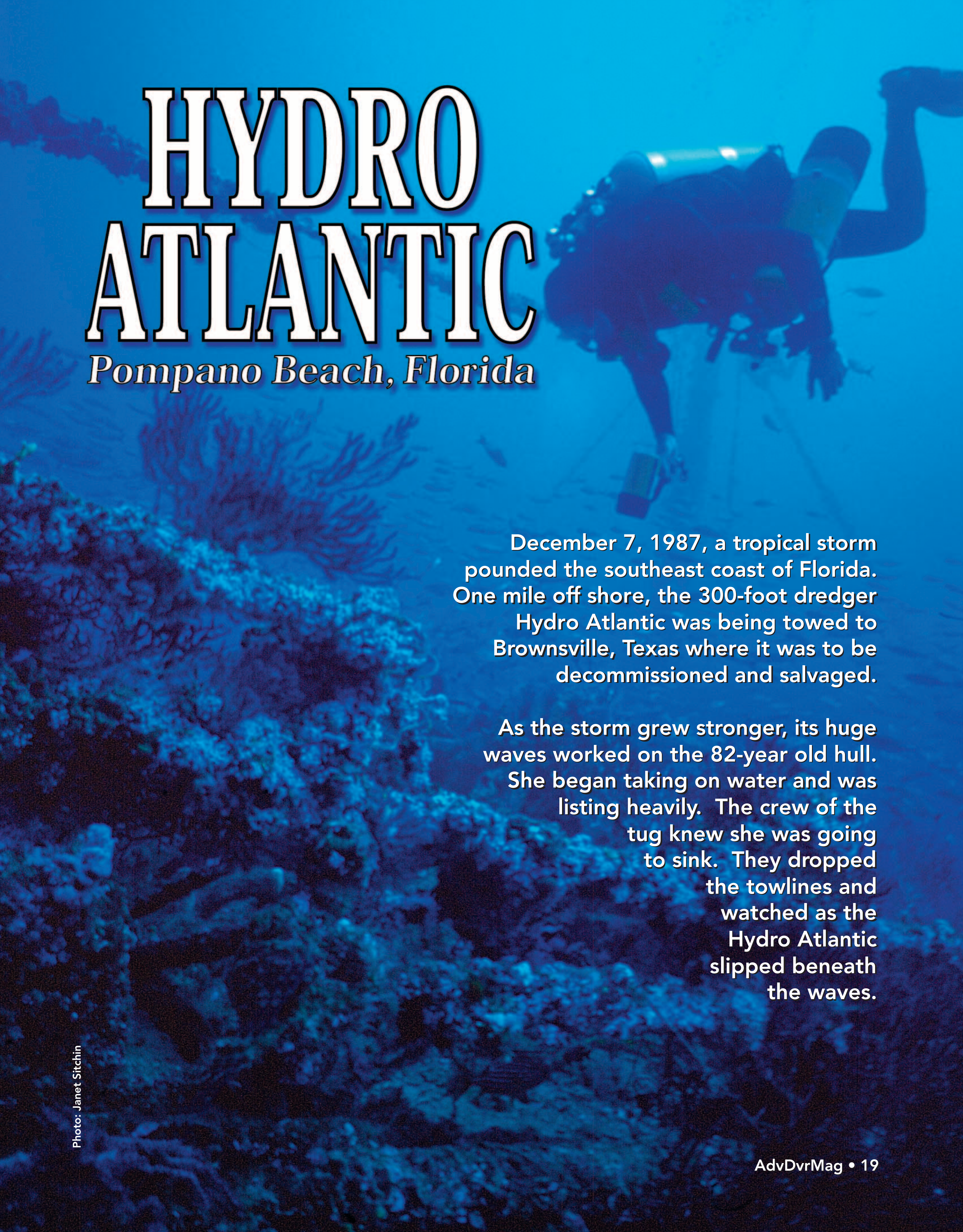


Photo: Janet Sitchin

HYDRO ATLANTIC

Pompano Beach, Florida

December 7, 1987, a tropical storm pounded the southeast coast of Florida. One mile off shore, the 300-foot dredger Hydro Atlantic was being towed to Brownsville, Texas where it was to be decommissioned and salvaged.

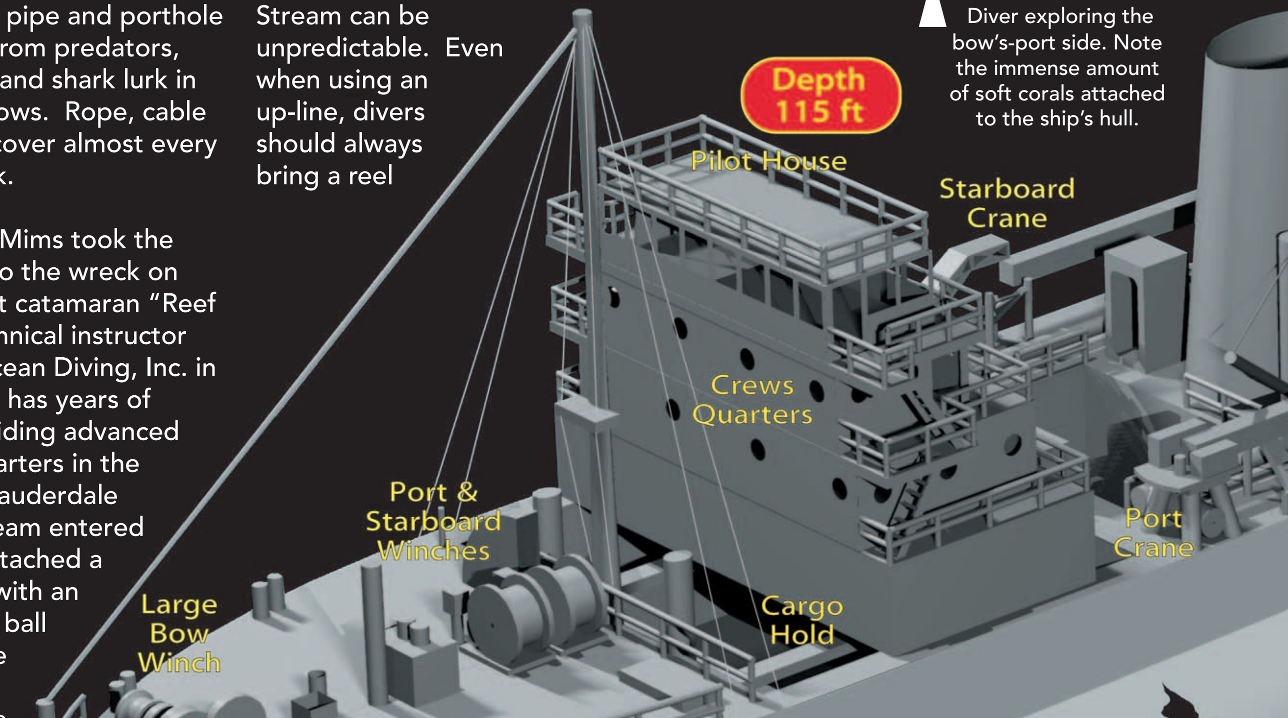
As the storm grew stronger, its huge waves worked on the 82-year old hull. She began taking on water and was listing heavily. The crew of the tug knew she was going to sink. They dropped the towlines and watched as the Hydro Atlantic slipped beneath the waves.

Resting upright on the sandy bottom at 172 feet, the Hydro Atlantic points into the nutrient rich waters of the Gulf Stream. Her deck is still crowded with equipment. Pipes that traverse the old hull from one pump to another. Cranes and giant winches still laden with cable. Barely recognizable, they are all covered with a thick blanket of coral and sponge. Thousands of tropical fish dart in and out of every pipe and porthole seeking shelter from predators, while barracuda and shark lurk in the distant shadows. Rope, cable and fishing line cover almost every inch of the wreck.

Captain Jim Mims took the ADM dive staff to the wreck on board his 34-foot catamaran "Reef Cat". Jim, a technical instructor and owner of Ocean Diving, Inc. in Deerfield Beach, has years of experience providing advanced and technical charters in the Pompano – Ft. Lauderdale area. The first team entered the water and attached a grappling hook with an up-line and float ball to the pilothouse rail. With the slack current, the remaining divers went down the line. In a strong current, we would have been dropped well up stream and made our descent directly to the wreck.

Our plan called for decompression to be done on the up-line. Dive times were planned so the last team to begin their ascent pulled the hook from the wreck, and we would all drift in comfort. But the Gulf Stream can be unpredictable. Even when using an up-line, divers should always bring a reel

Diver exploring the bow's-port side. Note the immense amount of soft corals attached to the ship's hull.



Port view of the pilot house.

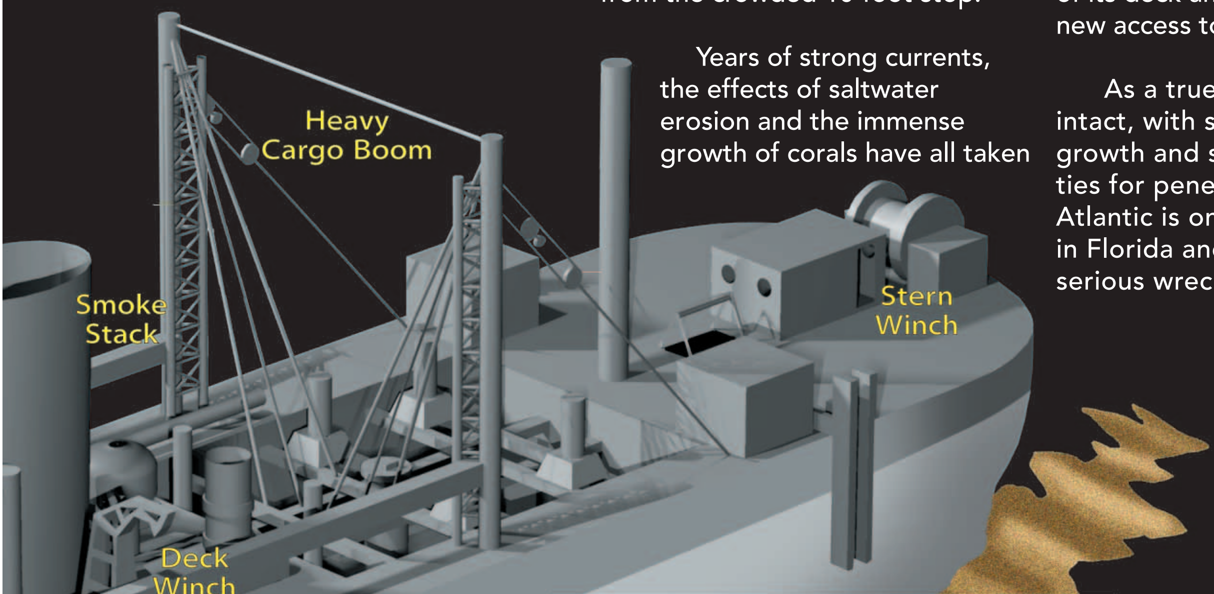
Soft corals cover the bows hand railings and two deck winches can be seen to the middle right

Photos: Janet Sitchin
Illustration: C. Bowen

and lift bag and be prepared for drift decompression. Once the hook was free, some of us shot our bags to finish out our deco away from the crowded 10-foot stop.

Years of strong currents, the effects of saltwater erosion and the immense growth of corals have all taken their toll on the ship's structure. Some walls of the superstructure have collapsed and the hull has started to crush under the weight of its deck and machinery providing new access to inner passages.

As a true wreck, equipment intact, with such an abundance of growth and so many opportunities for penetration, the Hydro Atlantic is one of the best wrecks in Florida and is a must for the serious wreck diver.



Immense soft coral growth covers almost every inch of the ship's hull, deck equipment and superstructure.

ADM Dive Staff:
Curt Bowen, Rusty Farst, Louis Powell, Leroy McNeal, Janet Sitchin, Alan Barefoot and Ed Pellar.

A multitude of other wrecks scatter the Miami, Ft. Lauderdale and Pompano Beach sea floor (*see list below*) along with many outstanding coral reefs.

Ocean Diving, Inc. can be reached at 954•943•3337

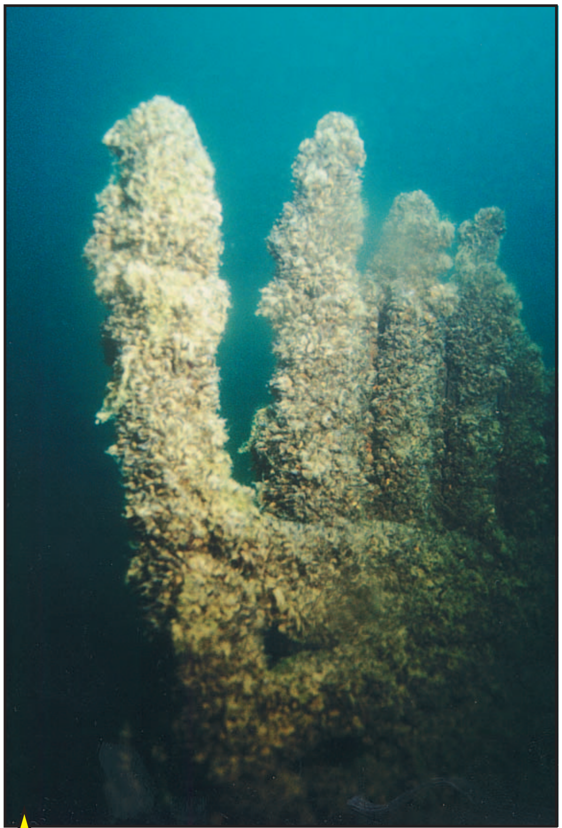
Pompano / Ft. Lauderdale Shipwrecks

Wreck Site	Depth	Length	Date Sunk	Ship Type	Wreck Site	Depth	Length	Date Sunk	Ship Type
Alpha	78 ft	85	3/25/89	Schooner	Miller Lite	164 ft	186	5/17/87	Freighter
Jay Dorman	78 ft	130	2/28/88	Schooner	Hydro Atlantic	174 ft	330	12/7/87	Hopper
Noula Express	78 ft	114	7/12/88	Freighter	Clinton	177 ft	170	5/12/95	Freighter
Mercedes	97 ft	194	3/30/85	Freighter	Renagade	190 ft	150	7/10/85	Freighter
Union Express	108 ft	174	5/16/91	Freighter	Lowrance	210 ft	420	3/31/84	Freighter
Captain Dan	110 ft	175	2/20/90	US Tender	Sucre	220 ft	200	5/13/96	Freighter
Rebel	110 ft	128	7/16/85	Freighter	Caicos Express	240 ft	188	11/12/85	Freighter
RSB-1	120 ft	160	5/14/94	US Tender	Bill Boyd	265 ft	211	7/18/86	Freighter
Rodeo 25	122 ft	215	5/12/90	Freighter	R.B. Johnson	268 ft	170	5/14/89	Freighter
Jim Atria	128 ft	227	9/23/87	Freighter	Corey & Chris	268 ft	188	5/18/86	Army Dredge
Guy Harvey	145 ft	175	5/18/97	Freighter	Pappa's Wreck	277 ft	170	5/14/89	Freighter

LAKE INVADERS

ZEBRA MUSSELS•DESTROYING MARITIME HISTORY

By Joe Rojas



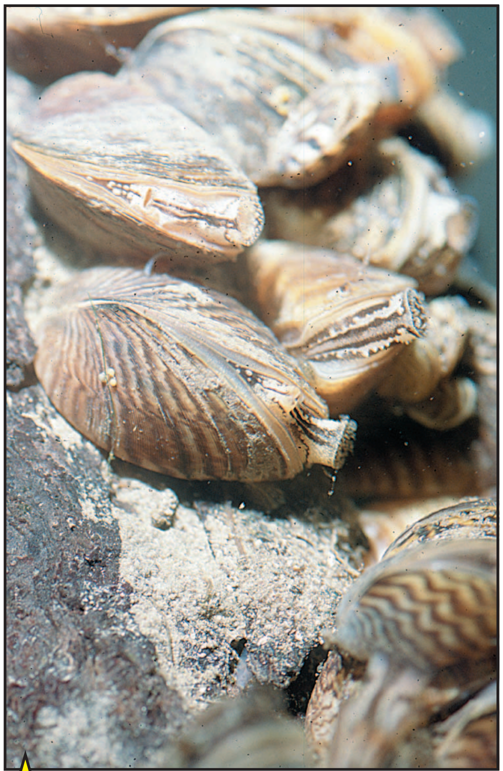
Millions of Zebra mussels engulf every inch of this shallow Lake Michigan shipwreck.

The Great Lakes have a nasty reputation as being some of the most treacherous waters to shipping in the entire world. In the 150 years that modern man has been navigating the lakes there have been an estimated 10,000 shipwrecks. These waters have everything from old wooden sailing ships to modern freighters scattered across the bottom. The fresh water and cold temperatures of the area preserve these wrecks in prisitne conditon, but just like the aritificial reefs of the open oceans, shipwrecks of the Great Lakes become a home for many living organisims. Non-native zebra mussels, freshwater sponges, hydroids, byrozoans, and other aquatic life forms inhabit each piece of maritime history on the bottom of the lakes. While colonization of the wrecks by aquatic life forms is inevitable, the non-native zebra sponge is spreading so fast that it is literally taking over. During the past few years, visibillity in the Great Lakes has increased dramatically (up to 100 feet in some areas!), so it is a shame that when descending on a wreck dive you see not a sunken ship but a breeding ground and home to zebra mussels. These non-native species can create a shell around a shipwreck as much as three inches thick, posing a danger to divers and gear with their sharp shells. The wrecks are quickly being engulfed by these foreign invaders, and soon there will be very little to recognize as a shipwreck. By rescuing some of the artifacts and becoming aware of the zebra mussel's presence on the Great Lakes divers can help preserve a valuable piece of history.

The North American Great Lakes are the largest freshwater system in the world. With over 10,000 miles of shoreline, they contain approximately 20% of the Earth's surface fresh water. The five lakes in the system (Superior, Huron, Michigan, Erie, and Ontario) were formed 14,000 years ago from glacial ice expanding south and melting. The glaciers left an estimated six quadrillion gallons of water that filled in the dunes and swale formations left in its path. It is the largest collection of glacial soil and sand dunes of freshwater origin in the world. This is an environment in a constant state of flux, evolving through erosion, plate tectonics, weather, and the impact of an expanding human population. The aquatic species of the region, including the zebra mussel, are also adapting to environmental changes in the area.

The non-native zebra mussel has successfully adapted itself to Great Lakes freshwater because of its unique colonizing abillities and the reduced threat of predation. Although adults of the species can be seen by the naked eye, microscopic veligers (juve-

Photos: Joe Rojas & Jim Gentile



Constantly filtering water for food, Zebra Mussels have cleaned up many pollution problems in the Great Lakes.

niles) are easily transported between waterways in the ballast water of ships, on boat hulls, and even on unwashed dive equipment. It has been speculated that zebra mussels were first transported to North America from Europe's Black and Caspian seas in the ballast water of a transatlantic freighter that previously visited a port in eastern Europe, where the mollusks are common. Since the first American sighting of zebra mussels in the spring of 1988 in Lake St. Clair, the mussels have successfully colonized each of the Lawrentian Great Lakes, the Mississippi River, and many inland lakes in the Midwestern United States and Canada. The zebra mussel is a sessile organism, but its abillity to attach to boat hulls allows it to spread across major rivers, colonizing new areas that have few predators and an abundance of beneficial resources.

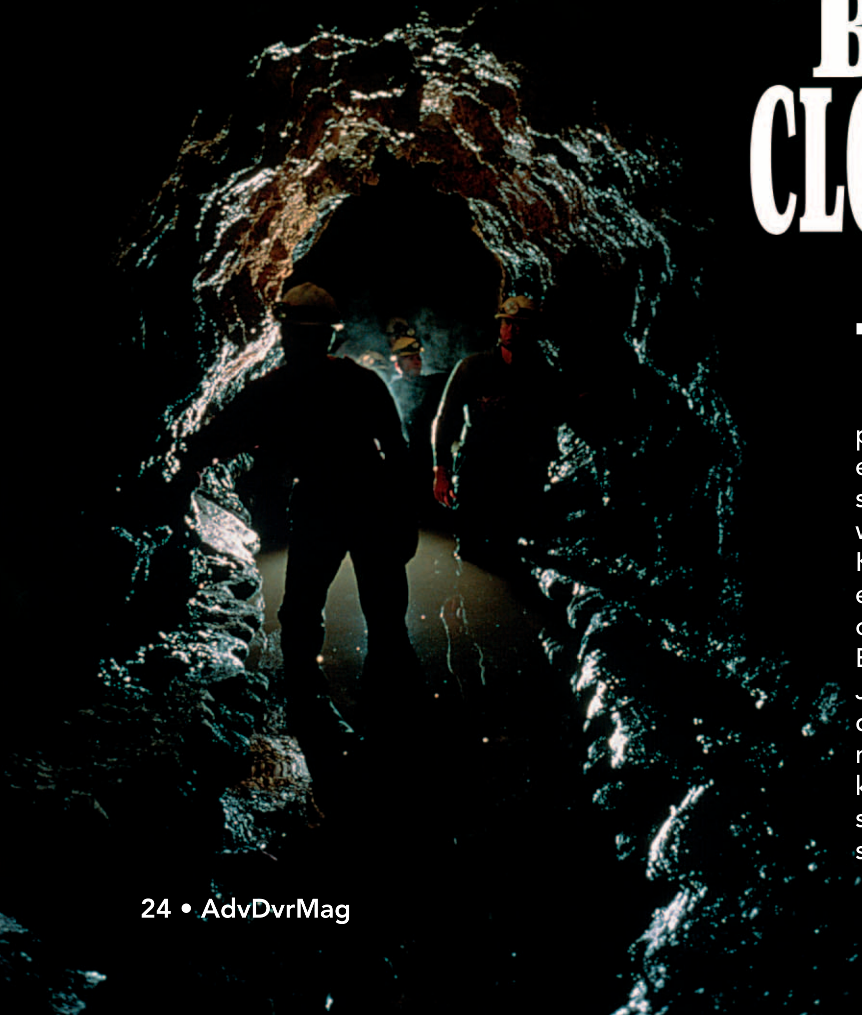
The life of a zebra mussel is a short, but productive one. These mollusks can survive under a wide range of conditions in water temperatures from 32 to 91 degrees farenhite. The zebra mussels rely on water as a medium for carrying

Photos: Joe Rojas & Jim Gentile

Continued on Page ?

BENEATH CLOUD MOUNTAIN

By Jim Bowden & Ann Kristovich



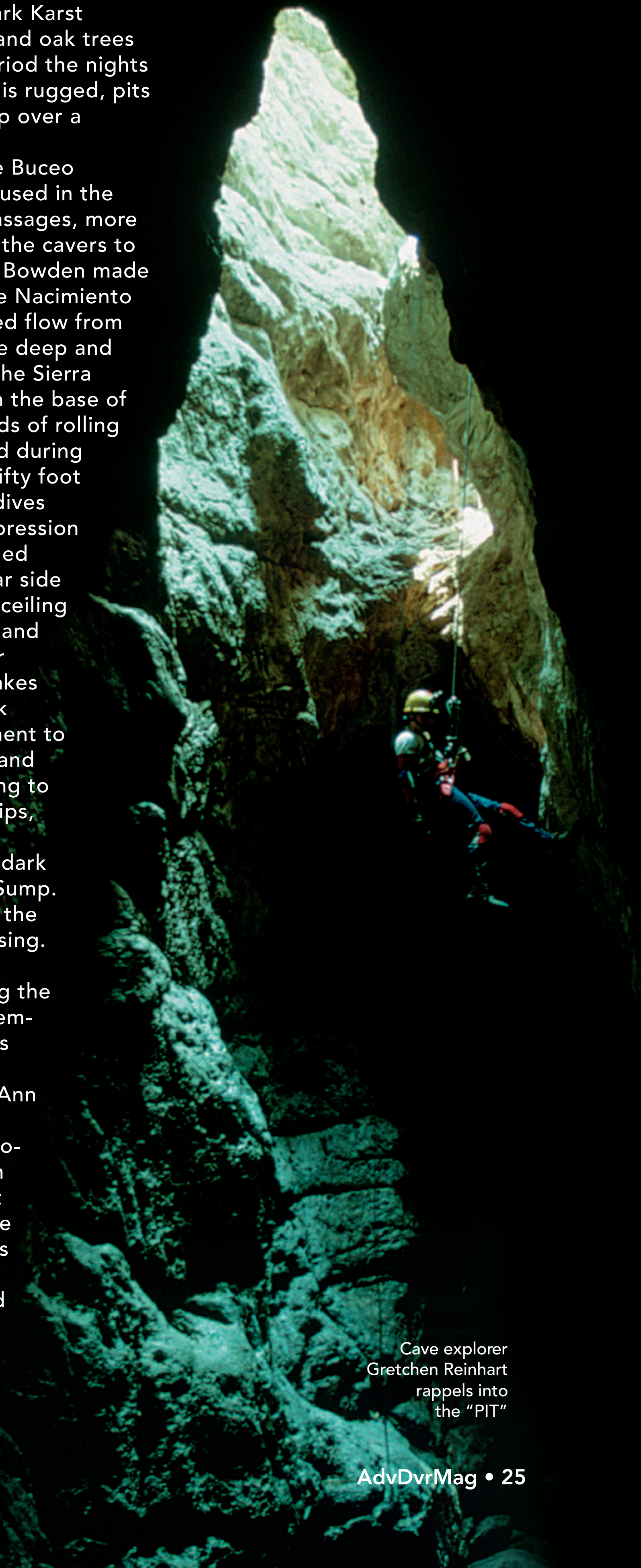
The entrance to El Sotano de Las Calenturas is a funnel shaped pit with a 140 foot vertical drop into the side of a mountain, a part of the Sierra Madres Oriental in northeastern Mexico. Calenturas is a portion of an expansive cave system known as Sistema Purification which could rival the Mammoth Cave system of Kentucky in linear distance. Work by cavers, exploration, mapping, and surveying, has been ongoing since the late sixties in this region. Exploration of the sumps began in 1987 when Jim Bowden and Karen Hohle made preliminary dives in Blazer sump. This beautiful cave is in the northern most part of the ecological wonder known as El Cielo, the Cloud Forest. It is a subtropical high altitude rain forest. The landscapes and sights in the Sierra are unusual and

Photos: Ann Kristovich

beautiful, tall long needled pines with large cones, stark Karst pinnacles covered with bromeliads and orchids, cacti and oak trees filled with Spanish moss. During our expeditionary period the nights are cold and clear and the days are warm. The terrain is rugged, pits and caves abound, and sheer limestone cliff faces drop over a thousand feet into densely forested valleys.

Work by Bowden and members of the Proyecto de Buceo Espeleologico Mexico y America Central has been focused in the upstream passages of Calenturas. The downstream passages, more than two kilometers from the entrance pit, are felt by the cavers to connect with the resurgence of the Rio Corona where Bowden made a dive in 1988. At the base of high limestone cliffs, the Nacimiento del Rio Corona flows from a deep pool. With the added flow from the Nacimiento de San Antonio, the Corona carves the deep and beautiful Canon el Olmo through the front ranges of the Sierra Madre Oriental on its fall to the Gulf of Mexico. From the base of the entrance pit, a kilometer of dry caving over mounds of rolling stones leads to the near shore of Lake Louise. Sumped during the fall and winter months, the lake presents a short fifty foot dive. Each team member, burdened with equipment, dives through to the other side. The sump is the smaller expression of Lake Louise, and divers emerge into a large lake filled room with a lofty cathedral ceiling. The bank on the far side leads to the "break down" a region in which the cave ceiling and walls collapsed to build a narrow jumble of stone and mud that restrains the waters upstream to form Blazer Sump. Without gear, the traverse of the breakdown takes fifteen minutes of hiking over treacherously sharp rock greased with cave mud. Adding the burden of equipment to supply two or more divers increases both the danger and the duration of the trip. On the one hand, it is tempting to carry a larger load to minimize the repetition of the trips, on the other, carrying more than yourself is nearly too much. The end of the breakdown drops to a beach of dark round stones and sand that form the banks of Blazer Sump. The water pools in a shallow lake, the ceiling meeting the water on the far side of the room. The beach is a blessing. At times, the water level is high, and the beach submerged. The shore forms an ideal place for assembling the equipment needed for the dives and to sustain the members of the team who will wait to support the divers as they return.

In 1988, Jim Bowden, supported by Karen Hohle, Ann Kristovich, Peter Oliver and Allen Jackson, dove upstream from Blazer Sump into a tunnel he named Percolation Passage. One thousand feet later he surfaced in an air filled cul-de-sac leading to a small room and yet another sump. He documented this continuation of the upstream system, and spent the remainder of his dives during this expeditionary effort surveying and mapping the passage named for the silt which "percolated from the ceiling" as a result of his exhaust bubbles. Bowden noticed that the central portion of the one thousand foot passage remained clear in spite of multiple dives during his mapping efforts. He ran a line vertically from his primary line and carefully



Cave explorer Gretchen Reinhart rappels into the "PIT"

Photos: Jim Bowden

Karen Hohle in an "Oasis" in the cave named ActunTah.

Jim Bowden in the very highly decorated cave named Mountain Cow.

Mayan skull fused into the solidified waters of a cave pool, discovered by Karen Hohle.

ascended into an air bell some fifty feet in length. The "T" in the line has been maintained as the bell provides explorers with an escape into an air filled space should an emergency occur.

Exploration in sumps requires expertise beyond knowledge of diving equipment and sump diving skills, it is necessary that the explorer masters the skills of dry caving and possess proficiency with single rope techniques, he/she must be able to prusik and rappel equipment into and out of both the dry and wet regions of a cave. Gear for the dives must be transported through the air filled regions of the cave to the sump, the place at which the cave ceiling meets a pool or stream of water. Sumps always present a special challenge to the cave diver. The pools are generally still water, and silt coats the floors, walls and ceilings. Bubbles from the divers exhaust will cloud the water, and in spite of meticulous technique, the return trip is often in zero visibility. Usually shallow, the linear distances of a sump will vary, and the potential for hazards such as waterfalls is real if the cave has a known vertical drop. A diver cannot hear a waterfall underwater if he/she is swimming down stream. This is not the case if a diver enters a pool into which water is falling. In this situation, the sound is both heard and felt. Sump divers often are challenged by a lack of tie-off points and may carry a variety of aids to allow the line to be belayed to prevent line traps. The water is usually cold, and often safety is enhanced by solo work. The solo diver obviously is still solo when he/she emerges from the sump. Any injury sustained by the explorer thus places him/her in a very difficult situation. Teams must plan for this contingency.

Since 1987 Bowden and his team have returned to Calenturas annually to continue the exploration of the upstream passage. Over a thousand feet of cave was surveyed and mapped. A small team returned in 1990, the plan to support Bowden and I in a push in the upstream passage in what now numbered the fourth sump. There the line had been tied in a dead end. We were confident that the passage continued underwater, and that somewhere a lead existed to the surface, or at least to a higher region of the cave, out of the water. Several days were needed to assemble the equipment on Blazer beach, and on the day of the planned push after four and a half hours of work, we were ready to begin the effort into Percolation Passage. Bowden and I dove together with doubles and a single stage bottle. We dropped the stage bottle after the first one thousand feet, and continued with the back mounted tanks. We swam through the third sump into the large air filled room. It ended in another sump, the fourth. We followed the line left from our previous work, turned and reeled it back to the point where its direction had deviated from the main azimuth heading. We swam a few yards on the typical compass bearing and I flashed Jim, ahead to the left was a clean gravel bank and booming passage. We swam for 150 feet under water before surfacing in yet another huge water filled room,

Photos: Ann Kristovich & Jim Bowden
Illustration: C. Bowen

ceiling high above us, and air fresh and breathable. Somewhere this mighty cave has a connection to the surface, some passage to daylight on the mountainside, but where? We swam, more than 400 feet, and discovered another sump, this one the fifth. We still had sufficient air to allow a modest penetration before turning on air thirds. This sump was unlike the others. The water was beautifully clear, it was canyon-like with large boulders visible on the bottom far below us. It pushed us deeper than the others, we dove at a depth of 37 feet when we turned the dive on air. As we journeyed back, we counted knots, and shot azimuths for our survey. Both of us were cold after more than five hours in the 62° water.

There was no better sight than that of teammate Allen Jackson, alone on the shores of Blazer Sump, ready with warm drinks and a helping hand as we dropped our extra gear. We still had the break down and the dive in Lake Louise ahead of us, but with cajoling, we managed to accomplish these efforts. Our staging area on the shores of the Lake Louise sump was lonely, I checked my watch, it was 12:30am, we had been at this effort continuously for twelve hours. The cold penetrated as we hurried to get dry and dressed. Jim was ready to go. I encouraged him to leave, hypothermia was a real risk, and our exposure continued, the cave air was the same 62° as the water, but the air in the pit, open to the sky, was in the mid-thirties. Allen stayed with me as I struggled up the mountains of round stones, one step up, half a step back. Fatigued, I reached the bottom of the pit as Jim was fastening his final Gibbs ascender to the rope to begin the 140 foot climb back to the surface. The rhythmic screech of his ascenders sang on the rope as he walked vertically up the gossamer line.

The Proyecto returned to Calenturas this winter. Many of the intervening years having been spent in the pursuit of the bottom of Zacaton. We were anxious to become reacquainted with the majesty of the mountain cave , her treasures and promise of a passage to the surface. We rappelled into Calenturas, unburdened by the usual tanks and dive gear, a simple reconnaissance was our plan . At the base of the stone mound we discovered a twisted bundle of knotted nylon line, our survey line, previously tied in th e far reaches of the cave. A line arrow marked with "El Proyecto" was wedged between rocks at the banks of Lake Louise. Clearly, some of our work will need to be repeated. Our wish is to pursue the further exploration of Calenturas with rebreather technology. The sumps are short and generally shallow and the compact size of the rebreather and its gas source will reduce the numbers or trips through the breakdown with equipment and facilitate exploration.

Karen Hohle rappelling into Mountain Cow. This fabulous cave is reached by a three hour hike through the densest part of the jungle.

Ann Kristovich working in a cave called Rochelles.

Jim Bowden standing in Blazer Sump, finalizing some details on his survey slate.

TRUK

By Andrew White and Curt Bowen

In the Pacific Theater of World War II, the Japanese-held Truk Lagoon was regarded by Allied forces as an almost mystical fortress. This atoll deep behind enemy lines had a well-deserved reputation as being one of Japan's strongest holds in the Pacific. The area had been sealed off to outsiders for nearly 25 years which led to uncertainty and near legend regarding its geography and the development of its defenses. The media of the time had fostered these myths of Truk referring to it in such terms as "Japan's impregnable bastion of the Pacific." As the legend grew, the Allies came to view the naval base at Truk with respect and more than a little fear.

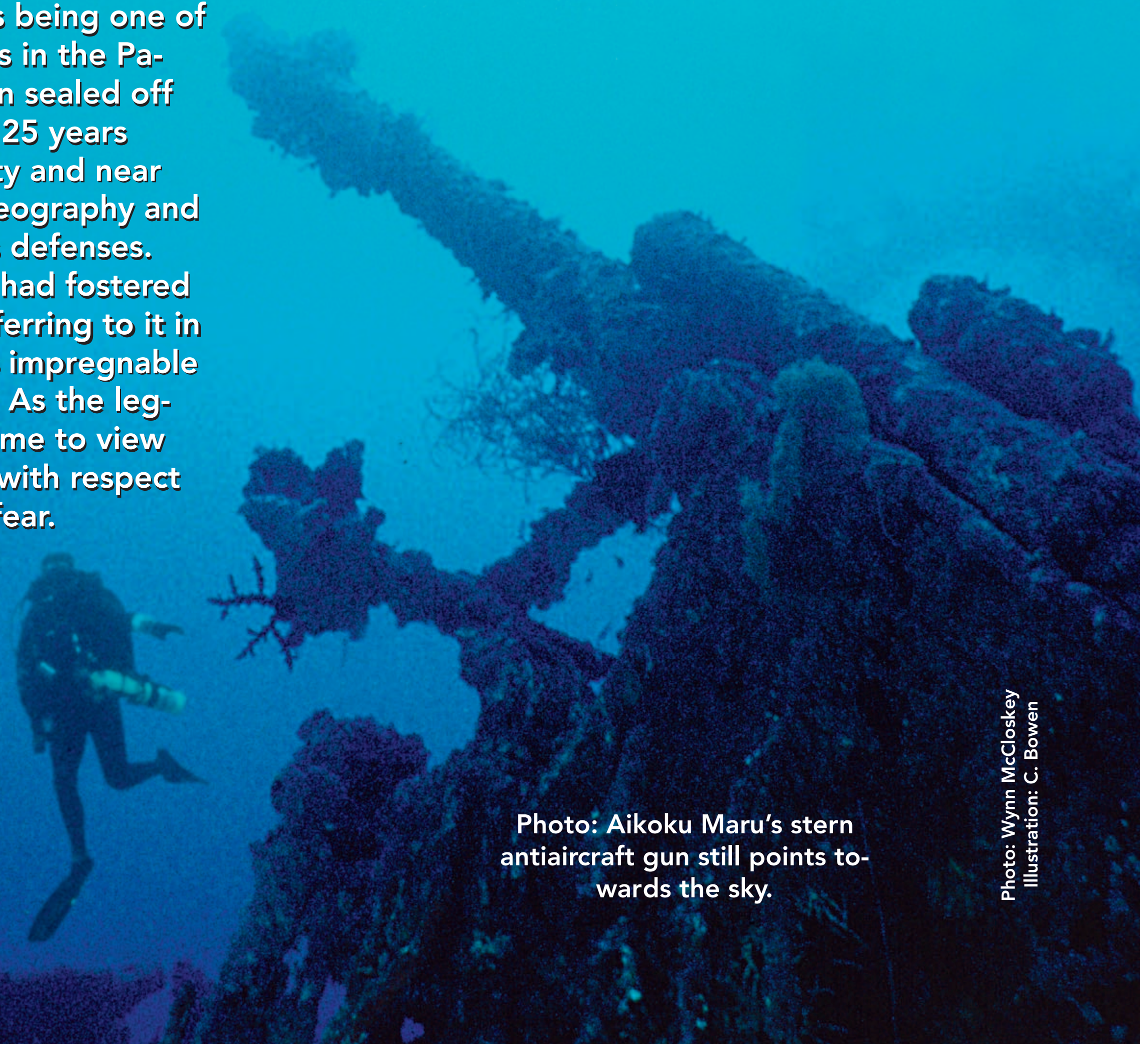


Photo: Aikoku Maru's stern antiaircraft gun still points towards the sky.

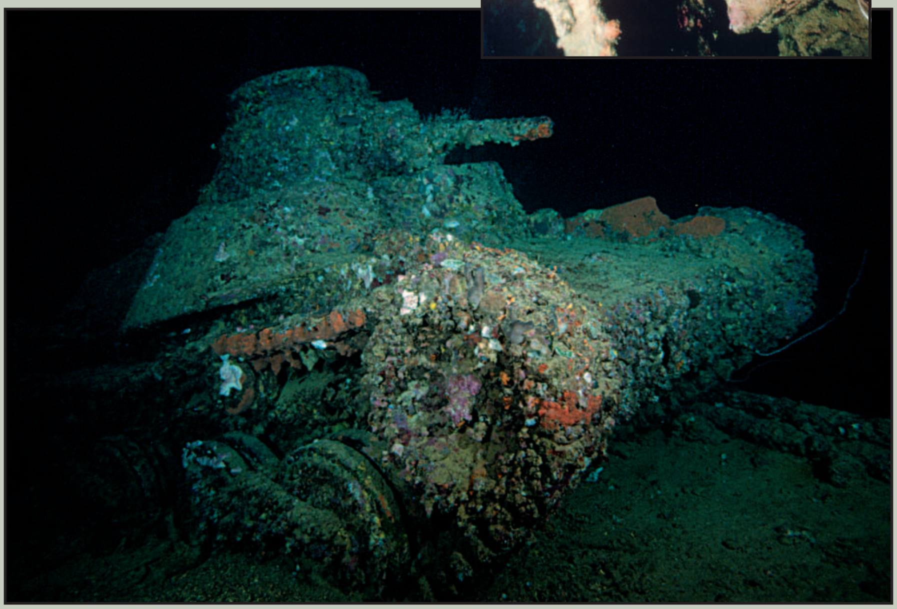
Photo: Wynn McCloskey
Illustration: C. Bowen

In reality, Truk was one of Japan's most important naval bases. It occupied a strategic position in the West-Central Pacific, acted as a main fleet anchorage, and served as an advanced base for many Japanese naval operations. The combined Japanese fleet, including the super-battleships Yamato and Musashi often held up in Truk between missions. Japanese forces in the Solomon Islands and Guadalcanal used Truk Lagoon as a staging point and vital stop in the supply route between Pacific islands and the homeland.

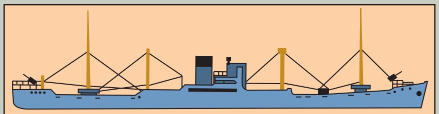
The geography of Truk made the perfect site for a naval base of the WW II era. The 40 mile diameter lagoon is encircled by shallow reef nearly 140 miles in circumference. At those distances, Japanese warships within the lagoon could stay outside the range of allied naval fire. The five navigable passes into the lagoon were strongly protected by artillery on flanking islands, and most were heavily mined. Navigation over the reef was impossible. Depths within the lagoon exceed 240 feet, providing plenty of mean water for ship and submarine navigation. Approximately 245 volcanic islands dot the lagoon, some with elevations in excess of 1500 feet. These islands were prime locations for airstrips, surface ship and submarine repair bases, troop barracks, bulk fuel storage, and radio communications. Most were heavily armed with antiaircraft weaponry.

While Truk had the potential to be one of the most formidable naval bases of the Pacific, Japanese losses at Midway and Coral Island had required them to spread their forces thin. By 1944 the tide of the war was turning and rising costs had dictated that Japan keep a large, mobile fleet. This forced them to cut back on armament

Below: Japanese Tank sits silenced on the deck of the San Francisco Maru
Right: Ship mines and antiaircraft shells stacked in a ships hall.

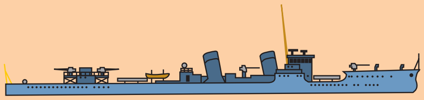


Photos: Paul Stone
Illustrations: C. Bowen

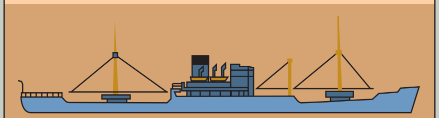


AMAGISAN MARU 7,620 tons
Dimensions: 450/60/27.5 Depth 95-220 ft.
Compliment: 48 crew, 7 passengers
Passenger-Cargo Ship
Lying 65° to port along an incline sloping downwards from bow to stern. Cargo includes aircraft parts, aerial bombs, fuel drums, a sedan and wooden planking. Many Artifacts

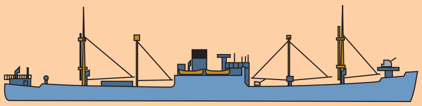
AIKOKU MARU 10,437 tons
Dimensions: 498/66/29 Depth 80-210 ft.
Compliment: Unknown Crew, 400 Passengers
Ex-Armed Merchant Cruiser and Raider
Sunk upright with bridge destroyed and heavily damaged foreship separated from wreck. Remains of hundreds of special troops can be found in the first of the aft holds.



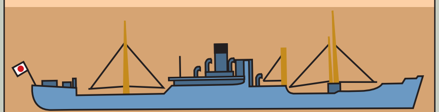
FUMITSUKI 1,913 tons
Dimensions: 320/30/10 Depth 110-140 ft.
Compliment: 150
Mutsuki Class Destroyer
Sunk upright with list to port. Interesting guns, torpedo tubes and depth charges. Many personal crew effects.



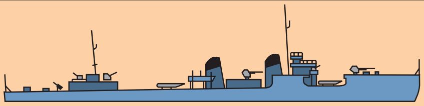
KENSHO MARU 4,862 tons
Dimensions: 384/52/30 Depth 40-120 ft.
Compliment: Unknown
Passenger-Cargo Ship
Sunk upright listing 20° to port. Many artifacts and plumbing / welding supplies.



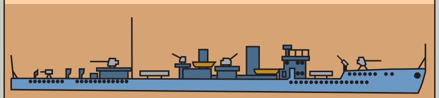
KIYOSUMI MARU 8,614 tons
Dimensions: 453/61/28 Depth 45-120 ft.
Compliment: 50 crew, 12 passengers
Passenger-Cargo Ship
Wreck lying on port side with partially collapsed bridge. AA guns, range finders, torpedo launchers and many artifacts.



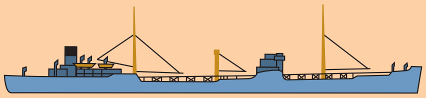
MOMOKAWA MARU 3,820 tons
Dimensions: 453/61/28 Depth 80-130 ft.
Compliment: Unknown
Passenger-Cargo Ship
Wreck lying on port side Foreship holds loaded with aircraft fuselage, aircraft parts, trucks, tires, and artillery shells. Crews personal effects and china located in galley and crews quarters.



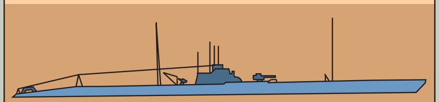
OITE **1,523 tons**
Dimensions: 327/30/10 **Depth 180-220 ft.**
Complement: 148
Kamikaze Class Destroyer
Ship is broken in two sections with the bow upside down. A large 4.7 inch gun in mounted in the center of the stern. Human remains are scattered everywhere in the around and in the wreckage.



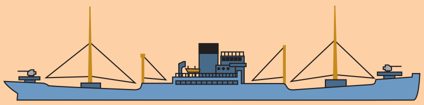
PATROL BOAT #34 **935 tons**
Dimensions: 280/26/8 **Depth 10-40 ft.**
Complement: 110
Ex-Kuri Type Momi Class Destroyer
Sunk upright with 20° list to port. Ship is deteriorating quickly because of shallow depths. Extensive fire damage before sinking.



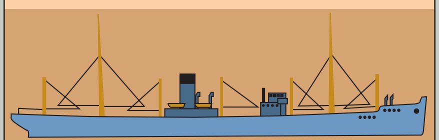
SHINKOKU MARU **10,020 tons**
Dimensions: 500/65/30 **Depth 40-120 ft.**
Compliment: Unknown
Naval Tanker
Sunk upright, Easy penetration into wheel-house with ships telegraph. Lots of marine life and soft coral growth.



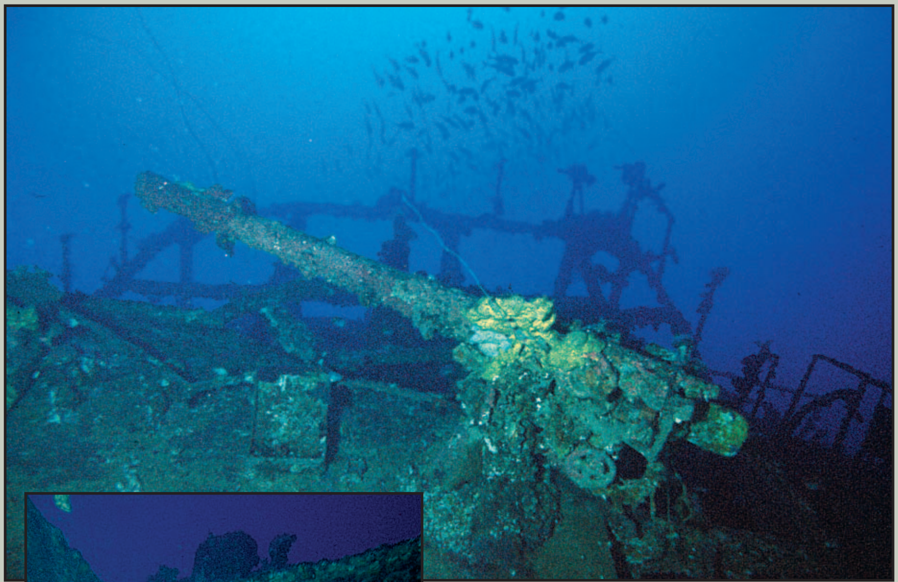
I-169 **1,400 tons**
Dimensions: 336/27/15 **Depth 90-140 ft.**
Compliment: 70
I 168 Class (Kaidai 6A) Submarine
Sunk upright, Heavily damaged foreship, dangerous penetration. Crew has been removed by salvors for ceremonial burial.



FUJIKAWA MARU **9,542 tons**
Dimensions: 490/65/28 **Depth 40-110 ft.**
Compliment: 48
Passenger-Cargo Ship
Sunk upright, Cargo includes 4 stripped aircraft, aircraft parts, torpedo, munitions and beer. Large deck guns on bow and stern.



HOKI MARU **7,112 tons**
Dimensions: 450/58/31 **Depth 80-150 ft.**
Compliment: Unknown crew, 12 passenger
Cargo Ship
Sunk upright, Cargo includes bulldozers, tractor, trucks, steamroller, various machinery, bombs, depth charges, mines, and aircraft parts.



Above: Large antiaircraft gun sits poised ready for allied invasion.
Left: Still locked to the decking this military transport vehicle is still fully loaded.

required to properly defend Truk from a direct assault.

The naval base at Truk had long been a high priority target for the American military. In the early parts of 1944, fresh on the heels of victories in the nearby Marshall and Solomon islands, a realistic invasion plan of Truk was established. Named Operation Hailstone, the plan was to assemble a large, mobile striking force capable of advancing on Truk swiftly and unleashing an immense attack on the naval base. Similar to Japan's attack on Pearl Harbor, the assault on Truk would be swift and destructive.

The first look at Truk by American forces came on a reconnaissance mission by two marine aircraft. Flying at an altitude of 20,000 feet, these planes managed to photograph the naval base at Truk between breaks in the heavy cloud cover. They were detected by Japanese radar and only able to spend 20 minutes over the atoll, but the pictures they brought back provided valuable information to the American invasion force. There were more than 60 ships anchored within the lagoon at Truk. The photos also showed several airstrips and seaplane bases. The pieces were falling into place for an incredible air and sea battle.

On February 16, 1944 Allied forces merged on Truk Lagoon with 4 carriers, 6 light carriers, 7 battleships, 27 destroyers, 6 heavy cruisers, 5 light cruisers and an assortment of smaller support vessels. Amazingly, the fleet arrived undetected and in the early morning hours the battle began with an intense air assault. The Japanese were caught off guard. Though heavy resistance through the air was encountered by the Allied team, most of the warships that the marine flyers had photographed two weeks earlier had departed. What ensued was one of the fiercest air battles in history.

Photos: Paul Stone
Illustrations: C. Bowen

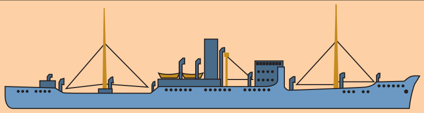
VESSEL	Tons	Type	Depth	Note
TACHI MARU	1,891	Civilian-cargo	100	Blown in two sections
EISEN No. 761	300	Tugboat	35-60	45 list to port
FUTAGAMI	625	Salvage Tug	35-110	Sunk Upright
NIPPO MARU	3,764	Cargo Ship	70-160	Guns, Mines, Munitions
OJIMA	812	Salvage Tug	90-120	Blown in two sections
GOSEI MARU	1,931	Cargo Ship	30-120	Torpedos, artifacts
YUBAE MARU	3,217	Cargo Ship	80-120	Lying on port, heavily damaged
TAIHO MARU	2,827	Cargo Ship	140-165	Blown in two sections
SANKISAN MARU	4,776	Cargo Ship	50-150	Blown in two sections
YAMAGIRI MARU	6,438	Cargo Ship	40-110	Huge naval artillery

For two days the battle was waged, and when the smoke cleared it was a decisive victory for the Allies. Approximately 275 Japanese planes were destroyed or damaged, 45 Japanese ships had been sunk and another 26 had suffered damage. Most of these ships were merchantmen and auxiliary vessels, but several destroyers were counted among the casualties. Airstrips, fuel and ammunition supply depots, and repair stations were completely wiped out. The mighty naval base at Truk Lagoon had been neutralized. Allied losses during the battle were minuscule in comparison, with 25 planes having gone down and 29 pilots lost.

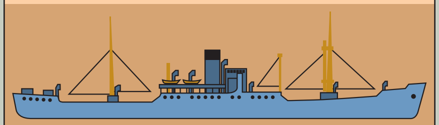
The Japanese never made a serious attempt to restore Truk to its former state of importance, however they held the atoll for nearly eighteen months after the initial raid. The Allies revisited Truk several times in that span, mostly in the form of high-altitude B-24

Right: Merchant ship's gauges and telegraph encrusted with corals and sponges.
Below: Deep below deck in the far reaches of a ship's hall ghostly human remains remind us of the consequences of war.

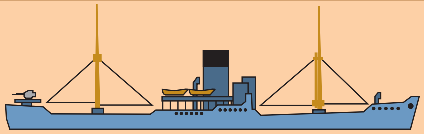
Photos: Paul Stone
Illustrations: C. Bowen



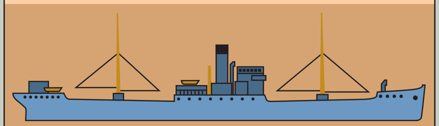
HOKUYO MARU 4,216 tons
Dimensions: 357/49/24 Depth 140-210 ft.
Compliment: Unknown crew, 3 passengers
Passenger-Cargo Ship
Sunk upright, Bridge contains two telegraphs, ships compass and wheel. Little exploration has been done on this wreck.



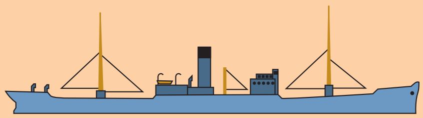
KIKUKAWA MARU 3,833 tons
Dimensions: 354/50/27 Depth 90-125 ft.
Compliment: Unknown crew, 10 passengers
Passenger-Cargo Ship
Blown apart into two sections. Bow cargo includes aircraft engines, aircraft parts, munitions, machinery and oil/gasoline drums.



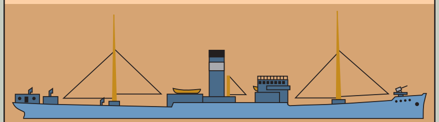
MATSUTAN MARU 1,999 tons
Dimensions: 285/40/20 Depth 120-165 ft.
Compliment: Unknown crew
Cargo Ship
Sunk upright, Cargo includes trucks, artillery, small arms munitions, metal sheets and gasoline. 3-inch gun mounted on stern.



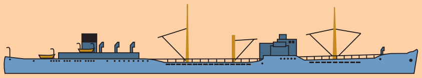
NAGANO MARU 3,824 tons
Dimensions: 345/50/24 Depth 160-210 ft.
Compliment: Unknown crew
Passenger-Cargo Ship
Sunk upright with list to port. Many artifacts in superstructure. Little exploration has been done on this wreck.



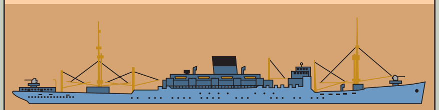
REIYO MARU 5,446 tons
Dimensions: 444/53/29 Depth 170-220 ft.
Compliment: 48 crew, 4 passengers
Passenger-Cargo Ship
Sunk upright, cargo removed before sinking and few artifacts are to be found.



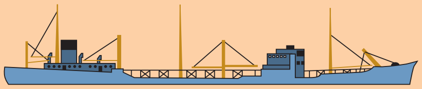
SAN FRANCISCO MARU 5,831 tons
Dimensions: 385/51/27 Depth 140-210 ft.
Compliment: 40 crew, 2 passengers
Passenger-Cargo Ship
Sunk upright, cargo includes trucks, tanks, mines, torpedoes, bombs, artillery, anti-aircraft munitions and airplane parts.



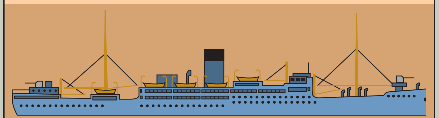
FUJISAN MARU **9,524 tons**
Dimensions: 490/65/28 **Depth 130-220 ft.**
Compliment: 48 crew
Naval Tanker
Sunk upright, 45° list to port. Heavy damage due to fire before sinking. Artifacts include china, telegraph and personal effects.



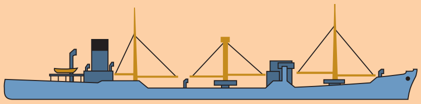
HEIAN MARU **11,614 tons**
Dimensions: 510/66/30 **Depth 35-110 ft.**
Compliment: 150 crew, 285 passengers
Submarine Tender
Sunk on port side. Heavy damage due to fire before sinking. Artifacts include torpedos, periscopes and personal effects.



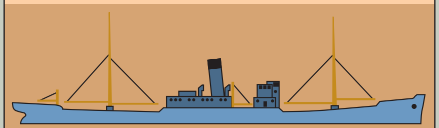
HOYO MARU **8,691 tons**
Dimensions: 475/61/30 **Depth 8-80 ft.**
Compliment: 50 crew
Naval Tanker
Sunk upside down with pilot house and crews quarters smashed under hull. Lots of marine life and corals.



RIO DE JANEIRO MARU **9,626 tons**
Dimensions: 461/62/26 **Depth 35-110 ft.**
Compliment: 150 crew, 1140 passenger
Ex-Passenger Liner and Submarine Tender
Lying on starboard side. Large deck guns on bow and stern. Artifacts include coastal defense guns, oil drums, beer and many personal effects.



SEIKO MARU **5,385 tons**
Dimensions: 392/53/30 **Depth 80-160 ft.**
Compliment: unknown
Passenger-Cargo Ship
Sunk upright, artifacts include long-lance torpedoes, china and many personal effects can be located in the crews quarters.



UNKIA MARU **3,220 tons**
Dimensions: 331/49/22 **Depth 80-130 ft.**
Compliment: unknown
Cargo Ship
Sunk upright, Heavily damaged due to fire before sinking. Large winches and some personal artifacts.

bombing raids. On September 2, 1945 the Japanese officially surrendered the island to Vice Admiral George Murray aboard the U.S.S. Portland, thus ending the reign of one of Japan's most formidable naval strongholds.

In 1947, Truk, along with all the Caroline Islands, were placed under a United Nations trusteeship that was administered by the United States. In 1979, it became a member of the United Federated States of Micronesia, where the islands are completely self-governing, but the United States is responsible for their defense.

Photos: Paul Stone
Illustrations: C. Bowen

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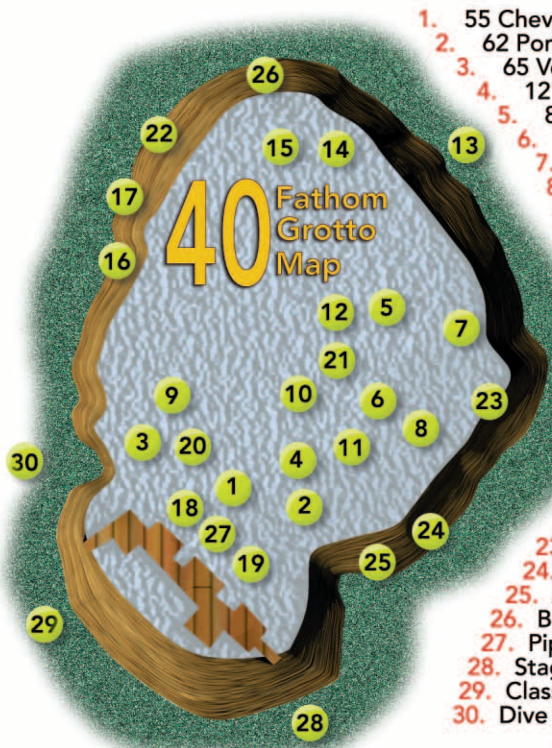

1. 55 Chevy @ 90ft.
2. 62 Pontiac @ 100ft.
3. 65 Vette @ 110ft.
4. 12' Sub @ 80ft.
5. 81 Motor Cycle @ 40ft.
6. Towsub @ 60ft.
7. Air Chamber @ 35ft.
8. Air Chamber @ 32ft.
9. 25' Cabin Cruiser @ 110ft.
10. 37 Chevy @ 140ft.
11. Falcon/Nova @ 150ft.
12. Chevy Van @ 150ft.
13. 28 Chrysler @ 200ft.
14. 53 Dodge @ 175ft.
15. 64 Corvair @ 187ft.
16. 62 Olds @ 200ft.
17. VW Bug @ 210ft.
18. 8 x 16 Platform @ 15ft.
19. 8 x 16 Platform @ 30ft.
20. 8 x 16 Platform @ 40ft.
21. 8 x 16 Platform @ 60ft.
22. KeyHole Cave @ 236ft.
23. Creature Cave @ 55ft.
24. Sea Biscuit Cave @ 50ft.
25. Aquifer Entry Cave @ 100ft.
26. Bonsai Line @ 240ft.
27. Piper Airplane @ 90ft.
28. Staging Area
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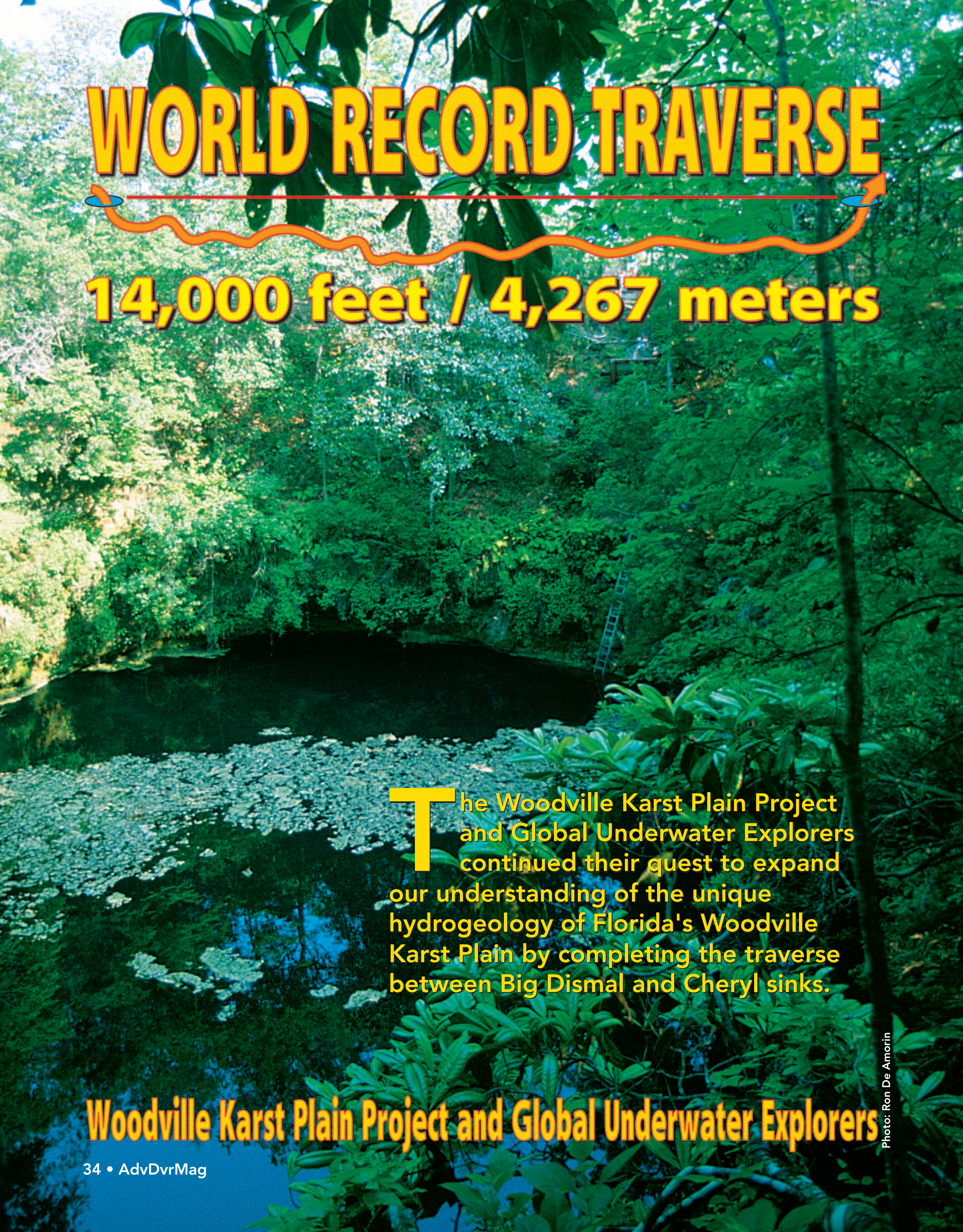


Photo: Ron De Amorin

WORLD RECORD TRAVERSE

14,000 feet / 4,267 meters

The Woodville Karst Plain Project and Global Underwater Explorers continued their quest to expand our understanding of the unique hydrogeology of Florida's Woodville Karst Plain by completing the traverse between Big Dismal and Cheryl sinks.

Woodville Karst Plain Project and Global Underwater Explorers

Big Dismal and Cheryl are in adjacent counties south of Tallahassee, separated by over 14,000 feet/ 4,267 meters of cave. The successful completion of the dive sets a new world record for longest traverse between Karst windows in an underwater cave. The exploration effort was the culmination of a decade's worth of hard work, a period of personal and financial sacrifice that would ultimately lead to a redefinition of technical diving and decompression practices.

May 29, 1999 The traverse was planned by WKPP exploration divers George Irvine (WKPP Project Director) and Jarrod Jablonski (GUE President); Irvine and Jablonski were joined on the dive by GUE instructor and WKPP gas diver Ted Cole. The dive was made possible through the dedicated surface and in-water support teamwork required to stage an exploration push under very difficult conditions.

For everyone involved, the dive was about much more than an attempt to break the record for longest underwater traverse. As Irvine notes, many of us a re involved with this project because it is serving to better protect the environment, especially the water quality of the Floridian aquifer that feeds Wakulla and other major springs. Water clarity at Wakulla and other springs has diminished markedly as more land has been cleared and drained north of the springs. In essence, anything that happens in the sink-holes upstream has the potential to enter these major conduits and to pollute the water downstream. The dive received extensive local news coverage, helping to raise awareness of groundwater and storm drainage issues in a fragile area of North Florida that must find a balance between conservation and economic development.

The WKPP's origins come from the exploration of the caves of the Leon Sinks National Geologic Area. Founding member Bill Gavin suspected the connection between the Cheryl and Big Dismal systems fifteen years ago, although the caves features are indicative of completely different geologic systems. From the surface, Big Dismal is an impressive sight. Its sheer limestone walls drop seventy five to a hundred feet (23/30 meters) from a scrub pine forest to the water. Just to get the gear and the divers to the water requires block and tackle and the use of an extended fire ladder suspended from the tree line. The cave from the Big Dismal side features large passages of scalloped white limestone and relatively little breakdown. The Cheryl cave has smaller passages, with walls stained dark brown or black and a large amount of breakdown. Support diver Bob Sherwood noted that large chunks of breakdown had fallen onto the primary line within the last week, probably dislodged by exhaust gases from the setup divers. From the surface, Cheryl is a gentle depression along the side of a road, with a clear pool about fifteen feet/4 meters across.

Although Bill Gavin's hunch that the two systems were connected was later predicted by radioisotope studies tracing water flow through the Leon system, it would take seven years before divers found the tunnel that would later connect Big D and Cheryl. The connection came just as the team was about to give up on the place on their third dive to the "Bitter End," so named by WKPP founder Parker Turner for that reason. The team was then able to extend the connection out to 9000 feet, but the push also cost the life of gas diver Sherwood Schille when he became entangled in line in a small section of Cheryl known as the shortcut. Sherwood's death would bring about a number of changes in the WKPP, including the transition of George Irvine to Project Director and the implementation of the Doing It Right philosophy of gear rigging and teamwork.

Assistants lowering the multiple cylinders and scooters into Big Dismal Sink for the world record traverse.

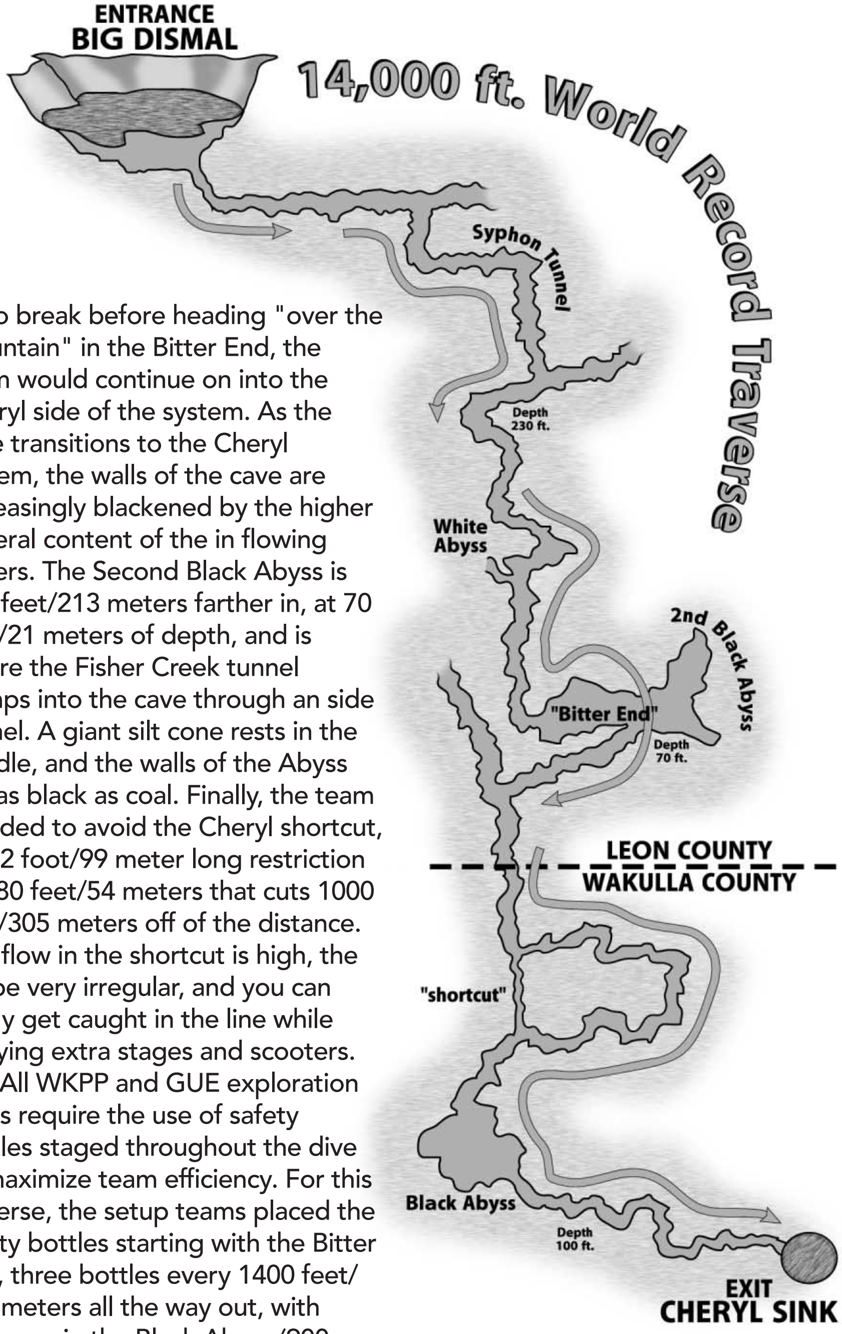


Illustration: C. Bowen

Jarrod Jablonski and Casey McKinley were the first to connect the line between the two systems from the Big D side several years ago. Although the swim through would have been possible at that time, weather, logistics, and then landowner disputes prevented access to the system until 1999. The team redirected its efforts to the exploration of Wakulla Springs while Irvine worked behind the scenes to renegotiate access to the Leon Sinks system.

The preparation for the traverse began again in the early months of 1999. Brent Scarabin and Irvine began by running the cave to 9,500 feet/2,895 meters upstream to check the connection from the Cheryl side, while Chris Werner replaced the line downstream Big D for 3500 feet/ 1,066 meters. Note that the traverse was established by checking the connection from both ends; the team would never attempt a circuit without first having confirmed the connection from both ends. The night before the traverse, Jablonski and Irvine checked the Abyss, the shortcut, the long route, the Bitter End, and placed the safety cylinders from the Cheryl side. The dive was set up with the ability to abort and get out either way from any distance. The team ran the in going bottles into the shallow beginning of Big Dismal like normal stages and reverse deco gas, dropping them at half plus two (while always maintaining full back gas as bailout) and placing deco bottles in the Big Dismal sink for use in the event of an aborted traverse.

During the dive, the team would be moving through a series of conduits with distinctly different hydrogeologic features. The cave in the Big Dismal side has smooth white scalloped walls, with relatively small passages (40 by 20 feet/12 by 8 meters). The two systems seem to connect at the Bitter End, a breakdown dome in a large, white room at 100 feet/30 meters which splits in a Y and appears to end. After a short deco break before heading "over the mountain" in the Bitter End, the team would continue on into the Cheryl side of the system. As the cave transitions to the Cheryl system, the walls of the cave are increasingly blackened by the higher mineral content of the in flowing waters. The Second Black Abyss is 700 feet/213 meters farther in, at 70 feet/21 meters of depth, and is where the Fisher Creek tunnel dumps into the cave through an side tunnel. A giant silt cone rests in the middle, and the walls of the Abyss are as black as coal. Finally, the team decided to avoid the Cheryl shortcut, a 352 foot/99 meter long restriction at 180 feet/54 meters that cuts 1000 feet/305 meters off of the distance. The flow in the shortcut is high, the shape very irregular, and you can easily get caught in the line while carrying extra stages and scooters.

All WKPP and GUE exploration dives require the use of safety bottles staged throughout the dive to maximize team efficiency. For this traverse, the setup teams placed the safety bottles starting with the Bitter End, three bottles every 1400 feet/ 427 meters all the way out, with deco gas in the Black Abyss (900 feet/152 meters into the cave from the Cheryl side). For any problems past one third in, the Cheryl side was the planned exit due to the flow direction. The logistics were planned so that the team would have enough gas and scooter power in reserve to get them all the way out without ever touching back gas or backup scooters from anywhere in the dive.

The first stage bottle was mixed for a 130 foot/40 meter depth, the next for 200 feet/60 meters. Jablonski, Irvine, and Cole carried two other stages with bottom gas (11% oxygen, 55% helium) for the trip from the drop-off to the Second Black Abyss (on the Cheryl side). Each of the divers on the exploration team took two long bodied Gavin scooters. By towing a spare scooter, the team could exit from either end with that at any point. This traverse would not have been possible without the support and dedication of all team members.

Deeper sites that require extended decompression many items are located in areas of strong currents, such as the Gulf Stream off the southeastern coast of the United States. Strong currents can turn an otherwise easy dive into a grueling experience, greatly increasing the diverís gas consumption rates.

Other risks associated with an increase in currents include the possibility of being ripped from the dive site and separated from the dive team. Entanglement in lines, nets, and fishing monofilament can become increasingly difficult to untangle when strong currents are thrown into the mix. Extremely strong currents have been known to pin a diver to wreckage, causing injury and damage to equipment. A worst case scenario of being caught in strong currents could include being totally separated from the dive team and boat and ultimately being lost at sea.

Many manufacturers produce equipment with current diving in mind, like hand held EPIRBs, marine radios, reels, dye markers, signaling mirrors, flare guns, drift lift bags, and even a personal life raft that can be tucked tightly away between the diver and harness plate.

With all of this added danger, divers have come up with some basic equipment and techniques to help alleviate the stress strong currents can provide. The following article covers many of the basic methods and added equipment needed for drift decompression diving.

Added Equipment Used for Drift Decompression Diving

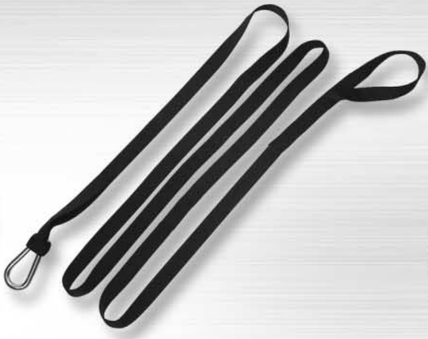
Small to medium reel used for wreck penetration and deploying drift decompression bag.

Jon Line used in rough seas to help lessen wave action.

EPERB: Last resort rescue satellite positioning unit.

Whistle used to attract attention of boaters or rescuers outside the range of voice.

Photos: Thaddius Bedford & OMS™

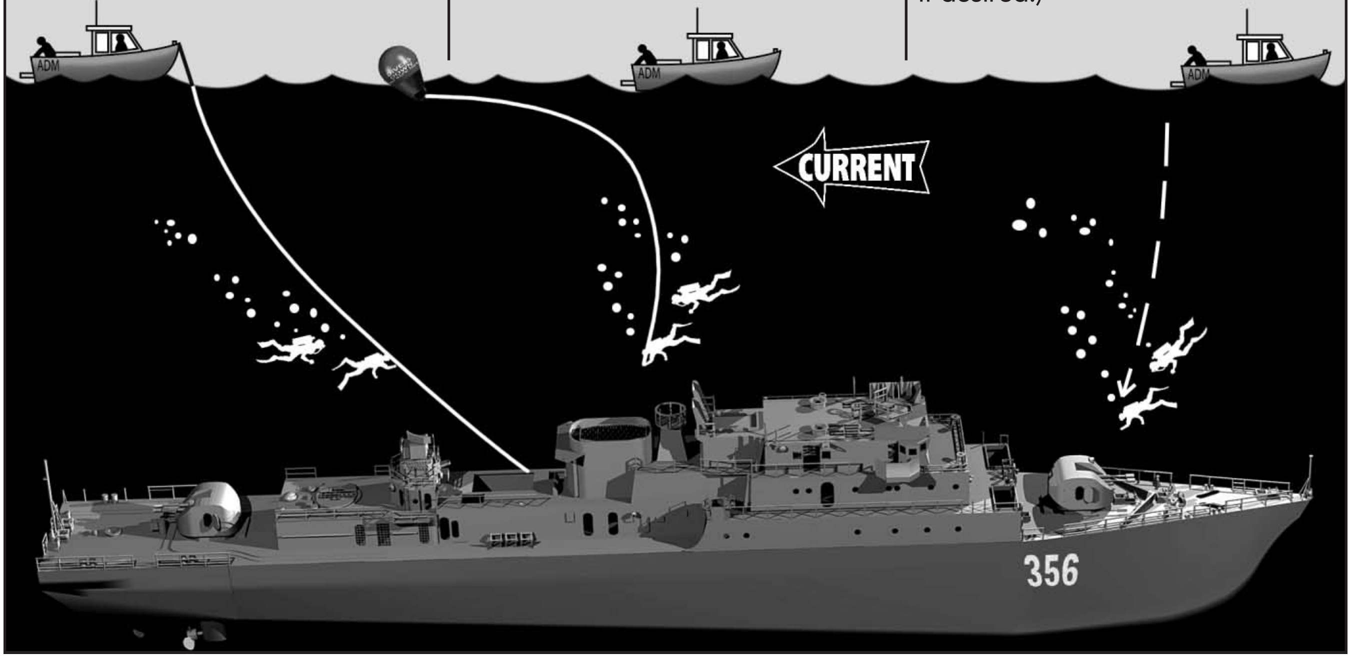


The Descent • 3 Scenarios

Standard Descent
Boat anchors into the wreck.
Current: Slow enough to allow the divers to pull themselves down the anchor line.

Buoy Line Descent
Boat drops divers up current.
Divers descend quickly to wreck with line. Once reaching the wreck the divers clip the line in securely.

Free Descent
Boat drops divers up current.
Divers descend quickly to wreck with no lines in hand.
(A pre-dropped hook can be used if desired.)



The Ascent • 3 Scenarios

Standard Drift Ascent
Anchor is pulled from the wreck and brought partially up the line and clipped in. Divers finish decompression on anchor line.

Buoy Line Ascent
Hook is pulled from wreck and brought partially up the line and clipped in. Divers finish decompression on buoy line.

Free Ascent
Divers ascend to just below their deepest decompression stop, deploy lift bags and complete required stops.

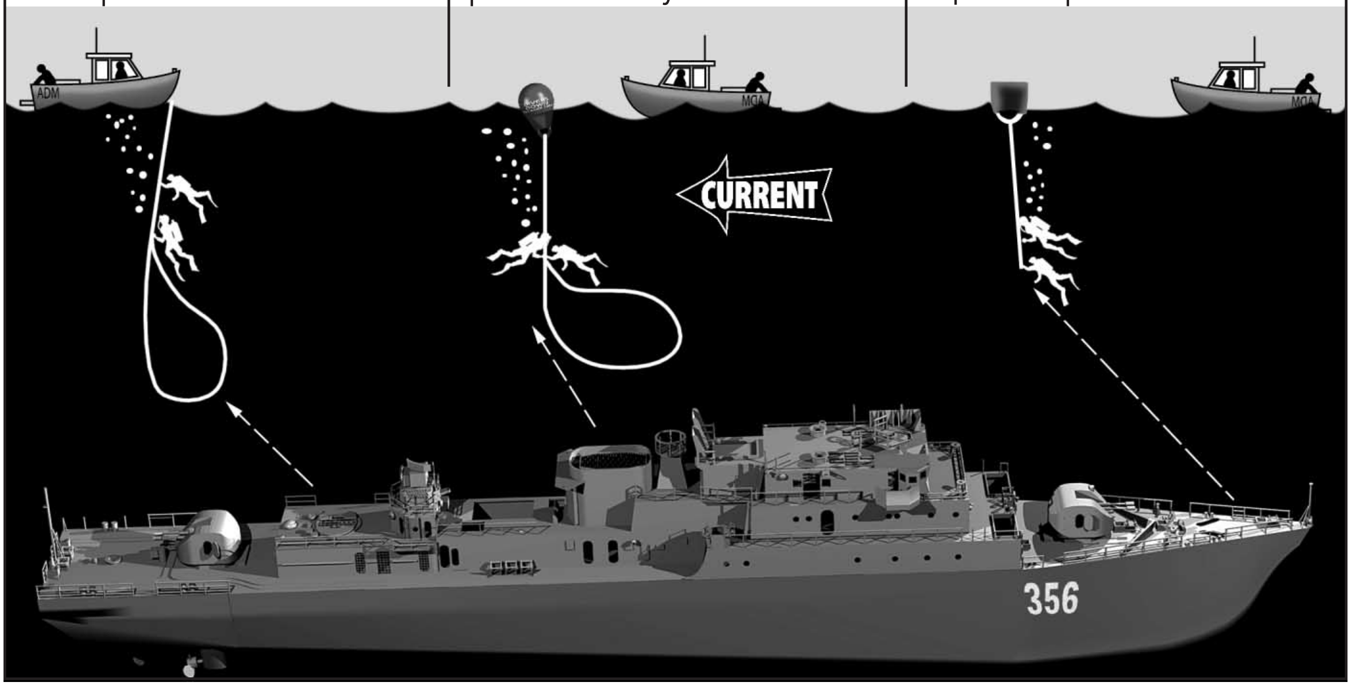
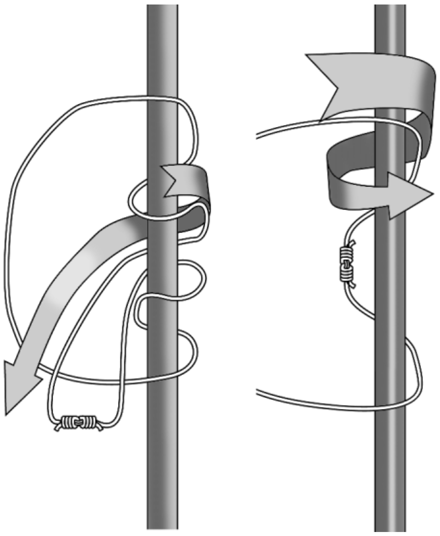
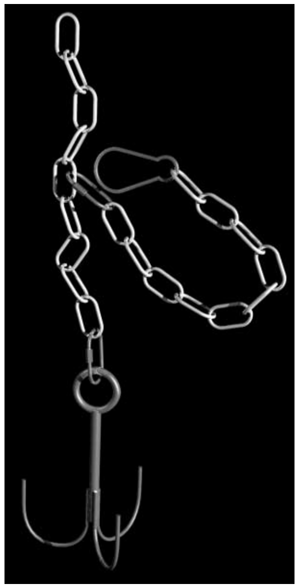


Illustration: C. Bowen

Most wrecks are littered with thousands of feet of fishing line, netting, electrical wiring, cables and ropes that always seem to snag a visiting diver. Above are several types of cutting tools that can be used to free yourself of such snags.

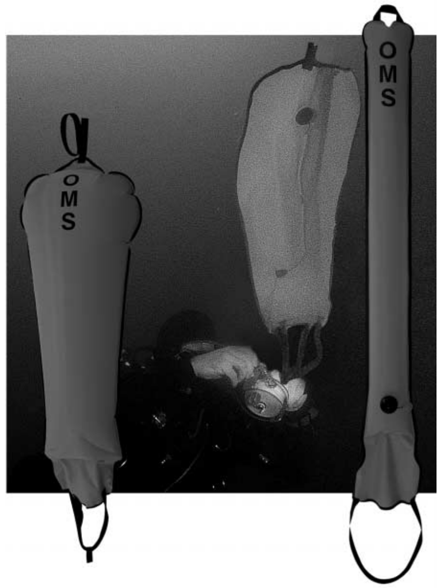


Prusik Line: Normally used by dry cavers, a Prusik line is nothing more than a strong line with its ends tied together forming a large circle. It is easily tied and untied in seconds but grips tightly when pressure is added. It also has many applications underwater such as a quick loop around some wreckage to hold extra equipment or extra stage tanks. It can also be used as a cheap but effective jon line. The illustration above shows how a prusik line is looped twice around the up line and pulled through its self to form a strong bite on the line.



Above Left: Float buoy with pre-measured knotted line. Knots allow divers to easily clip stage cylinders randomly on the line. A 20-25 pound weight should be used on the bottom of the buoy line to prevent divers or empty cylinders from pulling the line upwards if either become buoyant.

Above Right: Grappling hook with added chain and clip. Even in slow to moderate currents one of the main problems that can occur once an upline becomes taunt with the added weight and increased drag of several hanging divers is the inability of the last diver to pull the hook free from the wreckage. A simple solution is to add an extra chain and clip to the grappling hook. After descending the “hook Diver” wraps the extra chain and clip around a piece of strong wreckage and clips it into the grappling chain. The hook is then pulled free from the wreckage and the stress is placed on the extra chain and clip. This clip will then be considerably easier to release at the end of the dive when the added weight and drag is at its maximum.



Lift Bag and Reel: No wreck dive should be completed without these two pieces of equipment. The reel can be used as a guide to and from the anchor if visibility is extremely poor or as a exit line when penetrating below decks. Most importantly it can be used along with the lift bag for an ascent line to the surface. Completing long decompression times at multiple depths in open blue water with no reference points can be almost impossible. Even in slow currents a diver can drift several miles from the wreck site before completing his/her required decompression. The lift bag acts as a signaling device to the boat of the location of divers underwater. Without this reference for the boat to follow the diver could become separated from the support vessel and perhaps even lost at sea. The line and liftbag also act as a reference point for the decompressing diver. Once the bag is deployed the diver ascends to the first decompression stop, locks off his reel, twists the line around the clip several times to prevent accidental unspooling if the lock accidently loosens. Dumps a small amount of air from his BCD becoming slightly negative and sits back to enjoy his decompression time.

NEST

Continued from Page 8

After lunch we began our journey down a Crawl way that took us to the beginning of Glory Road. This passage is a high level area that has in all likelihood not flooded since the last ice age. It is covered with an amazing collection of intricate formations and crystals. To preserve the pristine nature of this passage we have laid a trail of small, ceramic tiles. The flat floored trunk passage is intersected by a series of deep, wide pits that can be bypassed on ledges and climb-ups into upper areas. After another few thousand feet we reached our primary objective: Gravity Pit.

This is the first spot in the cave where no natural bypass exists for the pit level. The traverse for the pit is on the left side with a large ledge complex on the right that does not quite reach the other side. After taking some photos, we made our way to the Formation room. This room is almost perfectly pristine with a variety of objects from squat white stalagmites the size of a car to intricate flowstone that covers the floor for over 150 by 50 feet, resembling a glacier. After shooting a roll of film, we moved to an upper level walking passage that cuts back the way we came. We then retraced our steps taking photos as we went.

We plan on continuing the survey of a new section that lies beyond where we turned this trip on our next effort and once this is complete to begin the next bolt climb across the last pit that stopped us. Hopefully Locust has many more virgin passages to show us. As our work at Locust and other systems continue, we must thank our sponsors and the many cavers who have participated in our efforts. Without their continued support, none of this valuable scientific work could have been accomplished.

For continuous up-dates of NEST exploration survey expeditions visit Advanced Diver Magazine Online.

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Continued from Page 11

the project as the note was brought to the surface. Team two's dive plan was altered to allow them to focus on scouring the walls for additional leads and off they went. As George and Brent exited the water, we realized that we had misinterpreted their note. The cave was not walled out, and "restriction" was a relative term that meant you could only go four abreast not eight! As team three began their dive with renewed enthusiasm, they met team two who confirmed, having pushed through the "restriction", that the cave did indeed go. Roughly one hour later, team 3 would return with another empty reel and the days' final tally would indicate that Cenote X'lacah was now the longest cave in the state of Yucatan with just over 3900 feet of surveyed passage in its single conduit at an average depth of 175 feet.

Subsequent dives in the following days were conducted primarily to allow the collection of samples from the different parts of the cave including several areas of halocline. Attempts were made to access the downstream regions of the cenote but even with side mount techniques success was limited. An additional attempt was made to extend the cave and resulted in an additional 350 feet of line being added to bring the total to 4250 feet. At this point the cave seems to be breaking down and becoming more fragile. During our brief stay in Merida, we had the chance to dive a couple of other smaller dive sites and to check out some sinkholes that had never been dove on. It was more than enough to whet out appetite and confirm that we are anxious to return to this beautiful part of Mexico.

Lake Invaders

Continued from Page 23

out reproduction. Within a few days of reproduction, eggs hatch into microscopic larvae called veligers. Two to three weeks after hatching, the veligers crawl about by means of a foot, searching for a suitable hard surface to adhere to. Once a suitable substrate is found, they attach themselves with a byssal thread. Located on the outside of the foot, the byssal threads have an incredible adhesion property. Within a year the juveniles will become mature adults capable of reproduction. Populations can become enormous if unchecked by natural predators- one female can produce up to one million eggs per year. The zebra mussel can grow up to two inches in length, and each has a life span of four years. They create colonies by forming dense layers that can contain over one million individuals per square meter. The mussels feed by filtering phytoplankton, bacteria, and detritus from the water. Each adult zebra mussel can filter up to one liter of water per day, giving them a beneficial role in diving the Great Lakes by assisting in increased visibility. In their native waters where predators exist in the natural food webs to check their populations, the Zebra mussel is relatively harmless. Nevertheless, when transported to other waters zebra mussels can cause major problems for native organisims. There is concern that extensive colonization in shoal areas of the Great Lakes may be causing problems for the reproduction of certain fish, including lake trout and walleye as they compete for habitat. And although fish are able to swim to find other spawning areas, some species of freshwater sponges have a more limited habitat range. The sponges, like the zebra mussel, are sessile filter feeders, relying on hard surfaces to adhere to, eat, reproduce, and colonize and many of these native species are being run out by these non-native mollusks.

Scientists, researchers, and environmental groups are attempting to control zebra mussel infestation by using chemical repellants, finding predators of the zebra mussel, and teaching prevention techniques. An interesting new procedure shows that zebra mussels are not planning to move south of the border! It is rumored that the mussels do not like spicy food. Scientists at the New Mexico Institute of Mining and Technology have developed a way to molecularly bond chili peppers into paint, stains, and other rubberized materials for application onto problematic areas (including intake pipes for water treatment plants) where zebra mussels colonize. The repellant is being maketed by MEDD4, a New Mexico-based company, for use in corporate and domestic settings. The US Fish and Wildlife Services estimates that this research could save up to five billion dollars for United States corporations and consumers over the next ten years. The Aquatic Research Institute (ARI), a nonprofit organization located on Lake Michigan tested the repellant and found that it deters zebra mussel attachment without disrupting other aquatic species and potential predators. Along with teaching the community about successful prevention techniques, ARI divers are studying the impact of zebra mussels on Great Lakes shipwrecks.

If the lakes cannot keep our shipwrecks preserved then it is up to us to facillitate efforts at preservation. These pieces of maritime history need to be collected and donated to local museums for all to appreciate. With the help of groups such as The Underwater Archeological Society of Chicago, Great Lakes Shipwreck Society, Preserve Our Wrecks of Kingston, Canada, and others we can all make a larger effort at preserving our historical shipwrecks.

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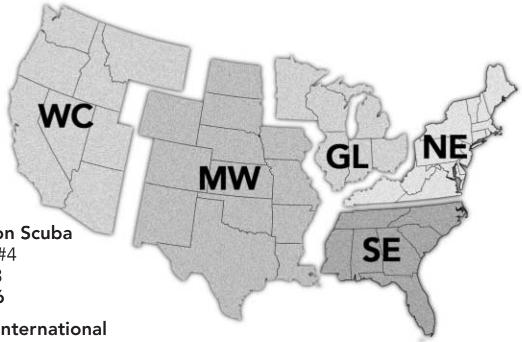

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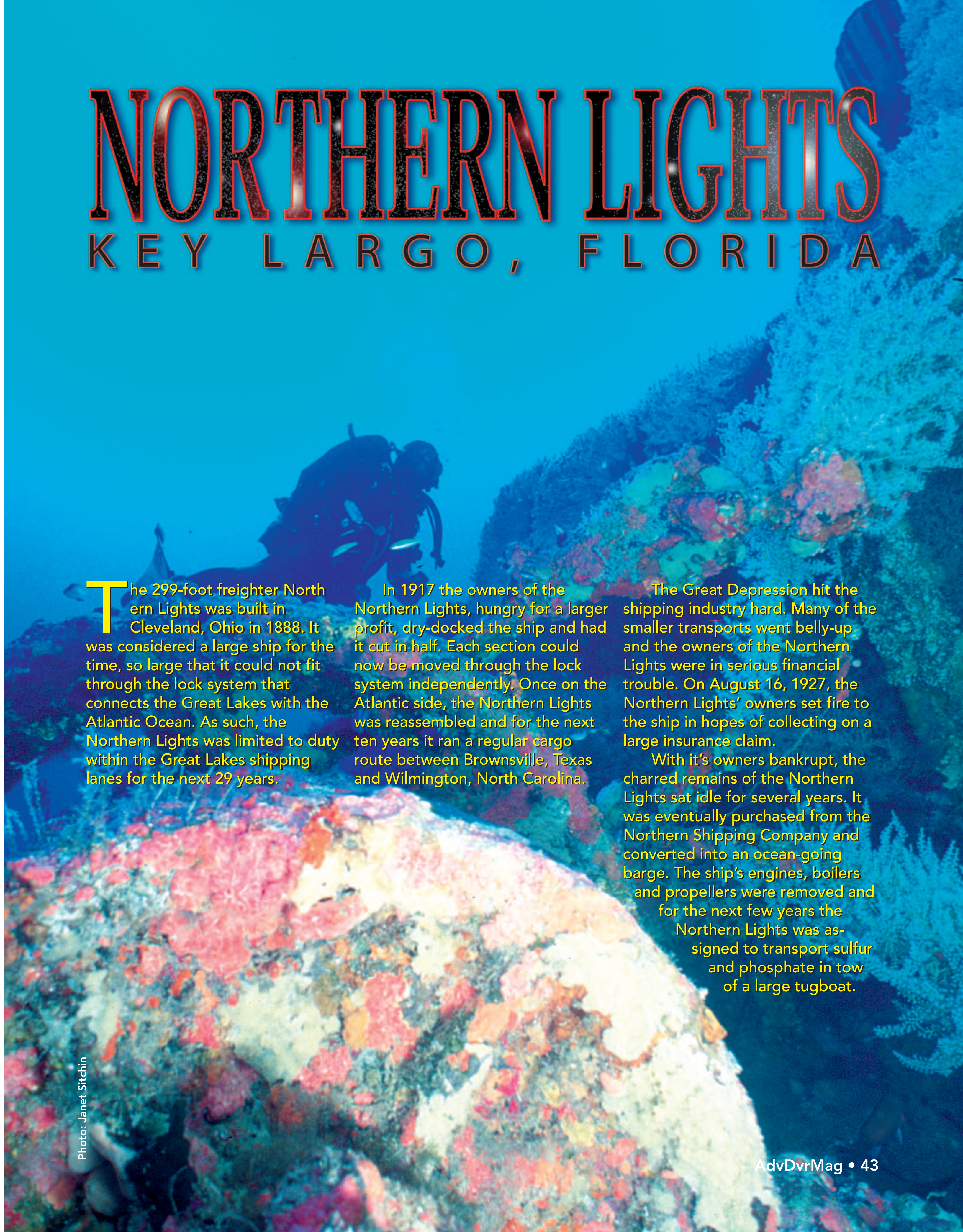


Photo: Janet Sitchin

The 299-foot freighter Northern Lights was built in Cleveland, Ohio in 1888. It was considered a large ship for the time, so large that it could not fit through the lock system that connects the Great Lakes with the Atlantic Ocean. As such, the Northern Lights was limited to duty within the Great Lakes shipping lanes for the next 29 years.

In 1917 the owners of the Northern Lights, hungry for a larger profit, dry-docked the ship and had it cut in half. Each section could now be moved through the lock system independently. Once on the Atlantic side, the Northern Lights was reassembled and for the next ten years it ran a regular cargo route between Brownsville, Texas and Wilmington, North Carolina.

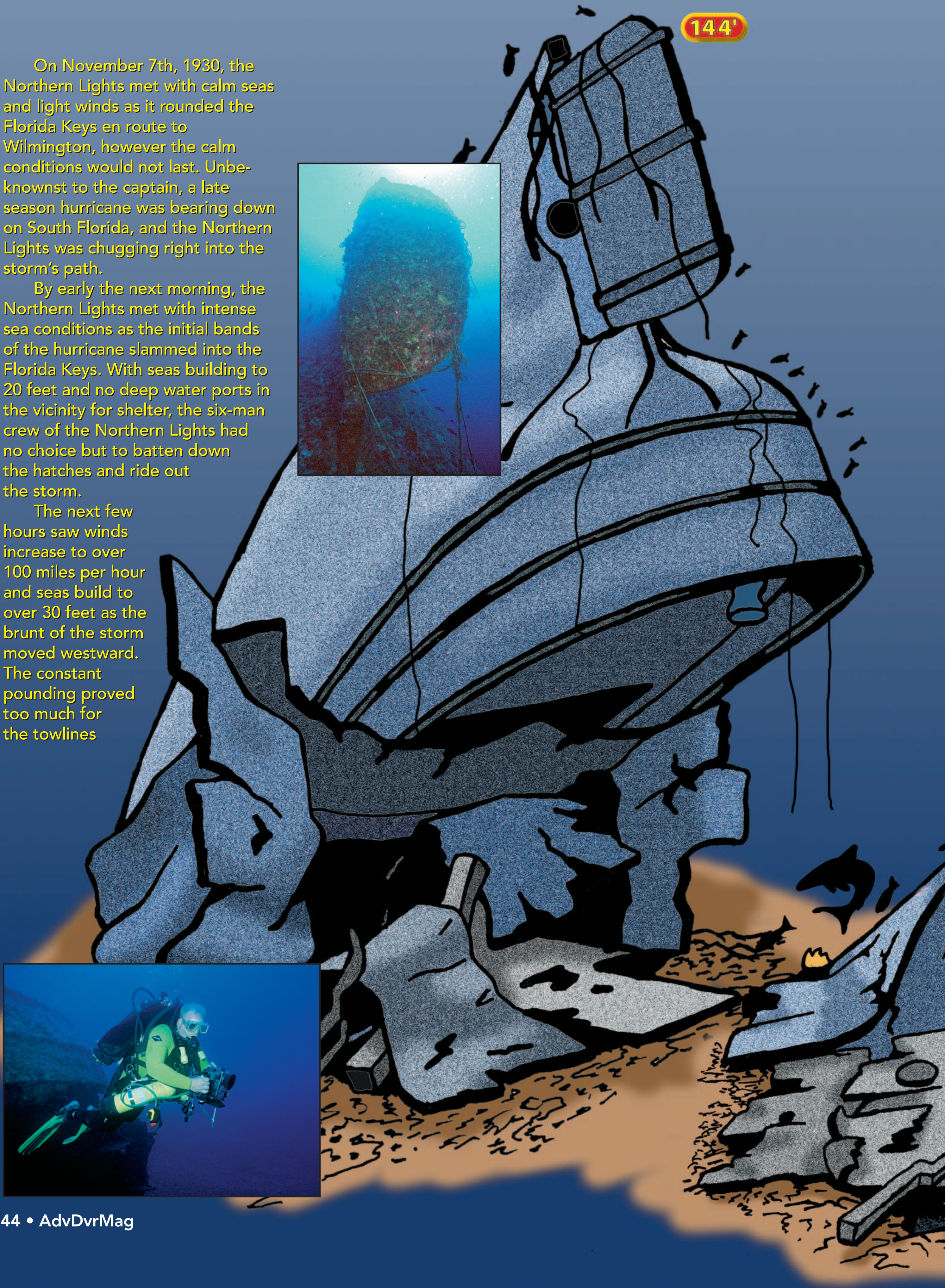
The Great Depression hit the shipping industry hard. Many of the smaller transports went belly-up and the owners of the Northern Lights were in serious financial trouble. On August 16, 1927, the Northern Lights' owners set fire to the ship in hopes of collecting on a large insurance claim.

With it's owners bankrupt, the charred remains of the Northern Lights sat idle for several years. It was eventually purchased from the Northern Shipping Company and converted into an ocean-going barge. The ship's engines, boilers and propellers were removed and for the next few years the Northern Lights was assigned to transport sulfur and phosphate in tow of a large tugboat.

On November 7th, 1930, the Northern Lights met with calm seas and light winds as it rounded the Florida Keys en route to Wilmington, however the calm conditions would not last. Unbeknownst to the captain, a late season hurricane was bearing down on South Florida, and the Northern Lights was chugging right into the storm's path.

By early the next morning, the Northern Lights met with intense sea conditions as the initial bands of the hurricane slammed into the Florida Keys. With seas building to 20 feet and no deep water ports in the vicinity for shelter, the six-man crew of the Northern Lights had no choice but to batten down the hatches and ride out the storm.

The next few hours saw winds increase to over 100 miles per hour and seas build to over 30 feet as the brunt of the storm moved westward. The constant pounding proved too much for the towlines



that connected the Northern Lights to the tug. One by one they snapped, leaving the Northern Lights at the mercy of the vicious seas. The captain of the tugboat, fearing for the lives of his own crew broke for deeper water. The crew of the Northern Lights now had to fend for themselves but with no engines to steer, the barge was helpless to fight the storm.

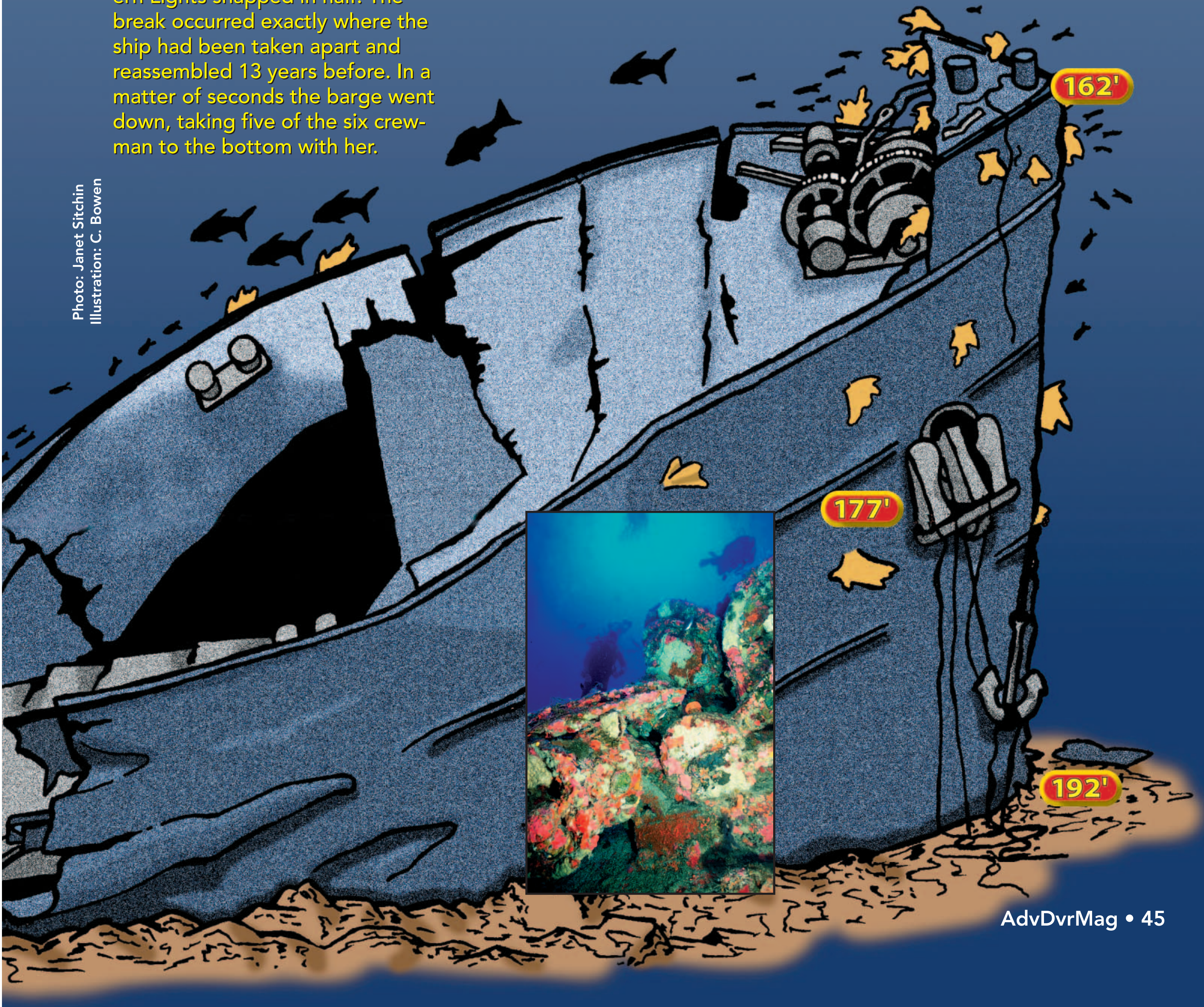
The unrelenting winds now had the Northern Lights on a direct course to smash into the shallow reefs off of Key Largo. The barge floundered in the high seas for a few hours before the strain became too great. Just three miles from the shore of Key Largo and one mile from the shallow reefs, the Northern Lights snapped in half. The break occurred exactly where the ship had been taken apart and reassembled 13 years before. In a matter of seconds the barge went down, taking five of the six crewman to the bottom with her.

Today the wreck of the Northern Lights sits in 194 feet of water just off the John Pennekamp State Park in Key Largo. The bow of the ship sits upright on the sea floor with the anchors still in their chucks and winches pulled tight. The stern of the ship flipped upside-down on it's way to the bottom and landed on top of the bow, smashing the crew quarters and old pilot house beneath the weight of the hull.

The wreckage is teeming with life. Thousands of tropical fish make their home in and around the hull while schools of barracuda hover above the wreck. Loggerhead turtles are often spotted at the site as are grey reef sharks between five and eight feet long.

Currents are a major consideration when diving the Northern Lights. Due to the close proximity to the Gulf Stream, the water flow can change drastically in less than an hour. Be prepared to perform drift decompression in two to three knot currents and three to five foot seas.

At a depth of 194 feet to the sand, a nice, light trimix is optimal for this dive with a nitrox decompression gas of 50% and 100% oxygen for the 20 and 10 foot stops. Tavernier Dive Center offers specialized dive trips to the Northern Lights. Their experience on the site and conditions are invaluable to anyone planning a dive trip here. See page 17 for information on Tavernier Dive Center.



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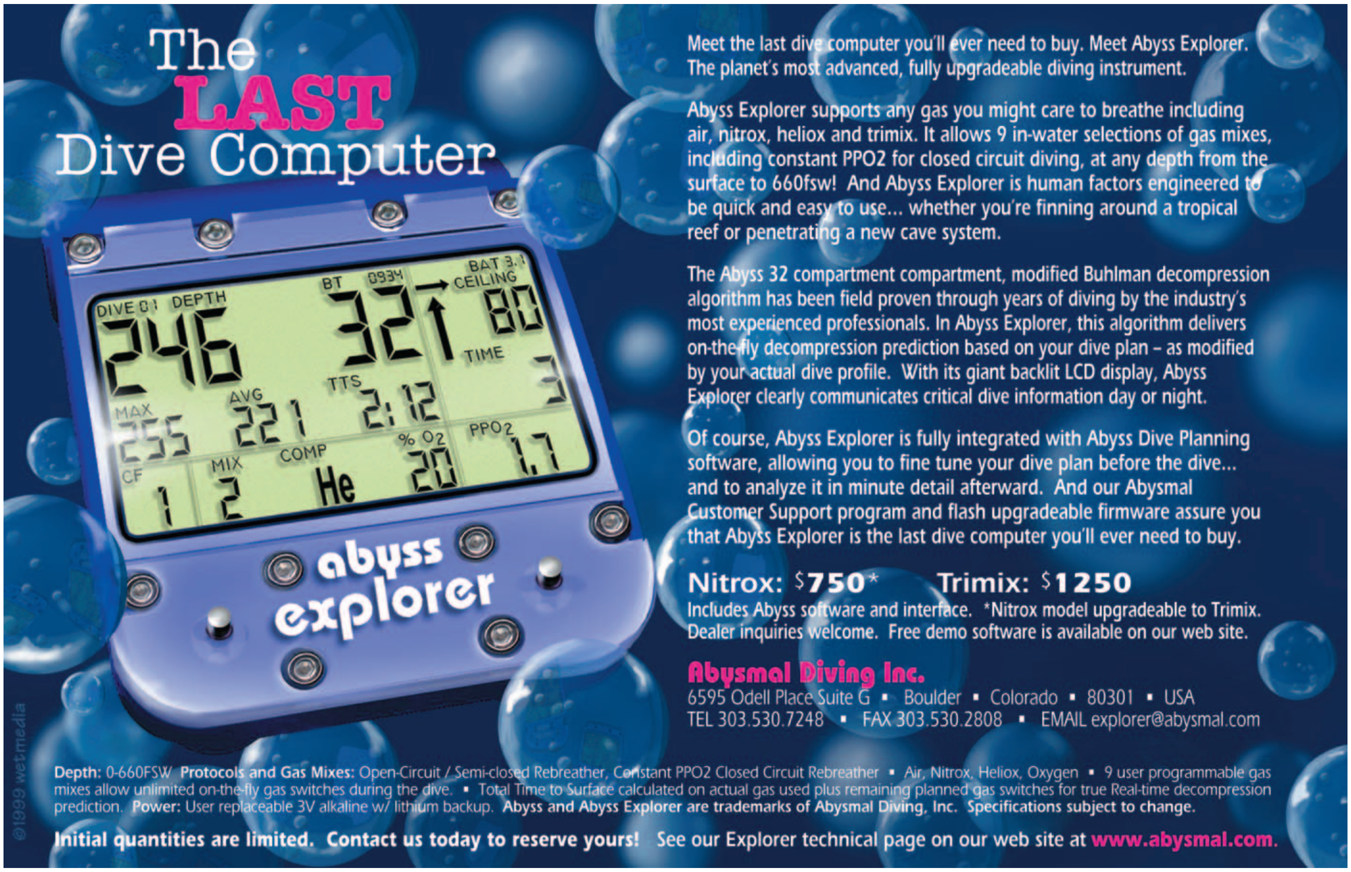
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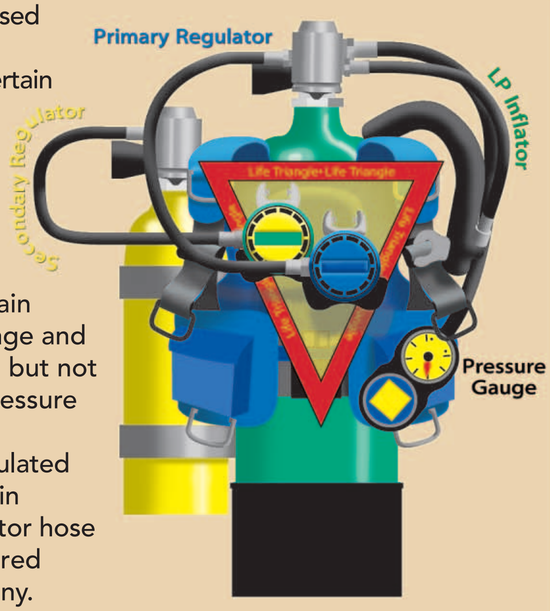
EQUIPMENT CONFIGURATION

Single with Pony

Equipment configuration is one of, if not the most important thing in diving. Poor configuration can cause confusion when trying to find personal items, frustration when items are not easily accessible, increased risk of entanglement, unpreparedness for emergency situations, increased drag causing heavier work loads and just all around discomfort.

Provided are basic examples for proper gear configuration. Certain modifications will be required according to your equipment brand names and the environment your using the gear in.

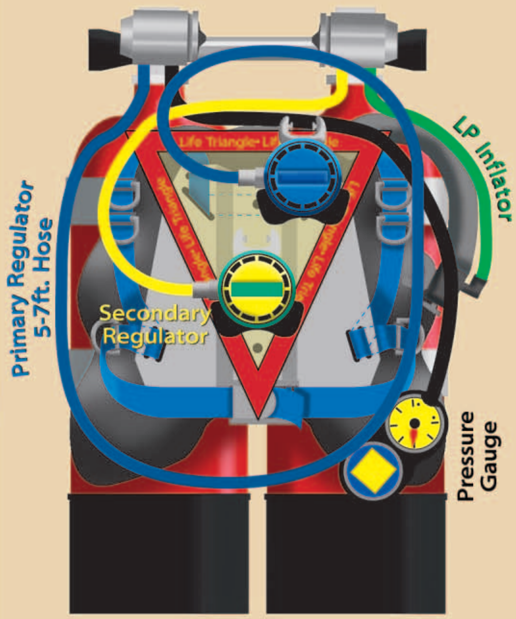


Single with Bailout:

Used for dives between 60 and 130 feet, provides an excellent fully redundant gas supply for emergency situations. The pony (13 to 30 cubic foot) is attached to the side of the main cylinder (72 to 125 cubic feet) and contains it's own second stage and regulator. A pressure gauge with a small HP hose is suggested but not absolutely required. If no pressure gauge is used, check the pressure in the pony cylinder prior to every dive!

The pony cylinder should never be used or its contents calculated in for a dive. Its sole purpose is for emergency use only. The main cylinder should contain the primary regulator, low pressure inflator hose and a pressure gauge or computer console. No octopus is required because of the totally redundant gas supply provided by the pony.

Standard Doubles



Used for deeper dives or in overhead environment situations, such as caves, under ice and inside wrecks. Matched cylinders are banded together with a connecting manifold. The manifold should contain a post for two separate first stage regulators and allow the shutting down of either first stage without interrupting the gas volume supply. Some manifolds contain an isolation valve which allows the doubles to be separated from each other. This valve is intended to be used in an emergency burst disk or cylinder O-ring failure. Not as a way to separate two different mixture of breathing gas!

Two first stage regulators are required, one for the divers right post and one for the divers left post. The right shoulder post normally carries the primary regulator attached to a 5-7 foot long hose and a pressure gauge or console (optional dry suit inflator). The left shoulder post carries the backup first and second stage and the low pressure inflator hose for the BCD.

All second stage regulators should be contained within the life triangle at all times. All hoses should be tucked in tightly along the body streamlining the equipment to help prevent entanglement. If an out of gas emergency should occur, the long hose is then passed to the diver without gas and the backup second stage is retrieved. The divers then immediately begin a controlled ascent or exit from the wreck or cave.

Illustration: C. Bowen