# ADVANCED DIVER MAGAZINE

ISSUE 14 / 2003


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## Wolf-Eels & Arctic Whales

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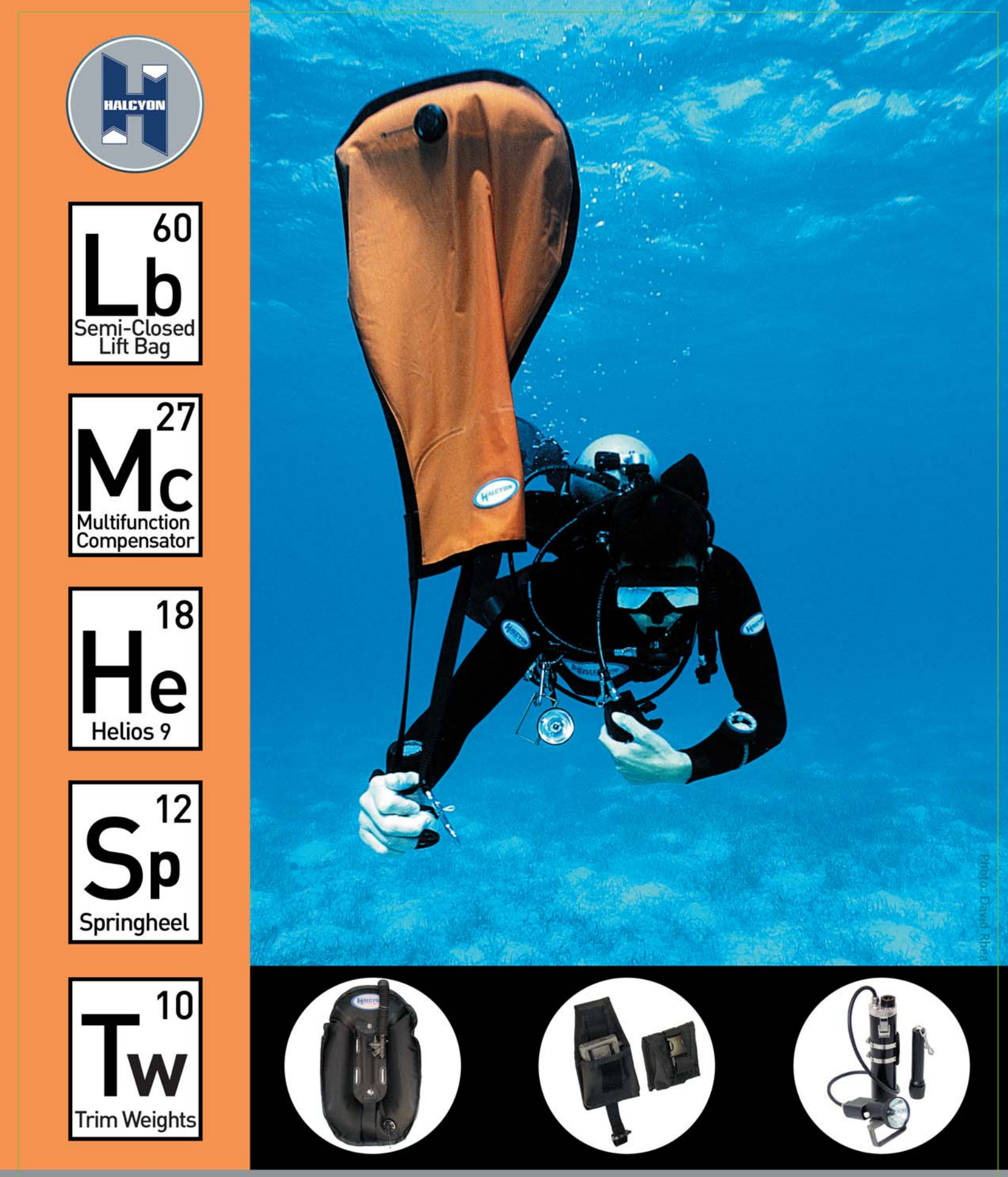
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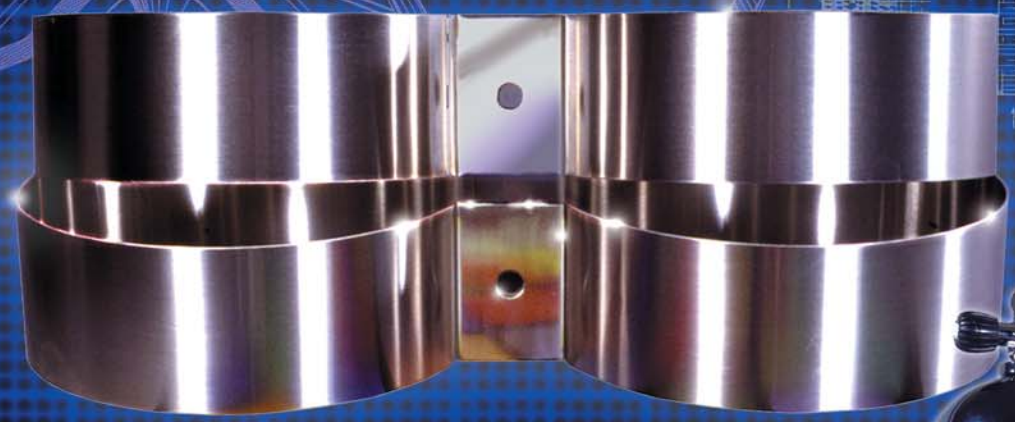

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# Publishers Notes

Photo by: Rusty Farst

What's my goal for 2003? To reach the rest of the world with Advanced Diver Magazine. I know it's a small goal, but I need to start somewhere.

My attack plan: incorporate Advanced Diver Magazine and all its past articles, photos, connections and information into a massive on-line magazine. Don't worry, we are still going to print hard copies of ADM with the same high quality our readers' expect. I don't think an on-line magazine will ever be as good as a hard copy in your hand, but an on-line magazine does have many benefits.

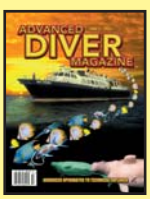
The main benefit is for all our foreign readers who, with the ever-increasing cost of postage, cannot afford an extra $35.00 just to receive a magazine in the mail four times a year. These readers will now be able to download ADM issues either by article or in their entirety. This alone should vastly increase the number of Advanced Diver Magazine readers around the globe.

For those who do not have high speed internet access, I have designed, ADM on CD. This is a single CD with all ADM back issues in a pdf format along with lots of extras, such as photos, forms, mixing charts, advertisements and more. (See ADM on CD ad on page ##.) This CD is light and easy to mail anywhere in the world at a reasonable cost.

Finally, I am building a worldwide army of divers who love to dive, gather material, take photos and videos and write articles. ADM's staff is always increasing, and I am constantly looking for new, energetic divers who wish to get out there, get wet and get involved.

As part of our new on-line focus, ADM wishes to welcome our new on-line business partner, Jakub Rehacek, who is a true master with html and web design. This new web site is scheduled to be launched on May 1, 2003. Initially there will be over a thousand pages on the site, including an on-line forum, a book and video store, discount dive charters, resort coupons, a photo gallery, a stock photo site, discounts on ADM back issues, subscription specials and dive travel, mixing tables and more. Check it out at **www.AdvancedDiverMagazine.com**

*Curt Bowen* Publisher Advanced Diver Magazine




Cover: The 90 foot live—aboard vessel, Sea Fever is engulfed by the sun's yellow and red light rays at the end of another perfect dive day off the island of Andros, Bahamas.
An array of tropical fish and Arctic Beluga whales are digitally painted onto the canvas.
Photo: Curt Bowen

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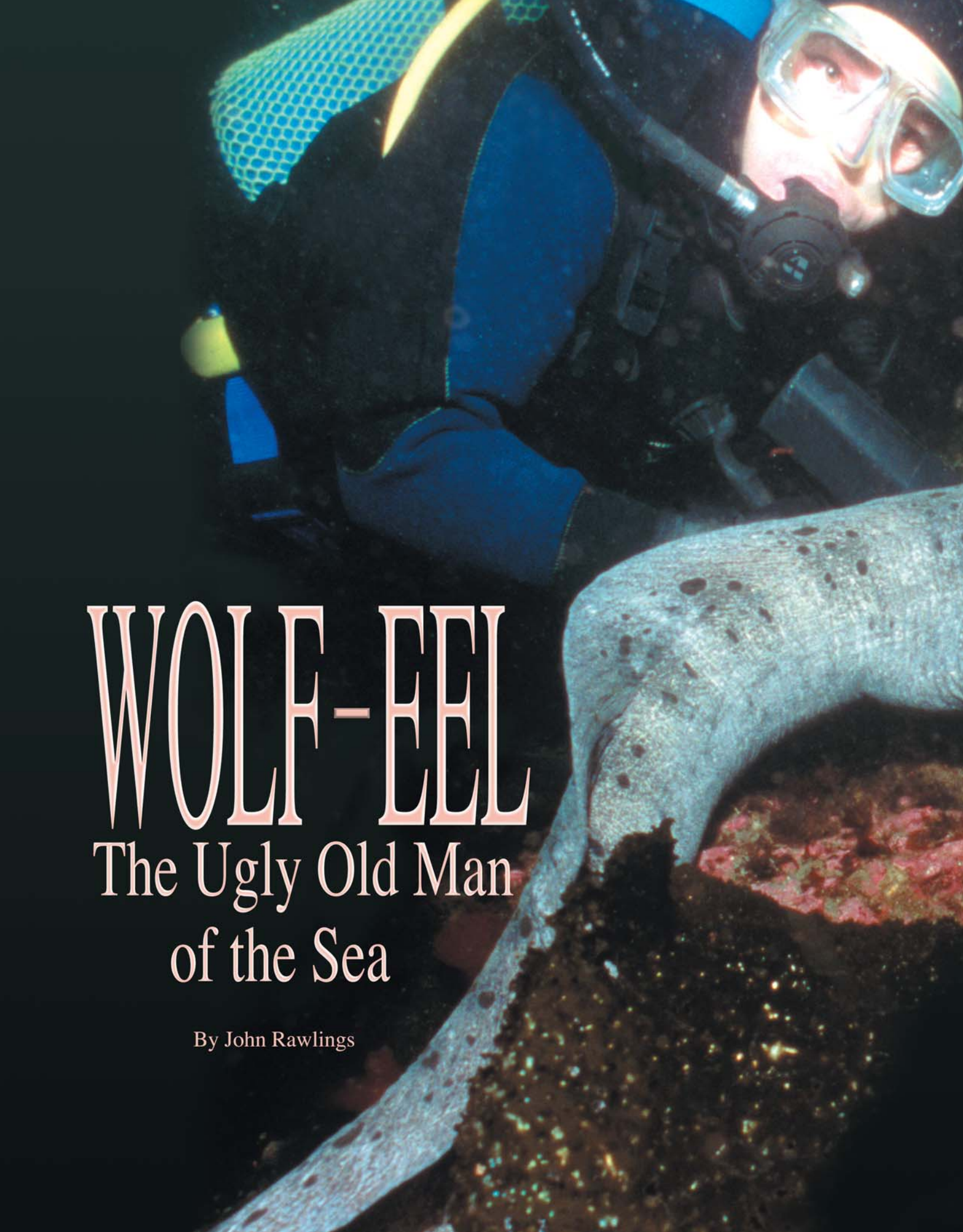


# WOLF-EEL

## The Ugly Old Man of the Sea

By John Rawlings

Above: A gaping wound in its forehead providing probable evidence of a lost mating battle, a large male wolf-eel glides past Marine Biologist Tony Parra near South Puget Sound's Sunrise Wall.

**A face only a mother could love.**

Last year I attended a local showing of the Hollywood blockbuster, "Lord of the Rings." Frequently, the heroes of the film were attacked by masses of hideous, howling and slathering "Orcs." I was absolutely struck by how much the Orcs resembled one of my favorite underwater creatures here on the west coast, the wolf-eel. After much reflection, I'm convinced that the make-up artists for the film MUST have taken their inspiration from the divinely ugly mugs of big male "Wolfies."

Get any group of divers together in the Pacific Northwest and ask them to reach a consensus on what the requirements are for a really GREAT dive, and invariably one of the things they will ultimately agree on is that a wolf-eel will somehow be involved. There's something about the supremely ugly face of an adult wolf-eel staring at you from its den that will turn an ordinary dive into a great one - poor visibility, terrible weather, rotten currents - all will be forgotten and forgiven once a Wolfie makes a public appearance. Divers travel from all over the world to glimpse these fascinating creatures and they go through all manner of underwater gyrations to get the perfect photo that proves that they, too, were able to "Dance with Wolfies."

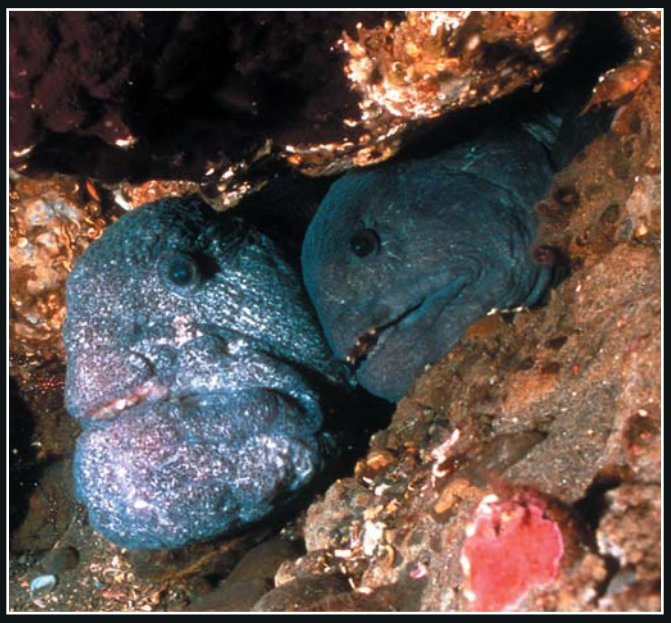
**An eel by any other name.**

Actually a wolf fish, not an eel, the wolf-eel can be found as far south as San Diego in southern California, then northward to the Aleutian Islands in Alaska. Its scientific name, *Anarrhichthys ocellatus*, comes from both Greek and Latin. *Anarrhichthys* comes from the Greek word *Anarhichas*, which is a Greek fish that the wolf-eel resembles. The second half of the name, *ocellatus*, is Latin for "eye-like spots," which is a pretty apt description of the wolf-eel's skin. The popular name, "wolf-eel," comes from the large frontal canine-like teeth that these fish use in seizing their prey, mainly hard-shelled crustaceans and invertebrates. Capable of growing to approximately eight feet in length, these massive fish are speculated to live up to 10 years, although documentation of their longevity is currently lacking in available research.

Throughout history, wolf-eels have been held in deep respect by the peoples of the northern Pacific. In many of the native tribes in the area, the tasty wolf-eel was reserved as a ritual food to be consumed only by a tribal shaman, never by "ordinary" men and women. In the state of Washington, the wolf-eel is now a protected species in both Puget Sound and Hood Canal. This is not because they are endangered, but simply because their value as a living resource to divers and photographers far exceeds whatever commercial value the species could possibly provide as a source of food. Some dive sites, such as Sunrise Wall near Tacoma, are well known as locations where wolf-eels interact with divers and can be hand fed as part of a unique photo opportunity. In both the American Pacific Northwest and in British Columbia, Canada, the prevailing attitude among divers regarding wolf-eels is that of both affection and protection.

**Life cycle of the rich and famous (and ugly!)**

Recent studies conducted by Tony Parra, Wayne Palsson, and Robert Pacunski, Marine Fish Biologists with the Washington Department of Fish and Wildlife, have revealed much new information regarding the life cycle of wolf-eels and also debunked a few myths. In the past it was regarded as a well-known fact that wolf-eels mated for life. This "fact" was the result of previous studies conducted in aquariums and on casual observations in the wild in which individual fish were not clearly identified with certainty. The new research has revealed that wolf-eels indeed do appear to be loyal mates, but apparently only on a fairly seasonal basis rather than for a lifetime. With some mated pairs, even this does not appear to be an ironclad rule, with the occasional female abandoning the loser of a fight between males to share a den with the victor. Adult wolf-eels mate between October and April, although research has revealed that



Old, scarred and gray, a massive male and his much smaller consort settle down in a typical wolf-eel den in anticipation of breeding.

most nests will appear from December to March within the greater Puget Sound area. It is speculated that spawning is timed in such a way that the eggs will hatch at approximately the same time as the major plankton blooms appear in the spring.

Approximately 24 hours prior to mating, the female's abdomen becomes noticeably distended. The male will butt his head against the back of her abdominal region, an action which appears to stimulate physiological activity in which a series of waves move through the body of the female from her head to her tail, being particularly pronounced in her abdominal area. The male will then wrap himself around the female in such a way that their heads will be side by side and their genital areas adjacent to each other. It is in this position that the female releases the eggs, usually between 5,000 and 10,000 in number, and the male fertilizes them as they appear. Following fertilization, the female will coil about the eggs, molding them into a ball-like cluster. The eggs are apparently adhesive to each other, but not to the rocky walls of the den. Both parents will then coil themselves about the egg mass, sometimes together and at other times individually, tending the eggs and taking care to ensure that they are rotated so that a good flow of water regularly passes through them. The primary role of the male during this time appears to be guarding the nest from any intruders that might appear. Males do make occasional forays out of the den itself, but at this point it is yet to be ascertained if they bring food back to the female.

Following an incubation of approximately 13 weeks (plus or minus, the variation is probably due to water temperature and/or other environmental conditions) the eggs will begin to hatch. In the Puget Sound area this will normally occur from February through the end of April. Larval wolf-eels are approximately one inch in length and are born hungry. From the moment of birth they are voracious predators and will strike at their planktonic prey much like a coiled snake will strike at a mouse. Constantly in search of prey, the larval wolf-eels will then lead a pelagic existence, free-swimming with the plankton for between as little as one month to as long as two years The length of time is presumably based on the availability of food and preferred habitat. They then will settle to the bottom, searching out nooks and crannies in which to dwell when not hunting.

The change from a pelagic to a bottom dwelling existence spawns physical changes in the juvenile wolf-eel. Juveniles will begin to change from a brownish, bright orange or orange-striped color pattern to the distinctive spotted pattern of an adult ("eye-like spots"). Males and most females will turn to a light blue/gray

WDFW Marine Biologist Tony Parra coaxes one of his study subjects out of its den with a tasty tidbit.

color, although often females will retain their brownish color into maturity. The males will also begin to develop a puffy face, enlarged jaws, huge bulbous lips and a powerful sagital crest at the top of their heads to support the increased muscle mass required as support for the jaws. With the exception of the frontal canine teeth, the teeth in the rear of the mouth become flattened molars designed to crush the hard-shelled crustaceans and mollusks that now will make up the majority of their diet. Favorite prey items will differ based on their immediate environment, with the most abundant food source often being the most preferred. For example, wolf-eels in Puget Sound appear to favor Sea Urchins, those in the waters of the northern Olympic Peninsula apparently prefer the Hairy Triton (a snail), while those off Monterey, California, apparently prefer Sand Dollars and Graceful Crab.

**Friends and foes.**

Life just isn't fair, especially not on a rocky reef when the ownership of a nice den site is in question. The giant Pacific octopus, *Enteroctopus dofleini*, is the wolf-eel's primary competitor and will often force a wolf-eel, or even a mated pair, out of a den and take it for its own. Basically, wolf-eels and octopuses occupy the same habitat, hunt the same prey and value the same type of den sites. The competition can be fierce! Once an octopus of even moderate size has made up its mind that it wants to occupy a particular den, there is not much that a wolf-eel can do to prevent the take-over because, as many a diver can attest, when an octopus has established itself in a den getting it to come out when it has no interest in doing so is a virtual impossibility.

Its brilliant orange color an indication of its young age, a juvenile wolf-eel peers from inside its temporary home in an old pipe in Northern Puget Sound.

Other species, however, seem to be able to share a den with wolf-eels as benevolent "roommates," or even as partners. Ling cod, for example, have been observed sharing the same crevice with wolf-eels, the egg masses of both within close proximity. It is unclear whether the relationship is competitive or cooperative, but both the ling cod and the wolf-eels have been seen apparently acting jointly to ward off unwanted intruders. Copper rockfish, brown rockfish, sailfin sculpin and several species of shrimp have also been observed sharing wolf-eel dens, apparently with no threat being perceived by either party.

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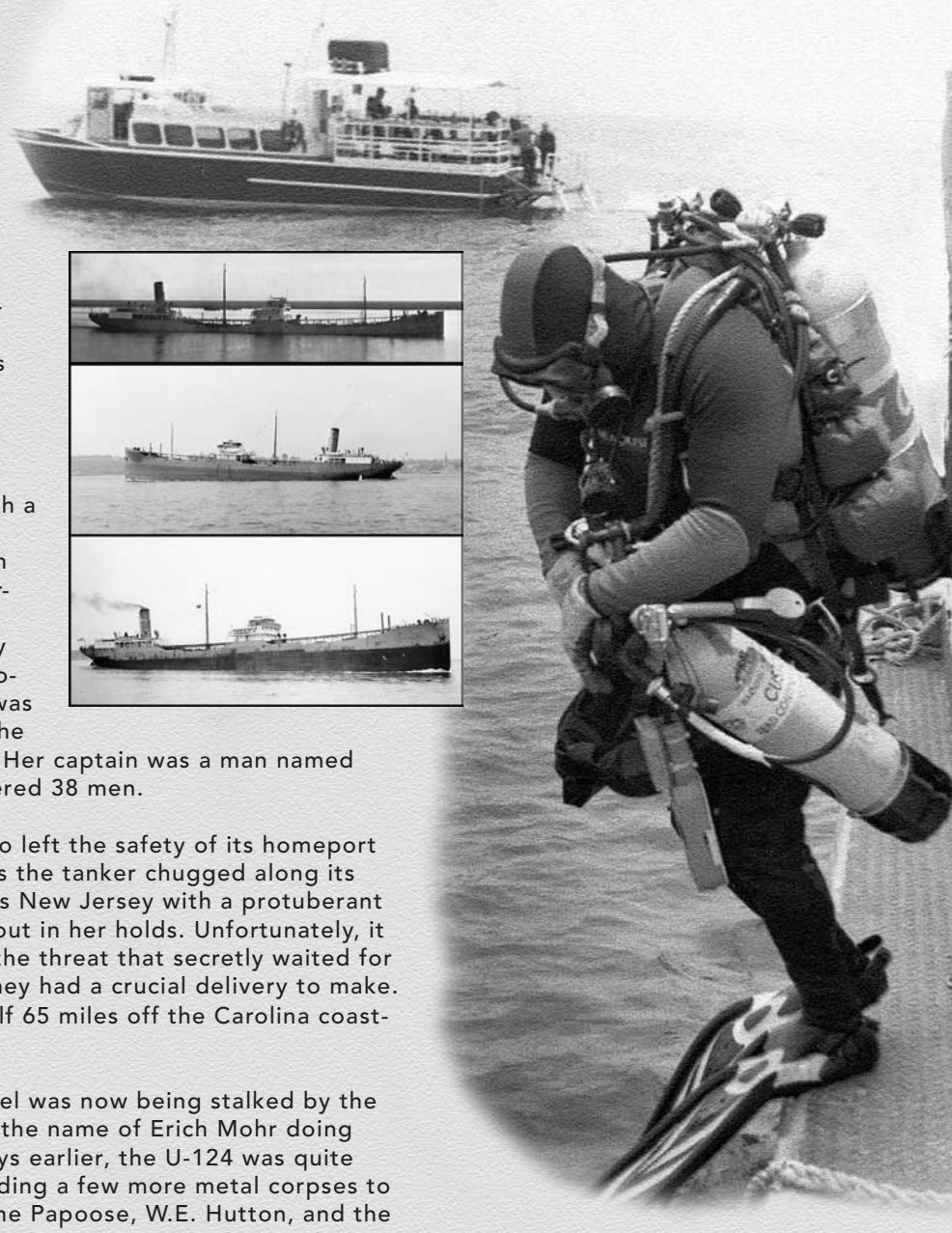
# North Carolina's Naeco Wreck



By Jeff Barris
Photography By Eric Henneffer and Ed Braun

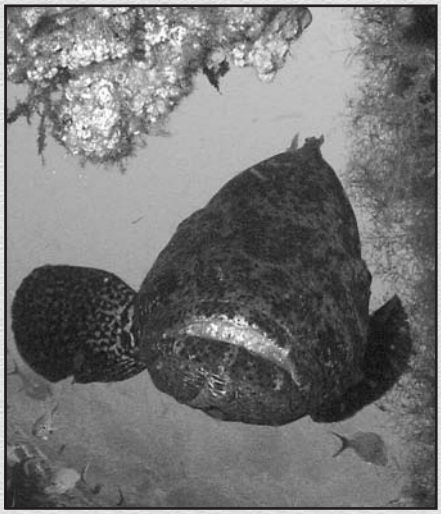


In the year of 1918 an agreement was drafted between the Pennsylvania Shipping Company and the Bethlehem Shipbuilding Corporation, located in Wilmington, Delaware, to construct a triple-decker tanker according to plan. Upon completion her hull was dubbed the Charles M. Everest. But in a short time she would adorn the newly acquired name of the Neaco, which oddly enough is the word "ocean" turned backwards. The Naeco measured a sleek 412 feet lengthwise with a gross tonnage of 5,372. Her power was summoned from a single, triple expansion piston engine that propelled her unwavering along at around 15 knots. Not unlike like similar ships of that time, her primary purpose was to convey fuel oils and petroleum products. Her usual delivery route was from the refinery rich docks of Texas to the mid-Atlantic region of the United States. Her captain was a man named Emil.H. Engelbreccht and his crew numbered 38 men.



Around mid-March of 1942, the Naeco left the safety of its homeport and plied east. It was business as usual as the tanker chugged along its watery path, turning north bound towards New Jersey with a protuberant load of fuel oil and kerosene sloshing about in her holds. Unfortunately, it was a time of war and all hands knew of the threat that secretly waited for them below the surface of the sea, but they had a crucial delivery to make. On March 24 the Neaco would find herself 65 miles off the Carolina coastline alone and without an escort.

Unbeknownst to the captain, his vessel was now being stalked by the U-124 with a devilish Korvettekapitan by the name of Erich Mohr doing most of the stalking. Only a few short days earlier, the U-124 was quite busy sinking several ships in the area, adding a few more metal corpses to the Atlantic's ship graveyard including: the Papoose, W.E. Hutton, and the E.M. Clark. With yet another easy target in his periscope sights, Mohr ordered the firing of a single torpedo, which quickly found its mark, easily penetrating the starboard side of the Naeco. Immediately following impact the steel ship convulsed then violently shuttered as the detonated torpedo fully released its volatile payload, thus scrambling the tanker's internal structure. In a half blink of an eye, her flammable cargo was set ablaze. Spewing like a volcanic eruption, flames and debris burst outward through the tanker's skin, rocketing skyward as the fire eagerly began to swallow up the now dying vessel. The raging inferno swiftly spread, reaching aft and engulfing the entire bridge area -- instantly cremating Captain Engelbrecht.



In all of the terrible confusion, only half of the remaining crew was able to deploy the remaining seaworthy lifeboats and drift away from their mortally wounded ship. A few short hours later, the U.S. Coast Guard vessel Dione rescued 10 of Naeco's survivors. The USS Umpua then saved four additional members of the crew, as the USS Osprey scooped up a final survivor, who clung for dear life on the last life raft. An hour later the Naeco lost its grip with the surface, broke apart and then sank in 140 fsw, 37 miles south of Cape Lookout, North Carolina. Today her bow lies about two miles from her much larger stern section.

**Exploring the Naeco Stern**

This fabulous wreck diving adventure begins with beautiful azure blue water and comfortably warm seas that welcome visiting divers to descend back 60 years in history when things really went bump in the night. One hundred feet of clear visibility and a sleek escort of amberjacks guide divers to her taciturn remains. At 60 feet the wreck starts coming into view. At 110 feet one can touch down on its decking, finding the wreck's highest relief and a convenient place to stash stage bottles. From this point it's easy to see a majority of the wrecks initial layout, lying upright and in somewhat of a contiguous line, making navigation a snap. Casually dropping over her stern to around 140 fsw, divers will likely encounter a few majestic lionfish that mysteriously started showing up on the deeper offshore wrecks off the North Carolina coast. Indigenous to the pacific, they are quite an exciting treat. Up close you'll see their "keep away from me" tines extended outward from all angles of their two-tone, vertically striped bodies. Their rigid, fin laced, venomous spines although eye pleasing, can inflict a very nasty sting, so one must heed their warning display and give them a little breathing room.

Moving right along one can observe an endless garden of hard and soft corals, accompanied by an infinite showing of multi-hued sponges and slowly waving sea fans that now occupy the entire wreckage, dulling her rough, rusting ridges. Her silent, easy to navigate sunken skeleton, now readily reveals a new derma of flourishing marine life that is literally filled to the gills with all sorts of odd-looking organisms that will keep the camera-toting "techies" snapping away like mad. Practically every-where are sub divisions of life with an endless array of painted tropical fish that proudly show off their brilliant neon colors, painting an unforgettable picture while performing their age-old dance against a showcase of fantastic flora and fauna.

Heading in a forward direction, divers can view the Naeco's enormous engine in its entirety, with its mam-moth pistons now frozen mid stroke in time. Right next door are her two equally large boilers that act as silent sentinels in the midst of this mind blowing, marine menagerie. If that seems impressive, then keep your peepers peeled for the resident Jewfish as it sports its chunky, camouflage carapace while it peeks out from under the protective wreckage like a neighborhood kid playing hide and seek. It's quite the ham, but like a finicky model, it will only tolerate a short photo session. Also keep an eye out for a nice showing of really large spiny lobsters in the eight to nine pound range hiding among the twisted remains.

**Exploring the Naeco Bow**

A few miles away and practically never visited by divers, lies the bow section in around 140 fsw. Somewhat smaller than her stern, the bow denotes an exceedingly impressive vista of marine life that easily surpasses that of her stern. As divers explore the wreck, schools upon schools of fish live as one, patrolling along the tankers collapsed hull, circumventing its entire perimeter, further fading into the ocean oasis. Large red snapper and grouper take time out of their busy food gather-ing schedules to briefly look over the strange, bubble spewing visitors that temporarily pass through for a look see. Divers will definitely be amazed at the infinite numbers of ornate spiny oysters, cowries and hairy tritons, along with a few beautiful nudibrancs that spruce up her corroding hull, adding to a plethora of other underwater delights that will keep one's head constantly turning from side to side. Find a seat anywhere you please for the spectacle of dive bombing amberjacks as they thin out the enormous silverside population that knows no ending. Experienced wreck divers with the proper training can easily pen-etrate her pockmarked, collapsing hull through several openings, allowing a fairly easy traverse from one end of the wreck to the other. The only problem in navigating this area is the immense wall of baitfish that cloaks most of the ambient light, which leads to the many exits.

With numerous dizzying distractions hitting one from all sides it's easy to alter one's dive plans. Bottom

time on both wrecks will seem short and decompression can quickly mount to four stages, so monitoring one's gages is a definite must.

Advanced and technical divers will find the Naeco stern and bow sections quite spectacular and one of the top wrecks to explore off the North Carolina coast. The best visibility (80 to 150 feet) and optimal sea conditions are normally found in the summer months of June, July and August. Recent reports of lionfish sightings and scores of tropicals, including a portly resident jewfish is enough to attract just about any diver willing to venture the 37 miles out to see her.

**The Author's Recommendations**

There are several charter operations in the area that will gladly take divers out to explore the Naeco. But one such operation I would highly recommend and the one I use on a regular basis is the Diver Down out of Atlantic Beach (Telephone: (252) 240-2043 or www.diverdownscubadiving.com).

Captain Bobby Cox operates his fast 42-foot aluminum crew boat that can accommodate up to 18 divers. Aside from being one of the nicest guys I've ever meet, he's an avid diver and a darn good spear fisherman. To make things even easier for visiting divers, I would further recommend staying at the Fisherman's Inn (Telephone: (800) 347-4571), located just a few short steps away from the Diver Down. Owners Billy and Barbara Brewer run this quaint, very clean operation with your utmost comfort in mind. Conveniently located next door to them is the Diveocean dive center. They provide divers with a friendly, full-service dive shop that pumps air and nitrox.
Ph: (877) 535-2399 *www.DiveOceanDiveCenter.com*

All three are conveniently located together on the causeway in Atlantic Beach, North Carolina, making any visit an easy one. Special thanks to Marc Weiss of Nordic Gear for kindly supplying the quality surface wear. Visit them at *www.nordicgear.com* or call 800 526-5776.

*This article is dedicated to the memory of my good friend Bill Schmoldt.*

**Wolf Eel**
**Continued from page 9**

**The Dive**

The inboard engine howled, drowning out the wind with its roar, as we shot over the calm green waters of Puget Sound toward our destination, Sunrise Wall, just North of the Tacoma Narrows and the sunken remains of "Galloping Gertie." Noted for its color and beauty, divers also flock to the wall because of the high population of both wolf-eels and giant Pacific octopuses that can be found there. Despite having been to Sunrise many times, this dive promised to be a special one for me. I would be diving with Marine Biologist Tony Parra, who, along with other Washington Department of Fish and Wildlife Biologists, has been conducting an extensive biological study of wolf-eels over the past few years. Few people know as much about wolf-eels as Tony, and I was anxious to tap into his knowledge as well as to meet some of his "Wolfie" buddies from the study up close and personal. It was late October and we excitedly expected that the wolf-eels would be beginning to pair off to breed, giving us the opportunity of photographing that aspect of their behavior.

Anchoring near the center of the wall, we descended the anchor line into the rich emerald green depths and soon found ourselves gliding down the slope of the wall, which was covered with bright pink swaths of coralline algae interspersed with clumps of bright and shining white and orange plumose anemones. Fall was at hand and the bull kelp that graces the wall in the spring and summer had decayed away to virtually nothing - small brown stalks being all that was left of the once mighty carpet I had seen earlier in the year. Orange, red and purple seastars dotted the seascape as they slowly inched along the rocks in their search for prey, while multi-colored red Irish lords and buffalo sculpins peered at us as we descended from their ledges on the wall. Often not visible until they moved, tiny hermit and decorator crabs scuttled here and there as we approached. The shiny and colorful remains of shellfish lay in heaps before numerous holes on the rocky reef - a sure sign of at least past occupancy by either wolf-eels or giant Pacific octopuses.

Within seconds of arriving at the bottom, Tony flashed his light in my direction and pointed out our first "clients" - a pair of mated wolf-eels sharing a den and nestled in side-by-side. The male was quite literally a monster, with a gnarled and puffy head the size of a slightly deflated basketball. As his mouth opened and closed we could clearly see his huge set of teeth, blunt and square as molars, worn away as a result of many years of feasting on the hard armor of urchins and other shellfish. Next to his huge bulk his mate looked almost toy-like, despite the fact that she, too, was clearly an adult. His body pale with age, her darker gray body stood out distinctly as she lay beside him in the large entryway to their den. We would later estimate the huge old male's size as between seven and eight feet in length.

Tony attempted to lure the pair out into the open with a proffered treat of raw chicken, but neither of them appeared to be the slightest bit interested. Prior to entering the water, Tony had explained to me that once a male has enticed a female into sharing a den with him, he becomes extremely reluctant to leave it and will not allow her to do so either, undoubtedly over concern that a "bachelor" male will quickly attempt to take his place. Nearby we noticed that there was another male, unusually out in the open and with a huge raw wound in his forehead - probably from a clash with another male. He circled around the den site, his eyes appearing to gleam bright with an intensity that seemed to border on desperation. He reminded me of a teenager who had just had his girlfriend lured away by the high school football star and whose anger was fed by a constant flow of pumping adrenalin. Obviously, he was a recent loser in the "game of love" and quite possibly he was the primary reason that our mated pair refused to leave their den even for a moment.

Moving southward down the wall we encountered two other mated pairs, who also, like the first, refused to leave their dens. Along with the wolf-eels we were encountering, we also discovered no less than six giant Pacific octopuses during the dive. Like the pairs of mated wolf-eels, they also refused to come out to play. Still, they

were only too happy to accept bits of our chicken, which they eagerly hauled into their dens with a single extended arm.

Toward the end of our dive we found what we were seeking, a single male in his den by himself and, because of his bachelorhood, still interested in such mundane things as food! Tony extended his hand, holding out a bit of chicken as an invitation. No sooner had he done so than the wolf-eel shot out of the den much like a torpedo launched from a tube! Swirling about Tony's arms, the wolf-eel chomped down on the treat while Tony rubbed under his chin and petted his head like I would one of my dogs at home. A beautiful purplish-gray, the dark eye-like spots on the flanks of the wolf-eel stood out brightly in my viewfinder as I happily clicked away. Piece after piece of food was consumed as copper rockfish, striped seaperch and various species of sculpins darted in to snatch up the tiny bits that were scattered about in the current as the big Wolfie fed, the sound of his huge jaws clearly audible through the water. All too soon the bottom of the feedbag was reached and suddenly Tony and I became MUCH less interesting. With a swirl of his long sinewy tail the male turned and plunged back into his hole, where he busily began enlarging it in anticipation of attracting a feminine housemate. Sand, small rocks and shells swirled out of the hole as he twisted and turned in his endeavors.

As we swam back toward the anchor line we again came across our friend with the open gash in his forehead, still wandering about the wall in search of a female not yet spoken for, the look on his fleshy face still every bit as intense as before. His glare seemed to say, "What the hell are YOU lookin' at?!!!" as we passed by, and he continued on with his mission. As we slowly made our way up the anchor line toward the waiting surface I found myself wondering if he would eventually achieve success. Perhaps another dive in the near future will provide the answer - after all, a wolf-eel with a bite taken out of his forehead shouldn't be THAT hard to recognize!

As we reached the surface and began to clamber into the boat, we noticed that another, larger, boat had arrived carrying several divers. Tony and I grinned at each other, knowing the wonders that the newcomers would be treated to when they arrived on the bottom. Later, as our small boat sped along eastward toward the huge silhouetted outline of Mount Rainier, the boat launch and home, Tony and I talked about the conclusions that we might draw from the types of behavior we had observed and photographed that day. It had been a marvelous and entertaining experience, one that we had been graciously allowed to share with the "*Ugly Old Man of the Sea*" - the wolf-eel.

*Author's Note: I would like to extend my thanks to Marine Biologist, Tony Parra, for his extensive help in the preparation of this article as well as his friendship. Thanks also to all the other staff members of the Washington Department of Fish and Wildlife who have taken time to answer my questions and assist me whenever they could.*

## Historic Wreck Discovery in the Java Sea

by Kevin Denlay

The wrecks of the Dutch WW11 cruisers *De Ruyter* (560ft/170mL, 6450T) and *Java* (509ft/155mL, 6670T) have been discovered, dived and positively identified off Bawean Island in the Java Sea. A group of international divers operating off the Singapore based *MV Empress*, using side-scan sonar technology, made the discovery on 1st December 2002. Sunk several miles apart by torpedos from the Japanese heavy cruisers *Nachi* and *Haguro*, during the Battle of the Java Sea on February 27th 1942, *De Ruyter* was the flagship of Admiral Karel Doorman and at the time the flagship of the multi-national 'Asiatic Fleet' or ABDAFLOAT. Admiral Doorman, along with 344 of his crew, went down with the ship.

The expedition was winding down and had just made a long overnight transit on their way to Bali, after having spent several fruitless days using the side scan sonar further north searching for *HMS Exeter* (sunk two days later and the expeditions primary target), when the side-scan sonar imaged what turned out to be the Java right next to their transit track. "Although we had been towing the side-scan 'fish' overnight during the transit, coming upon her like this was completely out of the blue as she is many miles from her reported sinking position." said Kevin Denlay, an expedition member. "We were actually on our way to a known wreck site for a dive, as we hadn't dived for several days, when we unexpectedly came upon her around 9am." Late the same afternoon, after diving and positively identifying *Java*, the expedition played a hunch and went on to side scan an area where some small vessels were fishing on the horizon. Sure enough, there was another large wreck that turned out to be *De Ruyter*, which they dived and positively identified the following day. The wrecks lay in 227ft/69m and 220ft/67m respectively, the *Java* on her starboard side and *De Ruyter* partially upright, although tilted well over to starboard.

Continuing their good fortune, upon leaving the site the skipper gave some fuel to one of the fisherman who reciprocated with one of his GPS fishing coordinates, which turned out to be almost 110 nautical miles away. Making an overnight detour from their intended course, the next morning found the team diving on an uncharted armed Japanese freighter in 246ft/75m, possibly the *Manyo Maru* (300ft/92mL, 2900T). Three virgin wrecks in three days, two of them cruisers, a 'home run' you might say!



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# *SCUBA Legends: Diving Myths and Phantoms of Florida*

**By Capt. Thomas A. Scott**

We've all heard the stories, sometimes on boats returning from a wreck dive, sometimes in smoky waterfront bars. They are the stuff of dreams, of the "big one" lying just offshore surely only hours from discovery.

These are some of the myths and legends of underwater Florida. In some of these stories there is a grain of truth, in others the mists of time conceal the answers....

The great rolling submarine of the Gulf: This is one of the finest, and most unlikely, of all stories. I get questions on this fairly regularly. The story goes that in the Gulf of Mexico a sunken German U-boat, her pressure hull still sealed, ballasted with extremely valuable, but highly poisonous, mercury, moving at the mercy of the tides. She has been seen by many, usually by a "friend of a friend who is a captain" as she breaks the surface “like a broaching whale,” only to sink back down before she can be located with certainty. She remains elusive, a phantom of war.

This story, while compelling, is filled with more holes than a depth-charged U-boat. Research through both American and German U-boat experts shows no German submarine unaccounted for in this area. This same research also puts to bed the theory of U-boats being ballasted with mercury. It simply wasn't done.

The Fort Lauderdale submarine: They say she lies just outside the third reef, in about 90 feet of water. The merciless sands continually shift to cover and uncover her remains, allowing for only a brief occasional glimpse. Once she allowed a photograph that was subsequently published in a dive magazine. Unfortunately, the photo was so poorly focused that it could have been anything, including the sail of a submarine; or the hood of a car.

Again, research through both American and German U-boat experts show no boats unaccounted for in this area.

The Key Largo submarine: In this case we have no adventurous tales, only consistent rumors of a u-boat sunk off Key Largo. Once again, no German subs are unaccounted for in this area. Interestingly enough, the wreck of the Vitric, a schooner-barge which carried tanks of syrup, shows an intriguingly rounded profile on a depth sounder in some circumstances. This may be the birthplace of these rumors. Perhaps years ago she was dived on air. A narcosis addled brain could possibly have seen a submarine in one of her deck tanks.

The Key Largo tanker: She was lost in war, yet somehow missed by history. Rumors of a tanker wreck seaward of Key Largo have persisted over the years. Once I was given “guaranteed” loran numbers to the grave of this gallant warrior.

On a summer day in 1991 we set out, two divers and a boat handler in a small private boat, in search of history and glory. Reaching the spot we set a jug, yet the bottom showed as flat and featureless, 200 feet below. For hours we searched, running pattern after pattern when finally the depth sounder exploded with activity! We could see shoals of fish and what appeared to be the structure of a "two-headed" vessel, surely a T-2 tanker! We set the hook quickly and prepared to dive, anticipation gnawing at our hearts.

Swimming downward into the blue, the first tingles of narcosis appearing as we swam through millions of baitfish and jacks. Finally, we reached the bottom only to find flat sand. We had missed. I took a compass and headed in my “best guess direction,” and we began swimming. Soon she loomed out of the mists -- a small sailboat.

She lies at 200 fsw on a flat featureless sand plain. Her hull is empty yet her mast reaches toward the surface. She has clearly rested here for a long time. Since the area is so devoid of structure, this wreck has attracted fish in unbelievable numbers, numbers great enough to give the effect, on a small cheap depth sounder, of a large wreck, perhaps of a tanker.

Searching for the lost, yet found: Their names haunt the aspiring wreck hunter, Oxford, Moonstone, Dixie,

Moffett, Ice Fog; and the list goes on. Vessels listed as casualties in various sources such as Lloyds List.

They can be found through research in dusty archives and yellowed newspapers crumbling with age. They were lost so surely they remain forgotten in time, rich prizes which may easily be found. These are wrecks which I have been invited to help search for during my career. Luckily, I have not yet been fooled as so many others have.

Each of the vessels listed above and countless more, were indeed lost but were also later recovered, raised from their watery graves to either sail again or become scrap. Many researchers stop researching too quickly and thus expeditions are born which are doomed from the start, searching for that which is no longer there.

The Motorcycle Wreck: In this case we reach the pinnacle of wreck diving legends, one that may actually exist. The story goes, with some variations, that she is a freighter with a cargo of motorcycles bound for a distant shore, usually a shore torn by war. Somehow she met her fate somewhere between Key Largo and Marathon. Today she lies waiting, variously reported at 150 to 300 feet of depth and everywhere in between.

During research for my last book I interviewed an old treasure hunter who shall remain nameless here. This man had dived Keys waters for decades and had certainly seen many strange sights. Among the strangest, he reported, was the ship filled with motorcycles. He gave the location as "seaward of French Reef, in 150 foot." Many days, many weeks, many months, I searched the waters off French Reef but found nothing. Perhaps she still awaits, perhaps, like so many others, she lives only in the hearts of those who seek her…

Hearts like mine. Good luck to all who search.

Capt. Thomas A. Scott is the author of "Histories & Mysteries: The Shipwrecks of Key Largo."

# OMS Cylinder Ad

# Italian Bomber
# Fiat BR20 Cicogna

by Aldo Ferrucci

On June 13, 1940, two Italian BR20 bombers of the 43rd assault group, the MM21505 and the MM21503, took off from the Cascina Vaga Camp in northern Italy. Their goal was to bomb the Fayence Airport. The operation was to take place in synergy with another squadron whose goals were the destruction of the naval base in Toulon and the Saint Mandrier and Hyères airdromes.

Bad weather caused a big delay, forcing the two bombers to arrive after the beginning of the operations. Meanwhile, the fighters responsible for defending the BR20s, were left short of fuel due to the delay and had to return to base, leaving the BR20 bombers without protection. Alerted by the bombings, three Dewoitine D520 fighters of the French squadron began hunting the two BR20 aircraft. Guided by Pierre Le Gloan, an elite pilot, they quickly shot down the MM21503, whereas the MM21505, although it was damaged, succeeded in escaping. However, its respite was short. The squadron leader, flying officer Catalano, was shot dead. The first mate, Marshal Aliani, tried to maintain the heavy bomber in flight. In spite of the right engine out of order and the left engine half working, he passed the border. However, in San Stefano bay, he had no choice but to attempt a landing. Aliani succeeded this prowess, but the bomber sank into the water. The crew left the cabin in a hurry, before the sea could take possession of the wreck -- dragging Catalano's body down with it.

The four survivors waited two hours to be rescued. Sadly, it was too long for Gaeta, the radio telegraphist, and Ferrari, the quartermaster sergeant, who perished. Only Aliani and the mechanic survived the tragedy.

**My Dive to the BR20**

At the crack of dawn we boarded the boat of the Diving Club Nautilus, which carried us to the BR20 wreck. The sea forecast was mild and the current was expected to be fairly weak. We were at Marina degli Aregai port, which was just five minutes by boat to the dive site. All the equipment was on board, and we climbed into the boat wearing our dry suits. Arriving at the dive site, we were delayed for a few minutes scanning for the wreck with the bottom finder, as the wreck was only two meters / 6 ft. higher than the sea bottom, making it difficult to detect. In spite of the early hour, the surface current was strong. Donning our equipment, a set of doubles and a stage decompression cylinder, we toppled into the water.

The descent was particularly difficult, especially for me, because I was carrying an extra camera with two unwieldy flashes. But the intensity of the current allowed for good visibility, and from 25m/82ft we could make out the silhouette of the wreck standing out against the white sand at 47m/152ft. From where we were it seemed the airplane had landed completely intact on the bottom. Nevertheless, getting closer, we noticed that the external surface was completely erroded and only the metallic armature was in place. But, even nude, the bomber by its dimensions and the two engines with their propellers was impressive.

Our descent line was snagged at the back of the plane and we let go of it before reaching the sand. We first stopped at the left engine, which allowed the emergency landing. At the cockpit, which is now "open sky," a plaque for the commemoration of the catastrophe was placed. Another plaque was fixed on the fuselage. The color explosion surprised us: sponges, anemones and many-colored gorgons covered anything and everything. Scorpion fish and little spiny lobsters hid by the hundreds. An enormous conger eel established his lair in the right engine; and between the strips torn off the wing, we could make out two beautiful dogfish. Davide confirmed at the surface that their shelter had been established there for a long time and it is possible to observe their characteristic eggs attached to the cockpit and the engines during their reproductive period.

All around rolled up clouds of anthiax, little red fish with a falciforme tail. We moved away a little to embrace the spectacle of these countless multi-colored "spots" dancing around the two engines and three-blade propeller. We also noticed the damage caused by the landing impact. The cockpit was crushed and twisted, it seemed impossible that a man could escape alive. As a witness of the past battle, a machine gun is still in place, fully covered by sponges and anemones. In the tail of the plane, we crossed a scorpion fish, capons, congers, little spiny lobsters and even a big lobster.

Even though the Nitrox 26% we used allowed us to stay on the bottom for 30 minutes, our time quickly expired and we were forced to head back up to the surface. We did this slowly, not to enjoy the spectacle, but because we were caught up in the current. During our decompression we used Nitrox 80%. Fortunately, the use of a jon line relaxed our arms, which were tired by that incessant battle with the current, and we emerged exhausted after a 53-minute-dive.

On the surface, the sea was flat and our exhaustion seemed incongruous in the hot sunlight. Only after a long recovery, the memory of the quasi-tropical contrast between the myriad of red anthiax and the intense blue background came back to us, making us marvel aloud,

"What a beautiful dive!"

Design features of the BR20:
Manufacturer: Fiat S.A.
Type: Light bomber
Plane year: 1936
Designer: Celestino Rosatelli
Wingspan: 21.56m/71ft.
Length: 16m/51ft.
Height: 4m/13ft.
Max takeoff weight: 9900 kg / 21,800 lbs
Max speed: 432 km/h / 268 mph at 5000 m / 17,000 ft.
Max altitude: 9000 m / 29,500 ft.
Engines: 2 Fiat A.80.RC.41 at 18 stars cylinders, cooled by air, each of 1014 CV
Crew: Five.
Bomb load: 1600 kg / 3500 lbs.

Defensive Armament: Machine gun Safat caliber 7.7mm at the front and a caliber 12.7mm at the center, on the fuselage back.

*Aldo Ferrucci, a 44-year-old native Italian, is a diving instructor on the French Riviera near Saint Tropez. Aldo specializes in Tech diving. He is also the team leader of "Xpedition team," a group of divers that specialize in the exploration of unknown or unexplored wrecks.*
*For more information, e-mail him at bubnotbub@aol.com or visit him on the web at www.bubnotbub.com or www.xpeditionteam.com.*

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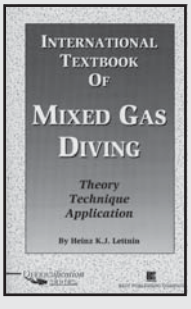


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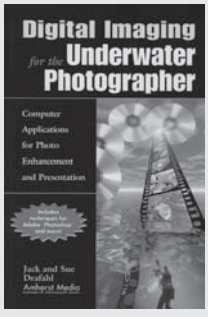


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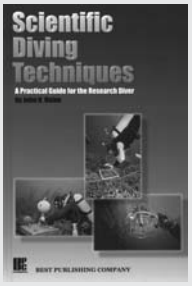


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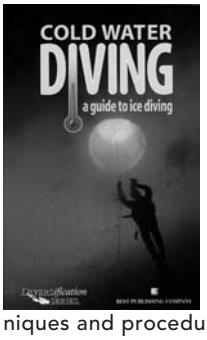


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# Kamloops
## Isle Royal • Lake Superior

By Rob Polich

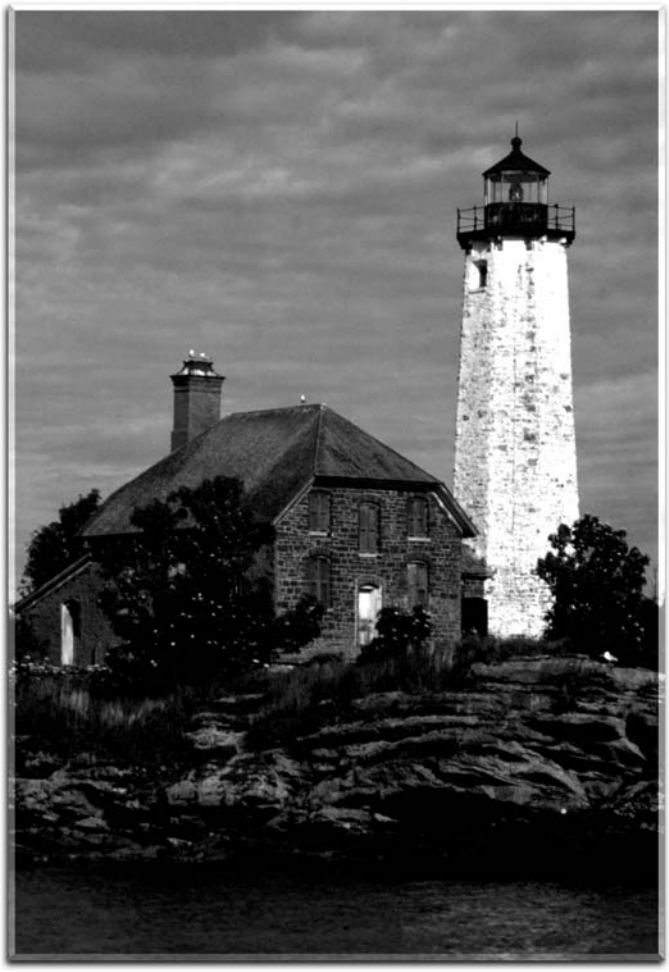
Shipwrecks and the tales that surround them have fascinated people for many years. It is no surprise that many wreck divers have extensive collections of articles and books on the subject. As divers, being well educated in specific shipwrecks can play a key role by enhancing each dive experience. Sometimes this can have such a significant impression that we visit the wreck site driven more by the notion of touching history and solving mystery, than by the idea of just viewing the wreck physically. Even wrecks that are not in particularly good condition will hold the interest of an advent wreck diver who has learned their interesting history. There are those rare instances when divers are lucky enough to find a shipwreck that has both of these attributes, a fascinating story that captures the imagination and the discovery of an anatomically impressive wreck site. The shipwreck and the story of the Steamer Kamloops are an example one of these rare treasures.

**The History of the Kamloops**

The Kamloops was a steam-powered, steel-hulled freighter built in England in the summer of 1924. From her oval stern to her sharply pointed bow she was 250ft long with a beam of 42 3/4 ft and a draft of 14ft. The vessel had two main decks, a stern auxiliary steering station and a pair of large hoisting gear amidships. Her Richardson and Westgarth triple expansion steam engine produced 1,000 shaft horsepower on a single screw that moved her through the water at a speed of 9 1/2 knots.

Departing on December 1, with a cargo of general freight, the Kamloops would complete the last voyage of the year for the Canada Steam Ship Lines, marking the end of the 1927 shipping season. On the Great Lakes November and December are known to be the most dangerous sailing months of the year. The gales they produce usually spelled disaster for any unfortunate vessels found in their path. No one understood this as well as the underwriters who insured the vessels and their cargo. In response to vessels that elected to sail during these months insurance companies raised their rates. This first occurred on November 30 and would increase again substantially on December 5. Finally, all coverage would cease by midnight on December 12 — this was partially due to the removal of most lighthouse keepers and other navigational aids.

Photo: Gary Gentile



Early on December 7, 1927, snow began to fall and northeast winds began to build across the open water of Lake Superior. In Sault Saint Marie, storm signals were raised as the winds approached and then quickly exceeded 30mph, barometers fell and air temperatures plummeted to 10 degrees below zero. Looking out at the lake through their wheelhouse windows many Great Lake boat captains thought a winter gale was upon them and prepared accordingly. What they couldn't possibly know was that soon they would be up against one of the worst storms in Lake Superiors history, a lethal blow that would bring hurricane force winds, thick fog, treacherous ice and unbearable temperatures. Quickly the winds climbed to 60 mph, then upwards eventually exceeding 80mph. The blinding, horizontal snow thickened, and air temperatures dropped even lower to a brutal 40 degrees below zero.

The storm would blow for five solid days. For the mariners that would be thrust into its devastating path it would seem an eternity. Their maritime skills would be put to an unprecedented test while mentally, emotionally and physically they would be pushed to their absolute limits. As one crewman of the Winnipeg describe it, "Unlike anything I have seen in 20 years of sailing. As if the storm wasn't bad enough, the combination of gales, fogs, and below zero temperatures all at the same time is something that has given many a mariner nerves that last only a few days". Two suicides were reported on the Lambton. Others aboard her believed that these men didn't attempt suicide, but instead were trying to swim to shore, an act of insane desperation brought on by extreme stress which shattered their nerves and allowed panic to consume them. Some ships and their brave crews would survive, others like the crew of the steamer Kamloops, would sail on to their destiny.

When the weather finally cleared there was no sign of the Kamloops; her fate was unknown. While other vessels had sighted the Kamloops at various times throughout her journey, the steamer Quedoc was the last to report seeing her. Captain Simpson gave the newspapers the following account:

"The Quedoc was upbound on December 4 with the Kamloops beside her also upbound. The Quedoc was leading, and the Kamloops was one-quarter mile astern. At 10 p.m. on December 6, the lookout of the Quedoc suddenly saw a dark mass ahead and gave the alarm immediately. The Quedoc turned sharply to avoid running head on into the rocks at the same time blowing her danger signal for the Kamloops. A north gale was blowing, there was a heavy sea and it was rough going. The visibility was poor, on account of the frost fog, and it is not known if the Kamloops saw the rock or heard the signal."

After weeks of fruitless searching, efforts to find her ceased. It was as if an invisible hand had wiped the Kamloops off the slate blue surface of Lake Superior.

On May 26 of the following year a fisherman on Isle Royal found the first bodies of the Kamloops' crew. The two bodies were found on a stretch of beach near Twelve O' Clock Point with life preservers on them baring the name Kamloops. A beached lifeboat and other wreck debris were also found at the site. On June 6, six more bodies were found 100 feet or so from Twelve O' Clock Point, the bodies badly decomposed. Each was fitted with lifebelts and dressed in heavy clothing. An old local Indian may have discovered these bodies earlier in the spring. He claimed that he discovered one of the bodies in a crude lean-to shelter sitting upright on a nearby log, wide eyed and staring straight ahead with a single lifesaver candy clenched between his fingers, steam rising from his frozen stiff body. Matches were not found on any of the bodies, nor was there any indication that they attempted to build a fire.

The following week, the remains of a man believed to be First Mate Henry Genest was located further inland. His body did not contain a life belt and was set in a hastily built shrub like shelter, which contained a box of lifesavers and a few other personal effects. As a result, a thorough search of the island's interior was conducted. Although the searchers (a group of very competent bushmen) didn't find any more bodies, they did discover more crude shelters, which may have been erected by other crew members that had tried to survive on the island.

Of the Kamloops 22 crew, two were women both employed as the stewardesses. One of the women was identified as Alice Bettridge, the Kamloops Assistant Stewardess. Incredibly, the following year a trapper found a note in a bottle near the mouth of the Agawa River approximately 70 miles north of Sualt Saint Marie, Canada. The note appeared to be from one of the Kamloops' crew. It read, "I am the last one left alive, freezing and starving to death on Isle Royal, I just wanted my Mom and Dad to know my fate," and was signed, "Alice Bettridge." This was eagerly reported by the press and was first thought to be a hoax until the parents of Alice Bettridge positively identified the writing as being that of their daughter. While the remains of nine of her crew may have been recovered, the location of the Kamloops would remain a mystery for another 50 years, and the circumstances surrounding her loss would never be completely known.

In 1977 SCUBA diver Ken Englebrecht found the Kamloops just 100 yards from Twelve O clock Point. She was found lying at the base of a near vertical rock ledge on her starboard side, miraculously intact. The wreck lies in 180 to 260ft of clear, cold water and visibility is usually excellent. Thermoclines are shallow to nonexistent depending on the time of year and the bottom temperature usually hovers around 39deg. Isle Royal is approximately 50 miles long and 10 miles wide and is one of the most beautiful national parks in the country. The island attracts many naturalists and their considerations come first. Few amenities are present, running water is a rarity and fuel is only available in only two harbors.

The remoteness of Isle Royal, its unpredictable weather, short season and severe rules and regulations set by the National Park Service combine to make the logistics of diving the Kamloops difficult, to say the least. As a result few divers visit the wreck and most dives are done on air.

My Dive to the Kamloops

Diving the Kamloops is always an exhilarating experience. Dropping down upon the wreck, I marvel at the pristine scene before me. Her multiple decks are complete with their crew cabins and a variety of air scoops stand conspicuously above the deck. The thin railings are straight and in their mounts, even the angle iron framework for her stern canvas is still intact. Below me is an old, clam shell-style drinking fountain with its plumbing and nozzle still attached, the copper and brass parts reflecting an attractive patina from the years of submersion.

Crossing her beam and heading toward the lake bottom, a substantial amount of debris comes into view. It contains a wide variety of items. This is her cargo of general freight from her once sound holds. I recognize some of the items: large rolls of tarpaper, fencing, hand tools, shoes and numerous wooden crates. The fencing may have contributed to the ship's demise. Lashed to her main deck they would have invited heavy ice to form, creating a top heavy and unstable condition. This could be one explanation for her apparent capsizing and sinking.

Swimming up and toward the stern I pass under a large hole that once housed her smokestack. The smokestack itself is no where to be found and some believe this is evidence that the smokestack was actually lost earlier in her voyage and lies miles from her actual resting place. This could perhaps be a sign that she lost power out on the open water of Lake Superior and was blown toward Isle Royal adrift and at the mercy of the storm.

I approach the engine room skylights. The frames are rectangular with thick undulated glass rings in their center — the glass is frosty white with age. All appear to be unbroken. One of the skylights is open and beckons. I pass through it and into the inky darkness of the engine room, pushing my light eagerly out in front of me. Immediately a reflection draws my attention. It seems to be a color or colors. They stand out from the rest of the compartment's drab interior; it only takes moments to recognize it as clothing. It is the remains of one the Kamloops unfortunate crew. He is propped up behind the engine, dressed in overalls in an odd and erect position, facing directly towards me. The apparition gives the distinct impression he was working on the engine right up to the fatal moment of her plunge. The skin is stone white to gray with an overall translucent quality. Most the extremities are missing, such as the head and hands. With quick glances I notice leg bones protruding from the skin in jointed areas. The body is in a degenerative state known as soapification. I am not aware of any human remains that have been found in this state after more than 70 years of submersion. The Ice Water Mansion's notorious preserving power apparently applies to both her organic and non-organic tenants.

Aft of the engine room is the mizzenmast. This thin and frail wooden mast protrudes from the wreck a good distance hanging over the debris field below like some strange trapeze. Swimming along the mast I notice a small intact wooden life boat below on the lake bottom. Turning back toward the wreck, I look back and pause for just a moment surprised by the view. I can see a good portion of the wreck behind me; it's an impressive site.

Feeling small and a bit agoraphobic I head back toward another set of skylights. These are the skylights to the officer's dining room. They are noticeably smaller than their larger cousins that are perched above the engine room. The glass is intact and the frames undamaged. Anxious to get inside, I enter through the main door on the stern side of the room. The doorway is more like a narrow slit since it now rests on a 90-degree angle. A large wooden table has broken free from its base and lies on the starboard bulkhead. Behind the table and along the forward bulkhead in the back of the room is a large wooden chinette, its doors open. Broken dishes and glass lay in the silt below it. Above me and to the port is another doorway that leads to the cook's bedroom, his bed clearly visible along with a small air pocket. In the back port corner of the room is another doorway that probably leads to the galley.

After exiting the dining room, I head for the ship's stern auxiliary steering station. The large 6-foot diameter wheel still sits on its pedestal, not a spoke missing, the wood clean and grainy. Next to the impressive wheel is a binnacle, its glass intact but the compass absent. A small winch sits on the deck nearby. I am not sure of its

purpose, a sounder perhaps? Facing forward I grasp the wheel in my hands, my body on a 90-degree angle proportional to the wreck. The soft, dim, green glow of sunlight touches the stern just above me. I feel like I am sailing a ghost ship into the night.

I head upward and aft swimming above the ship's rudder. The large rudder and screw are exposed and undamaged, while large rocks from the sheer wall lay next them, the wall itself only feet away. I head up the ascent line, looking down for a few last seconds at surreal images of the eerie, icy wreck of the steamer Kamloops.

As for her demise, many questions still remain. Was she out of steam before she reached the island adrift? Did they drag anchor and try to repair the engines? Did the bow strike the rocks on the shoal at twelve O' Clock Point or perhaps another out on the open lake? Did she sink fast or slowly? Why was only some of her crew put ashore? Why did they not have any supplies? What allowed her to slip away down that vertical rock wall so unscathed? While theories may abound, we will probably never know. The Kamloops is, without a doubt, one of the most interesting and preserved shipwrecks to be found anywhere. It is a buried slice of 1920s Americana — a capsule literally frozen in time.

*The author would like to thank friend and dive buddy Tom Doubleday as well as Bill Gardner and Ken Merryman for their significant contributions the dives and this article.*

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# "Seventy Fathoms Deep"


**by Leigh Bishop**

***In their quest to explore the world's most famous shipwrecks, the deep wreck diving team "Starfish Enterprise" focuses on the treasure ship, the Egypt. Lost in 1922, the Egypt carried 1,083,527 in gold and silver bullion and specie — approximately 10 tons of silver and five tons of gold! That is today's equivalent of over 56 million U.S. dollars! Leigh Bishop, in helping to pursue this salvage attempt, brings to the surface the story of history's greatest salvage attempt, as well as the first images of the wreck taken at 420feet/127meters!***

Rebreather diver David Wilkins giant strides into the Atlantic with over 200 pounds of equipment, including a 100 pound Aquazep.

# EGYPT

**June 2001**

Expedition leader Chris Hutchison stands on the foredeck of the search vessel, Loyal Watcher, closely watching the activities. On this day he will oversee diving operations to the famous Egypt. He wears no diving equipment and has no plans to see the wreck on this day. Instead, knowing that no error can be spared in the Atlantic, his concerns on this first day are with the wellbeing of his colleagues and not the wreck that lies 420ft/127m below, 25 miles west of Ushant, France.

Flying the Cis-Lunar Mk 5, electronically-controlled, closed-circuit re-breather, team member David Wilkins, accompanied by Richard Stevenson, is set in the task of securing the grapnel to the wreck. Richard and David's dives run smoothly, save for the fact that David's CCR computer is surprised to find itself 420ft deep in the Atlantic, and the duo indicates to the surface that the "route to exploration is open" for the remainder to follow. As a color-coded marker appears, systems are a "go" and with a beehive of surface activity, the five remaining divers are deployed. The very success in the mission lies in the "team effort," and on the surface supporting the operation sits a number of diving colleagues – people used to deep wreck dives themselves, who understand what success means and how it is achieved.

Today just seven divers will see the wreck, although their remaining colleagues will work incredibly hard for them to do so, only to listen to their exciting tales at the end. Richard and David made it clear that their dive had been conducted on the upright bow of the wreck. The shot line had cozily draped itself into a trawl net suspended off the bow tip. The wreck appears very clean in that she is

1. The treasure ship Egypt in England during 1921.
2. Italian diver Giovanni Lenci exits the observation chamber soon after the first gold had been discovered.
3. Commendatore Quaglia and his men with various size gold bars from the wreck.
4. The bucket and grab in operation over the wreck during the recovery of the gold.

not heavily encrusted within marine growth, which is certainly an advantageous point to the team in that its features could be easily distinguished.

From commercial reports the expedition team knows that the wreck is lying upright with a section missing from SORIMA, a salvage project attempted in the 1930s. The divers were also told that the wreck is home to some extremely large conger, although they were unaware how true these reports would actually be — but indeed, the rumors were correct! In fact, several took more than a welcome interest in the divers' presence.

Good progress is made along what can be described as a very intact bow foredeck, but then without warning the wreck simply drops away to seabed level. Her port side hull, however, remains very much intact with all interior deck levels along its internal structure broken away again down to seabed level. What remains when looking up from the seabed is a bellied hull suspended of its own free will — clearly displaying the internal side of typical P&O portholes. The expedition divers also see numerous portholes, all with drip trays and square fastening dogs — a trademark of P&O liners with which they were familiar.

Visibility on the dive is exceptional. As the eyes settle into the dive, ambient light becomes acceptable and displays the upper outline of the wreck from the seabed. From the bow the bridge is unclear. In fact, one wonders if it is there at all. Just beyond the distance of where it should have been, the deck drops down a level where, a short distance later, the diver meets a cargo hold. The hold's hatch combings appear intact, as do small oblong brass windows alongside. After this hold the wreck clearly breaks down! On the dropped well deck level is a spare prop blade upright and intact — quite an unusual sight, and then to the far port side is the obvious lamp locker. Several lamps that could be seen show their age, as do the surrounding compartment walls where sections have begun to both rot and collapse. Central to this deck level is an internal companionway leading back towards the bow, which is located on the deck below and inside. Swimming along this passage, and now totally within the wreck itself, the divers see rooms leading off either side. Some rooms are obviously sanitary areas with rust-stained, broken ceramics; others are clearly cabins with what consisted of their makeup now dumped on the floors. In several rooms large amounts of crockery were easily distinguishable. After the initial dives Steve Wright, captain of Loyal Watchers, established that the wreck did not quite lie in a position across the tide, but more so NNE by SSW with her bow located at the far northwestern end of the site.

**May 1922**

It was the third day of a voyage that should have taken the Egypt from England to the shores of Bombay. Instead, the elegant P&O liner, built in 1897, ran into thick fog in the middle of a part of the Atlantic known to produce treacherous seas. Due to the terrible weather conditions, the Egypt came to a virtual standstill, while nearby sounds of repeated steam whistle blasts could clearly be heard. As the Egypt continued to do likewise, the blasts became louder until right out of the fog and to the port side, the French steamer Seine rammed her


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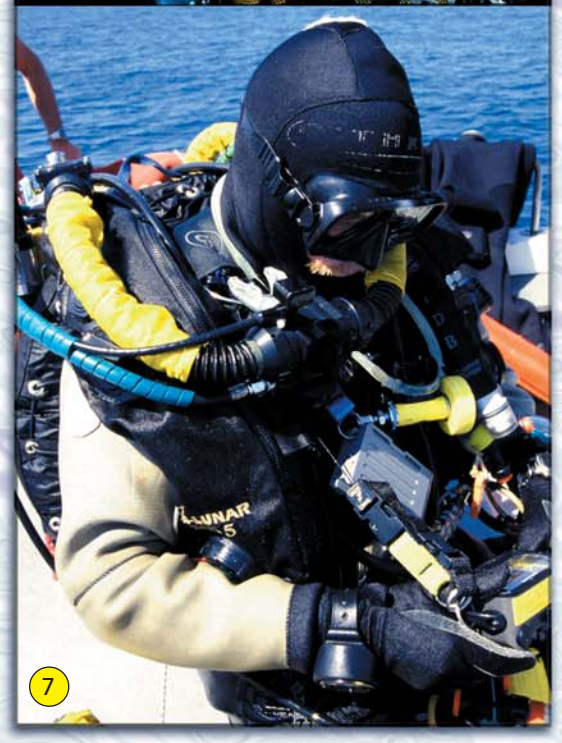

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5. British diver Bob Hughes enjoys a moment before diving the wreck.
6. Open circuit diver Alan Boness prepares last minute checks before diving the Egypt.
7. David Wilkins runs pre-dive checks on his Cis-Lunar MK 5 rebreather.

8. Several unusual items could be seen on the wreck.

9. A cargo hatch combing clearly intact along side a brass skylight window.

10. Typical P&O portholes on the interior of the port hull.

11. This spare prop blade was an unusual sight upright on the bow decking.

12. The wreck is home to many large ling and conger. These fish swim freely deep inside the wreckage.

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between the funnels. The Seine, whose bows were strengthened to deal with Baltic ice, was little damaged. Egypt, however, heeled over from the impact and sank in approximately 20 minutes.

**June 1929**

Almost immediately after Egypt sank she became a fantasy treasure shipwreck. She was deep — in fact, she sat at a depth of over twice what any man had been too at the time. Therefore, the underwriters had no alternative other than to consider the Egypt's precious cargo as lost. For seven years men from several nations had dreamed of salvaging the lost gold; some had even searched for the wreck with no avail. Now it was the turn of Commendatore Giovanni Quaglia, an irrepressible Italian salvage expert who specialized in the impossible. Quaglia was the founder of an infamous salvage company, Societ· Ricuperi Marittimi, known as SORIMA for short.

**August 1930**

Using the traditional method of toeing a suspended cable between two vessels over the seabed proved successful in locating the wreck. The wreck lied upright on an even keel, but her strong room where the bullion was stowed in a small narrow chamber 24ft/7m long was at the bottom of the ship. Quaglia's technique for recovery was based on the Iron Man, an armored diving suit of 1/2-ton in weight that could be lowered to the wreck as an observation chamber. The diver encased within would then in ambient light direct operations carried out from the surface by means of a telephone link to the salvage vessel Artiglio. The surface team would then be able to guide cranes and winches, which in turn would lower explosives and steel grabs into place. It worked, and for the next two years the team would slowly tear their way through the wreck in search of gold 70 fathoms deep!

**June 1932**

For three years SORIMA had battled the Atlantic in its quest for gold. But now, however, the impossible had become a reality as the

first gold was recovered from the wreck. By the end of the month, the operation amassed a pile of ingots and coins! Quaglia reported to Lloyds in London and was given a hero's welcome. The world was intrigued by the feat and newspapers around the globe ran the story. Until 1935 SORIMA returned to the wreck by which time an estimated 95 percent of the treasure had been recovered. SORIMA's operation was a story of ultimate success — a story still regarded within the marine recovery business as one of the greatest salvage feats of all time. The story of the Egypt and her gold would never be forgotten. It is a tale that is guaranteed to spring up in almost any treasure shipwreck book since written! Research indicates that, in fact, the gold was cast in several different sizes and today 14,929 sovereigns, 17 gold bars and 30 silver ingots are still unaccounted for and lie somewhere on the bottom of the Atlantic in the midst of the wreck!

**July 2001**

With such precious little bottom time, a dive of this nature is over all too soon for the divers. Maximum times ran up to 20 minutes of actually exploring the wreck, and when the contents gauge needle moves with each breath, time is of the essence. Convinced he was carrying enough gas in his doubles, Hutchison was openly reminded of his depth after assessing his gas consumption only to find that he still had 230bar remaining 10 minutes into his dive! The pressure was so great that the glass of the gauge forced upon the needle prevented it from actually operating!

Christina Campbell, a diver who accompanied him, would set a new record for the deepest wreck to be visited by a female — a record she gained during the Britannic dives of 1998. Although modest of her ability, Christina openly admits she's not in the game to claim records or be the first. Like the men, she simply enjoys exploring wrecks. "It just so happens some of them are a little deep," she remarked.

For more information on this article, please contact *leigh@starfishenterprise.org* or visit *www.starfishenterprise.org.*

**Gas Menu**

Divers on the Egypt utilized either double 138, 166 or 185 cubic feet capacity working on a European fill pressure of 3,675 psi based open circuit configurations or closed circuit re-breathers (CCR) out of personal choice.

Open circuit divers breathed a bottom mix of HeliAir (Helium & air) 9/57 (9%$O^2$ / 57% He) giving a target END (Equivalent Narcosis Depth) of 141ft/43m for the expected 363m/110m-380ft/115m of the Egypt. Running a HeliAir, as opposed to a trimix with an optimized $ppO^2$, gave some flexibility to the MOD (Maximum Operating Depth), which was fortunate since we discovered her in 420ft/127m! The team prefered lower $ppO^2$'s @ depth to avoid potential problems at high workloads and also to keep the CNS loading down enabling it to be boosted later where it is most beneficial for decompression and the divers are under observation. The total CNS loading ran on this occasion to a maximum of 160%. The first stops were pulled in at either 257ft/78m or 247ft/75m on bottom mix depending on exploration time and the first decompression gas switch was @ 178ft/54m to trimix 25/20 (25% $O^2$/20% He balance $N^2$). Nitrox 50 was then breathed from 70ft/21m to 20ft/6m where another switch to 100% $O^2$ was made. While on 100% $O^2$ a five-minute break on trimix 25/20 was taken every 20 minutes. The decompression schedules were cut using Gordon Henderson's DDPLAN (*http://www.drogon.net/ddplan*), with Gradient Factors set to 25% (Low) and 75% (High) In hindsight, had we known the Egypt was 50ft/15m deeper, a stronger helium based bottom mix would have been selected. Equally the trimix 25/20 would have been replaced with two intermediate decompression trimix enabling the first switch to occur approximately at 248ft/75m-264ft/80m, and a second switch at approximately 132ft/40m.

The inspiration re-breather divers used a diluent of 7/67 giving an END or 99ft/30m-116ft/35m for the 363ft/110m-420ft/127m-depth range. They were run with a fixed $PPO^2$ of 1.3 until the six-meter stop, where the $ppO^2$ was manually kept higher. From 20ft/6m upwards, cylinders of air staged on the decompression station were used to take a five minute air break every 20 minutes and were counted as part of the decompression schedule. Side mounted 65cuft cylinders of 13/55-trimix-bottom bailout, and in some cases a 50% Nitrox deco bailout were carried. The 65cuft choice provides sufficient gas to overcome all problems except a total CCR loop flood; however, in this highly unlikely situation, there is sufficient gas between a CCR buddy pair for an open circuit ascent. In addition, an experienced safety team ran support down to sufficient depths to meet a diver with such requirements. Each re-breather diver ran an 18-minute bottom time, giving run times of just over three hours. Once again, the decompression schedules were cut using DDPLAN, but this time with the Gradient Factors set to 20% (Low) and 85% (High).

# Cave Diving for Science

By Brian Kakuk
Bahama Caves
Research Foundation

Over the last 50 years, progressive leaps in diving technology have quickly become commonplace tools for recreational use. As this has happened, many more technically-oriented divers are gaining access to underwater cave environments that have seen little or no presence of humans. Most of these divers are justifiably enthralled with the sheer opulence of virgin sites, and the amazing geological features within. Just "being there" is more than enough reason for these new explorers to endure the rigors of advanced training, expense of equipment and the logistical nightmares that can go hand in hand with diving in this type of environment.

Much like a tourist who stands at the edge of the Grand Canyon for the first time, these divers are often hypnotized by the grandeur of their surroundings, so much so that many never see the environmental diversity that exists within the site on a much less obvious scale. Enter the Scientific Cave Diver.

Diving for science is certainly not a new endeavor. For more than 50 years, these meticulous underwater researchers have donned hard hat diving gear, scuba, snorkels or whatever diving apparatus they could get their hands on, much for the same reasons as their exploring counterparts do—for the chance of discovery. However, these divers see their surroundings in a completely different view. In their eyes, the emphasis is on why and when the cave formed, what forms of life have lived there, what now lives there and why. To them, the huge galleries of stalactites and stalagmites and massive tunnels of gin clear water are simply storage areas of new life and information yet untapped.

Now that these researchers have access to the same new technology as their exploring counterparts, they too are on the fast track to discovery. Each year more new life is discovered in underwater caves than in any other environment on earth. Not just new species, but new genera, families, orders and classes of animal life as well. These "cave critters" come in the form of crustaceans, worms, sponges, fish and even microbes and bacteria.

The objective of the scientific cave diver is to go into these places, sometimes to record distances and depths, in order to collect samples, be it cave critters, water samples or geological material. The trick is then to document the collections, then get themselves and the samples safely out of the cave and on to the lab where the mysteries of these environments can begin to unravel. As if simply going into these technically challenging places was not enough, the scientific cave diver greatly increases his or her task loading with the additional objectives, as well as having to carry an array of various data or sample collection devices.

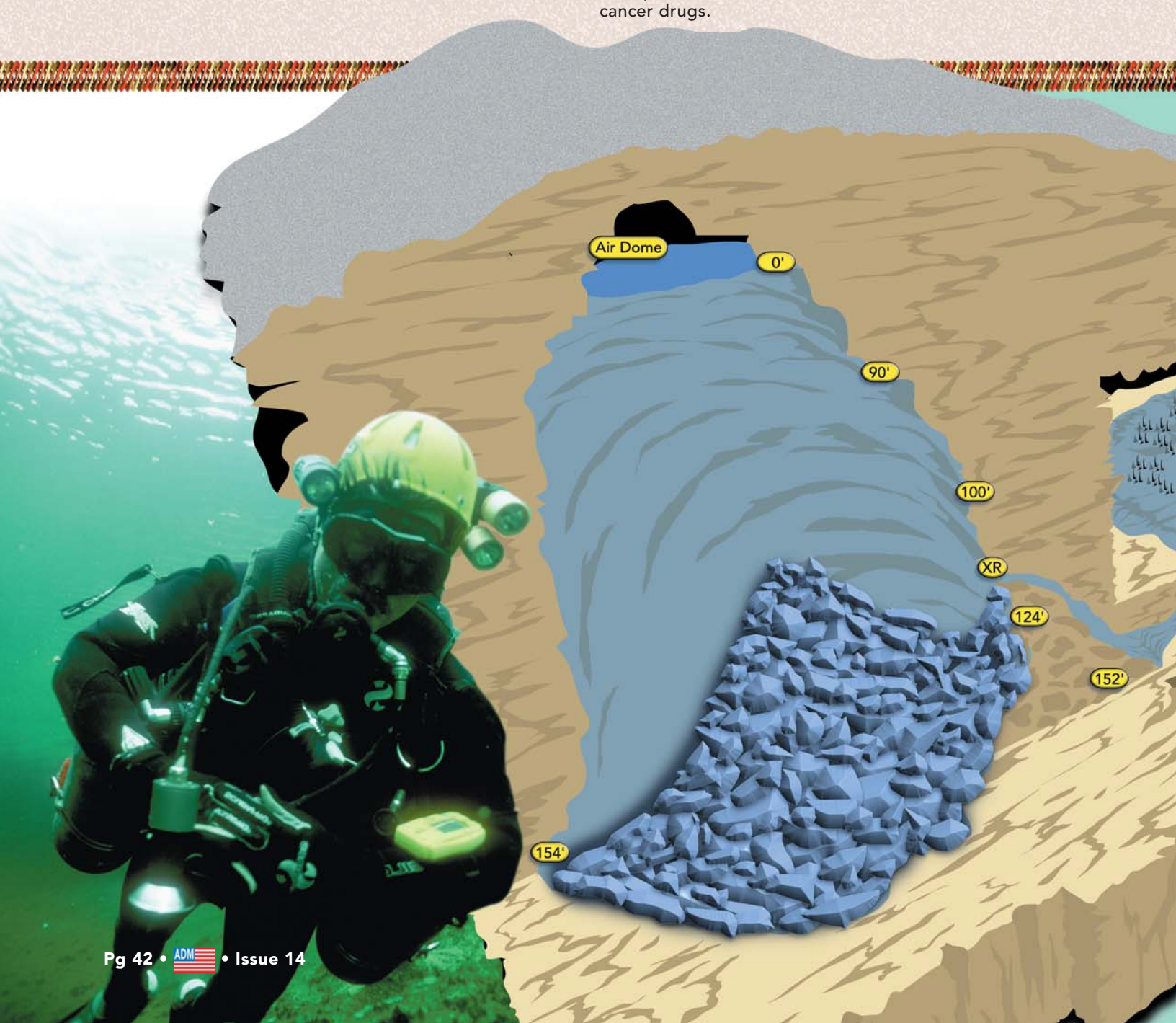
At the Caribbean Marine Research Center (CMRC), several scientists have undertaken the technological challenge of discovering new life and biomedically significant species in one of the most extreme environments left on this planet—the underwater caves and blue holes of the Bahamas.

Dr. Thomas Iliffe of Texas A&M University at Galveston and Dr. Marc Slattery of the University of Mississippi, received grants from the CMRC for investigations into cave environments in the Bahamas. Dr. Slattery's work is focused on bioprospecting, with regards to the microbial defenses of cave sponges and sessile (animals attached to the walls, floor and ceiling of the cave) communities as a possible source of biomedical or agricultural resources. Dr. Iliffe's investigations are that of identifying new forms of cave limited marine life, concentrating on troglobitic (cave adapted)crustaceans.

While conducting collections in Basil Minn's Blue Hole, an inland blue hole previously explored by Brian Kakuk, Dr. Iliffe and Brian passed a restriction only 18 inches in height, at a depth of 165 feet and more than 1,000 feet into the cave. Once this restriction was passed, they entered a highly decorated room that ascended back to the surface, though still underground in a large dry dome. Around the deep edges of this room they collected a host of troglobitic crustaceans, including a new species of Speaonebalia, a genus of crustacean found in only two other caves in the world. This scenario has repeated itself in hundreds of underwater caves around the world. Every time researchers enter a new site, there is very good chance that they will find something new to science.

**Chemical Warfare**

In the case of cave sponges and bacteria, each colony is documented either on the survey map, or via underwater video or photograph and measured prior to being collected. Dr. Slattery has been collecting and monitoring cave sponge colonies in several extensive underwater cave systems in the Exuma Cays over the last few years. His findings have revealed many new species of sponges, as well as identifying the chemical defenses that these animals use in the caves. There is literally chemical warfare going on between these sessile animals within the cave. Each sponge has developed a unique chemical that will help it "defend its turf" against other, fast-growing colonies that may be competing for the same space. Dr. Slattery is looking at the chemicals of sponges and many different types of cave bacteria for their potential use as anti-bacterial agents or even anti-cancer drugs.



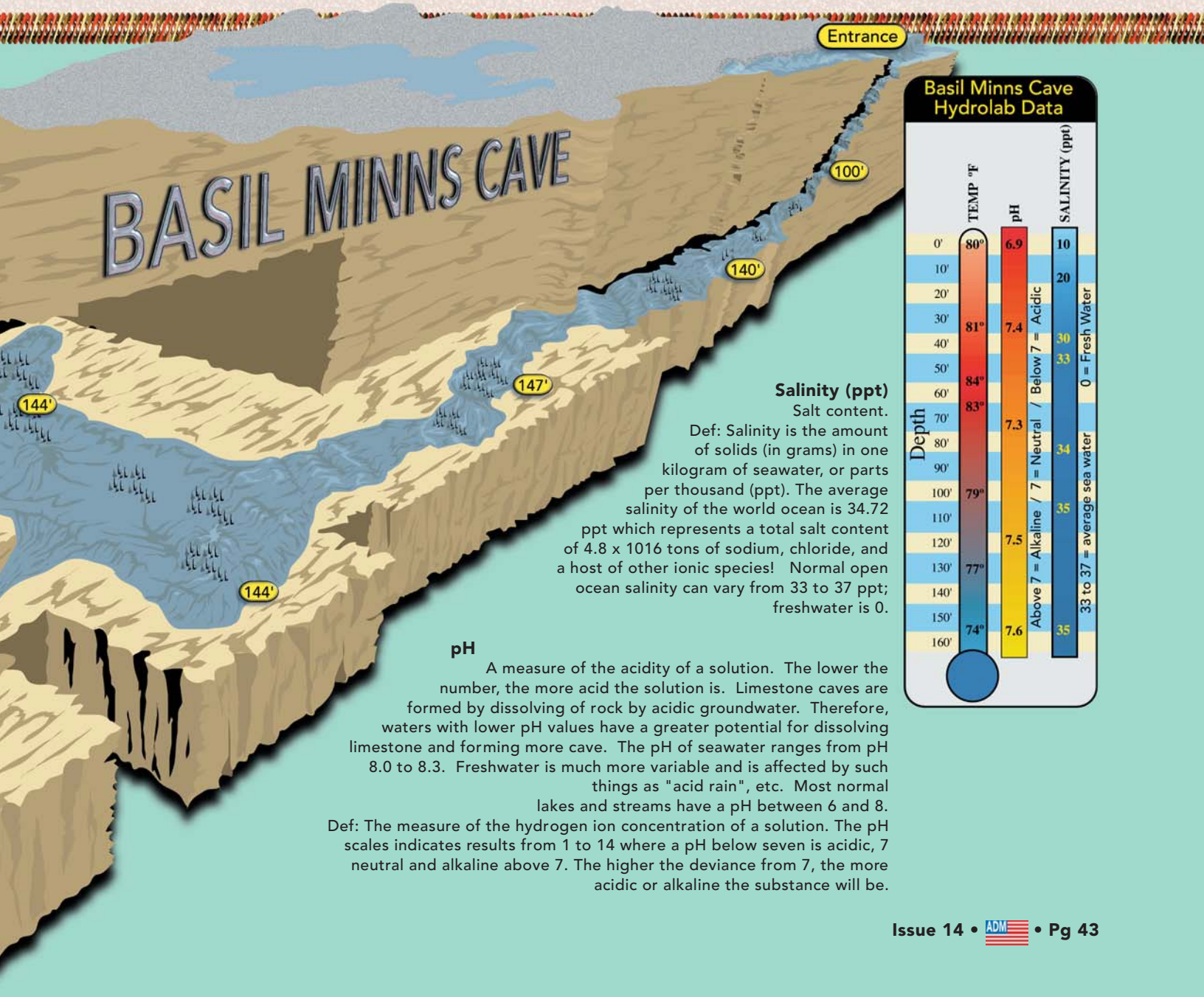
**Biological Collections in Caves**

It does not necessarily take a rocket scientist (or even a marine biologist) to physically collect any particular cave organism, but the manner in which the sample is collected, how it is stored, and information about the environment that the sample was collected in all must be meticulously documented.

Collections are conducted by the use of several fairly basic devices. Suction bottles with one-way valves, small plankton nets, small traps and the never-ending supply of zip-lock bags usually make up the arsenal of tools used by the cave diving scientist.

The use of several collection devices for any particular group of critters (and keeping them all in order and documented) is absolutely necessary. Unfortunately, this increases task loading, as well as the profile and drag of the diver. Plankton nets are a good solution for near-microscopic animals, but again can be particularly unwieldy in a small or high-current cave, such as is found in the Bahamas.

Researchers must keep in mind that some cave organisms are very opportunistic, and if collected in the same device as their prey, can wreak havoc on the other life forms in the collector. One example is collecting cave amphipods in the same device as, say, a small shrimp or thermosbeanaceans (small crustaceans). One would think that the stress of being captured would keep the predators from even considering a meal. But the reality is that by the time the sample makes it to the lab, the amphipods will have reduced the rest of the animals in the device to a pile of legs, antennae and assorted shell parts. This leaves the researcher nothing more than a jigsaw puzzle of crustacean parts to sort out back at the lab.




**Salinity (ppt)**
Salt content.
Def: Salinity is the amount of solids (in grams) in one kilogram of seawater, or parts per thousand (ppt). The average salinity of the world ocean is 34.72 ppt which represents a total salt content of 4.8 x 1016 tons of sodium, chloride, and a host of other ionic species! Normal open ocean salinity can vary from 33 to 37 ppt; freshwater is 0.

**pH**
A measure of the acidity of a solution. The lower the number, the more acid the solution is. Limestone caves are formed by dissolving of rock by acidic groundwater. Therefore, waters with lower pH values have a greater potential for dissolving limestone and forming more cave. The pH of seawater ranges from pH 8.0 to 8.3. Freshwater is much more variable and is affected by such things as "acid rain", etc. Most normal lakes and streams have a pH between 6 and 8.
Def: The measure of the hydrogen ion concentration of a solution. The pH scales indicates results from 1 to 14 where a pH below seven is acidic, 7 neutral and alkaline above 7. The higher the deviance from 7, the more acidic or alkaline the substance will be.

**Geological sampling**

One source of information obtained from the collection of speleothemes (stalactites, stalagmites and flowstone formations) in deeper caves is the history of our planet's sea level rises and falls. The Bahamas is considered one of the most tectonically stable carbonate platforms in the world, giving researchers a benchmark in which to study the extents of both high and low sea levels throughout the glacial and interglacial periods. This information is particularly useful for researchers in regards to our current global warming issues.

Two stalagmite samples from Basil Minn's Blue Hole on Great Exuma Island have been sent to Dr. Peter Swart at the University of Miami's Rosenstiel School of Marine and Atmospheric Sciences (RSMAS) for dating. Brian Kakuk collected both samples from a depth of 165 feet.

Dr. Swart dated the formations at 21,000 to 26,000 years old, giving us a very good indication of the age of the cave, and when the sea levels were low enough to create the cave and the formations.

**Scientific Responsibility**

The collections made by researchers are by no means haphazard. Each site is considered individually for its ability to sustain the collections and the effect that the collections might have on the eco-system within. Special permits are required by state or federal agencies prior to anything coming out of the cave. Most divers are keenly aware that the collection of formations is a taboo activity in caves. Again, special permits and meticulous selection of the collection site must be considered prior to what can only be described as defacing the cave. If there is not a specific question that can be answered with a particular sample, then it should not be considered for collection.

**A Never Ending Search**

As explorers continue to reveal more and more new caves, the researchers will continue to be right behind or even beside them. Each has their own reason for being there and each will continue to make significant discoveries that will allow us to better understand our world in the past, present and future.

*Brian Kakuk is the Diving Safety Officer of the Caribbean Marine Research Center on Lee Stocking Island, Bahamas. He has been conducting deep exploration and research diving activities in the underwater caves of the Bahamas for the last 15 years and is also the Director of the Bahama Caves Research Foundation, a not-for-profit organization for the exploration, research and conservation of underwater caves and blue holes in the Bahamas.*


# SEA FEVER

## Bahamas Diving Adventure

**Text by Jeff Barris**
**Photography by Tom Isgar and Curt Bowen**

Diving with conventional open circuit scuba gear is the way that most of us land folk basically began our diving careers. And for most of us, this is the way that we will continue to dive for many years to come. Along with the likelihood of seeing more than 20,000 different species of pretty little fish and underwater oddities, it's the serenity and silence that probably best describes one of our main reasons for strapping on a tank full of air and leaving dry land to enter this tranquil, yet relatively unexplored, world. When we breathe through an open circuit scuba regulator during a dive, we simultaneously hear and accept the delivered air as it flows past our awaiting mouths and into our lungs. Moments later we exhale, expelling the old air out in the form of bubbles that leaves the exhaust port of our regulator which then scatters about our heads and ascends toward the surface in a flurry of disorganized, sky rocketing spheres. During this repeated process of life support, we imagine these expelled bubbles are relatively quiet in nature, only making a few faint, quiet pops and burps along their ride up to the surface. Well, contrary to what you've read in your last fortune cookie, this is the furthest from the truth.

Most of us know from our basic open-water, scuba course and elementary science class that sound travels much quicker in water than it does on dry land. Armed with this abundance of scientific knowledge stored in our orb shaped appendages atop our shoulders, we now know that our exhaust bubbles create nothing but a whole lot of noisy racket, which understandably shatters the undersea silence we all desperately crave, thus proving this theory of sound. Now aren't you glad you paid attention in class? Adding to this sensation which we perceive through our hearing organs, sea creatures big and small quickly shy away from us, foiling our chances at really close encounters and frustrating the underwater photographer looking to take that "perfect shot." So, why not tone things down a bit and make a few "close friends." How am I suppose do that, Einstein, you say? Easy my frog-footed friends. The answer is re-breathers.

What is a rebreather?

In a nut shell a re-breather is a self contained underwater breathing apparatus (scuba) that works by recycling one's exhaled breath which holds a mountain of carbon dioxide, water vapor and around 16 percent oxygen (the stuff inside those noisy exhaust bubbles). By removing the carbon dioxide through a scrubber device filled with soda lime and adding a fresh batch of new air (nitrox), which is then mixed together and delivered to the diver over and over again, we sustain life. Easy, isn't it? This cycle, although quite simple, keeps us quiet and virtually bubble free.

Under the cover of darkness ADM Publisher Curt Bowen and I boarded the Miami-based vessel, Sea Fever, for a week of live aboard diving in the beautiful Bahamas. Our mission was to casually mingle and dive among a group of strong, silent types. You know, "re-breather divers." No, not any of those lean, mean, navy-seal types with their painted green faces shouting "Hoo Ya" along the way. Just a group of normal folks like you and me. Our objective this week was to further report on what all of the "hush, hush" is all about on diving these silent scuba units and publish our findings for the world to see.

After our was gear neatly stowed below, we settled in and became acquainted with this savvy group that recently escaped their winter doldrums to thaw out a bit on a tropical training trip surrounding the proper use of semi-closed re-breathers, namely the drager dolphin.

For most of us it was our first time aboard the 90-plus-foot Sea Fever. But from the look of this newly refurbished vessel's spacious deck, cozy salon, and quaint guest quarters, we decided she'd do just fine as our home, classroom and dive platform for the next week. Accompanying us on this trip was Sea Fever's very own charter manager Deanna Kenny. Deanna is a "fins on" kind of manager who effortlessly displays her professional ability in everything she takes on. Her no non-sense approach of how things are supposed to run out in the "field" resulted in nothing but smooth sailing for everyone aboard. The rest of the cast of characters ranged from dive shop owners to course directors, with a few hard core wreck divers in between. We also had aboard an observer, H.B.Caak, a noted trimix instructor trainer and single engine airplane pilot who has logged thousands of dives in many environments, including virgin cave systems and deep shipwrecks. He accompanied us on most of our dives.

**School Is In Session**

The practical portion of our re-breather training was held in the beautiful Bimini and Andros Islands. These islands are included in the 700 individual, land masses scattered about in the Bahaman chain of coral islands and atolls that include Grand Bahama, Nassau, Eleuthra, San Salvador, Conception Island and the Exumas. Collectively, this massive puzzle of coral landmasses assembles nicely in a spectacular turquoise bath of unspeakable beauty above and below the surface. I was told from the Sea Fever's captain that we would expect soothing tropical breezes, toasty water temperatures, and 100 foot or more visibility. And, of course, "The Captain's word is law."

During our semi-bumpy ocean crossing from Miami to Bimini, both of our re-breather instructors, Don Beiger and Nick Jenny, stayed busy schooling this eager group during their 30-mile jaunt across the sea. Both instructors interject as one while reviewing material and firing out important technical data such as flow rates, PO2's, scrubber duration, unit nomenclature, along with a multitude of pre and post dive checks, ensuring a full understanding was had by all.

With the classroom theory finally behind us and upon clearing customs, it was time to finally "wring out" these so-called silent scuba machines. And for the next several days, that is exactly what we did. Imagine how thrilling it would be to sneak up on all of the critters that once bolted from you in the past. Well, it is! As we got accustomed to our new units, we began see this new, welcomed transformation from foe to friend taking place, realizing how nice it was to really "fit in" with the local fish population. It was nothing but pure diving delight.

During our tremendous "Sea Fever Week" of island hopping, we spent hours upon hours sharing this crystalline ocean real estate with a multitude of friendly fish inhabitants. Species such as Butterfly fish, Blue tang, Squirrel fish, along with a few spotted morays were just a few of the many life forms seen at our first stop, called Blue Cronis. At our next dive location, which was aptly named, Fish Market, we drifted like feathers in the breeze past a planted seabed of wide mesh sea fans that seemed to greet us by slowly waving as we passed them by. Schools upon schools of fish smothered us and the reefs in which they resided. We further witnessed an orchestrated ensemble of angular sea whips and numbers of finely textured swollen knob candelabrum which separated a vertical swimming trumpet fish from its neighbor, the brilliantly painted French angelfish.

At yet another great location called Mama Rhoda's rock, our re-breathers allowed us to come within inches of a chubby little Nassau grouper and a small showing of damsels who shared a section in a garden of sprouting brain corals. On every dive during the day and night, our group finned and photographed bubble free among this underwater garden of amazing marine life, covered reefs, walls and wrecks. Depths ranged from 29 to 130 fsw. The abounding marine life looked like a "who's who" amongst fish. The vast varieties of corals we further marveled at had us completely mind boggled — not to mention the heart pounding shark dive we did mid week.



During that dive, a number of feisty Caribbean reef and a couple of less aggressive nurse sharks vigorously darted in all directions in underwater food fight frenzy, while huge grouper, yellowtail and jacks made sure the perimeter was clean of the leftover scraps. We even witnessed from above, a few dives from a couple of amazing kamikaze sea birds that seemed to enjoy living on the edge as they chanced crashing in on this party from above during this crazed eating event. Above the waterline, our stress-free surface intervals were done in typical "Sea Fever fashion," soaking up a few tropical sunrays and relaxing in a lounge chair with an ice cold soft drink and tasty snack.

Once our re-breather checks were completed and the units were set to dive, it was time to enjoy some of the incredible eats and scrumptious snack fare that awaited us. After a day's diving it was on to the real food that consisted of the tastiest cuisine I think I've ever eaten. Our chef, Red, performed his non-stop culinary magic at every sitting. From his spectacular marinated grilled tuna steaks, accompanied with a spicy wasabi sauce, to his mouth watering, melt in your mouth, prime rib, life at sea does not get better.

The grand finale of this trip was a liberty call on the quaint little island of Bimini. Our group welcomed "terra firma" as they strolled up and down the rickety streets, casually browsing in the various shops, buying up a few island trinkets and your standard souvenir T-shirts. The rest of the evening was spent dancing the night away with some sensation rum drinks and friendly conversation. All in all, it was a perfect way to spend some quiet time in the Bahamas.

Special thanks to Don Beiger of Hunterdon Scuba, Nick Jenny of Blue Horizons Dive Shop, and to the captain and entire crew of the Sea Fever.

Exploration Technology Continues

# HELIUM DIVE COMPUTER

# NiTek He

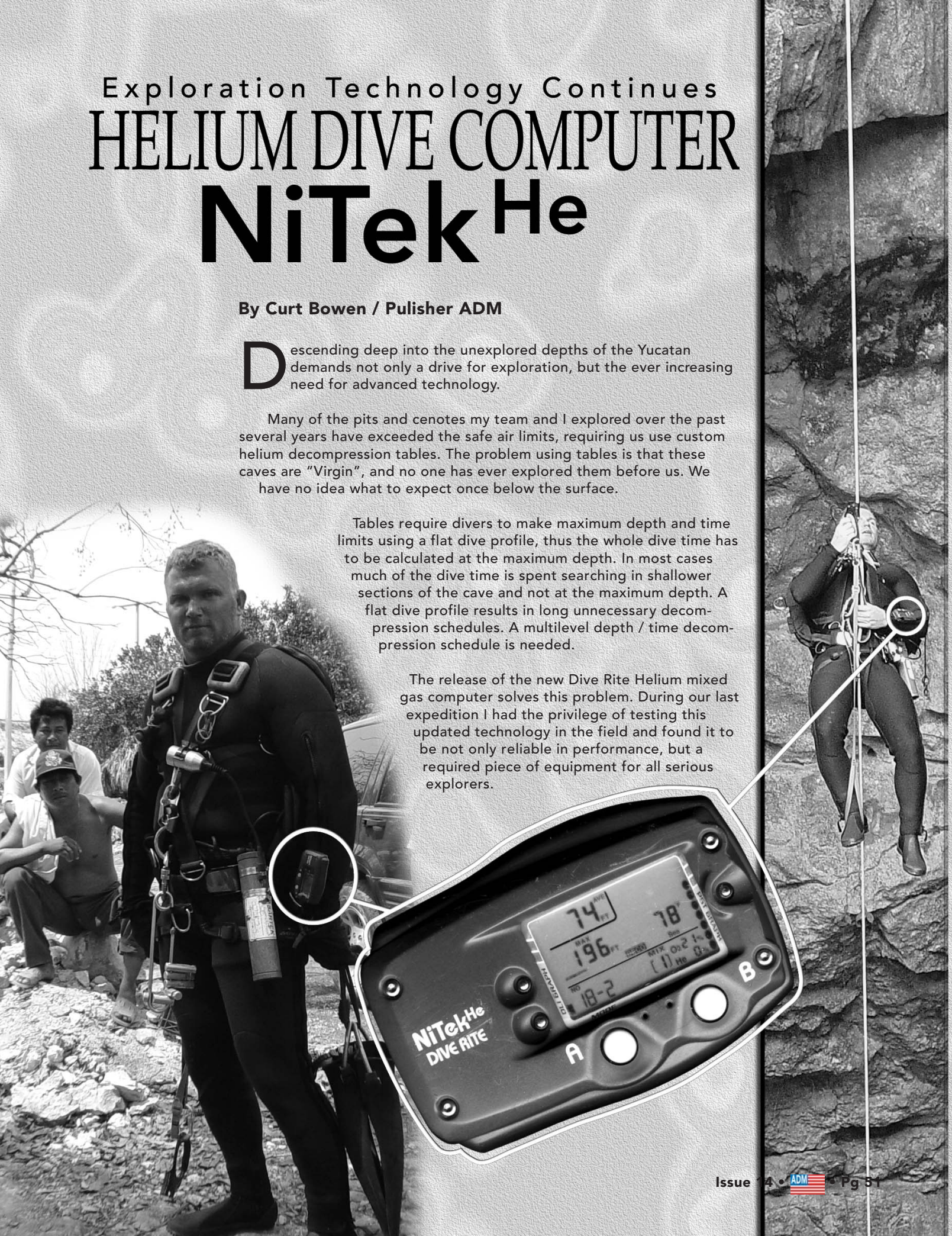
**By Curt Bowen / Pulisher ADM**

Descending deep into the unexplored depths of the Yucatan demands not only a drive for exploration, but the ever increasing need for advanced technology.

Many of the pits and cenotes my team and I explored over the past several years have exceeded the safe air limits, requiring us use custom helium decompression tables. The problem using tables is that these caves are "Virgin", and no one has ever explored them before us. We have no idea what to expect once below the surface.

Tables require divers to make maximum depth and time limits using a flat dive profile, thus the whole dive time has to be calculated at the maximum depth. In most cases much of the dive time is spent searching in shallower sections of the cave and not at the maximum depth. A flat dive profile results in long unnecessary decompression schedules. A multilevel depth / time decompression schedule is needed.

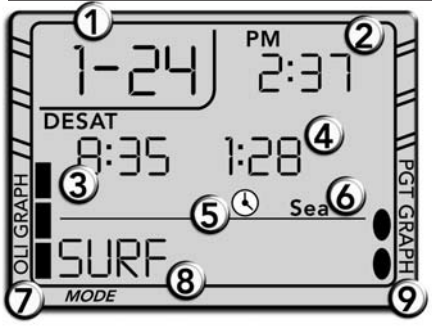
The release of the new Dive Rite Helium mixed gas computer solves this problem. During our last expedition I had the privilege of testing this updated technology in the field and found it to be not only reliable in performance, but a required piece of equipment for all serious explorers.



The NiTek He allows you to use one computer to dive Air, Nitrox, Heliox, Trimix, Oxygen or any combination of these gasses. You can program up to seven different gas mixes per dive. FO2 can be set for 8%-99%. Bar graphs displayed on the screen help you to monitor your exposure to inert gasses and oxygen. It provides a constant display of your current PO2 level while diving.

Large push buttons make it easy to set oxygen and helium percentages, to switch mixes, and access information under water. The NiTek He has a backlit display on demand. The NiTek He's case contains a separate battery compartment for its long-life, user-replaceable battery. Divers can upload dive data to NiTekLogic using Dive Rite's optional PC interface. The NiTek He will also work hand in hand using Dive Rite's Dive Voyager Decompression Planning Software.


## Surface Mode

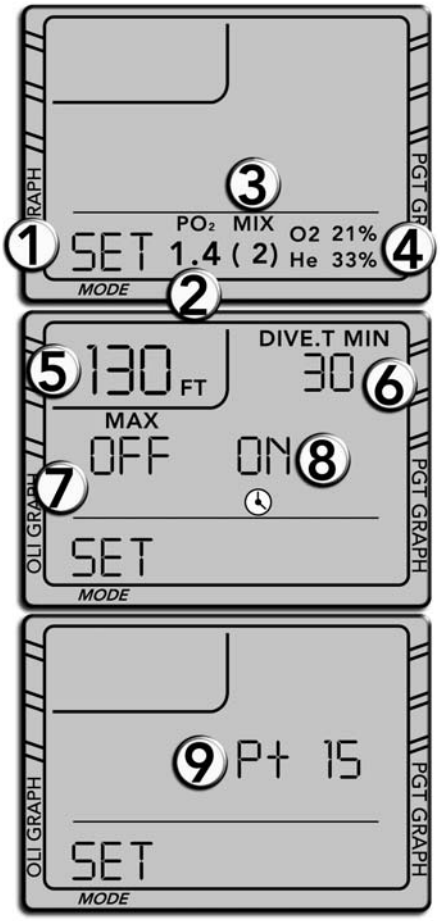



1. Date
2. Time
3. Desat Time
4. Surface Time
5. Alarm
6. Fresh/Salt
7. O2 Limit
8. Mode
9. Pressure of gas in tissue graph.

The surface mode is the Nitek He's default mode. The computer automatically returns to this mode upon surfacing from dive mode, and from other display modes after two to three minutes of inactivity.

The above display is how the computer appears when it calculates that there is still residual inert gas remaining in the users body after a dive.

## Dive Set Mode

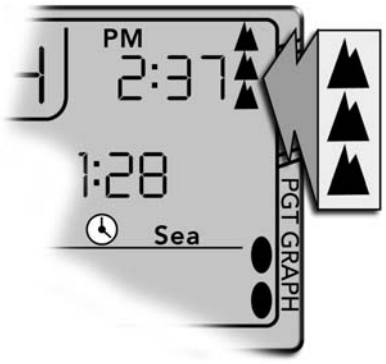



1. Mode
2. PO2 Alarm Value
3. Mix Number
4. FO2 FHe
5. Max depth alarm value
6. Max time alarm value
7. Max depth alarm on/off
8. Max time alarm on/off
9. Sampling rate

The Dive Set Mode is where you set important parameters such as Fraction of Oxygen / Helium, PO2/ Depth/Time warnings and sampling rate. It is also where you can switch to Gauge mode, or back to dive computer mode.

While in Gauge Mode the Nitek He only acts as a bottom timer and depth gauge to 656 fsw / 200m. Once you have conducted a dive in Gauge Mode, you cannot return to dive mode until at least 48 hours after the dive.

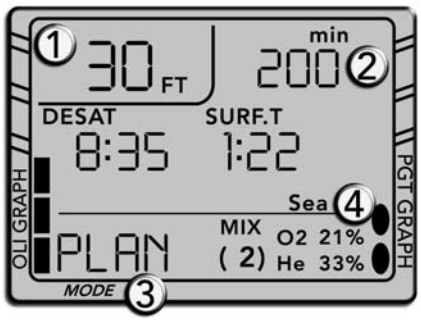
## Altitude Symbols




0 Sea Level to 2,624'
1 2,624' to 5,248'
2 5,248 to 7,872'
3 7,872' to 19,680
Err Above 19,680 (Out of Range)

The Nitek He adjusts automatically for diving at altitude of up to 19,680 ft / 6,000 m. To show that it has made this adjustment, the Nitek He displays its altitude settings using either the no altitude symbol, from one to three mountain symbols, or the letters Err.

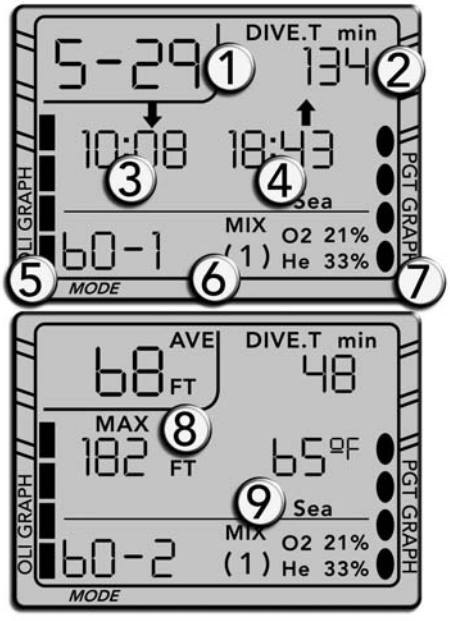
## Plan Mode




1. Plan Depth
2. No Decompression Limit
3. Mode
4. Mix Gas Settings

The Nitek He Plan Mode enables the diver to answer the question, "If I enter the water right now, how long can I stay at various depths while remaining within the Nitek He's No-Decompression Limits?" It is designed to help plan single-mix, no decompression dives.

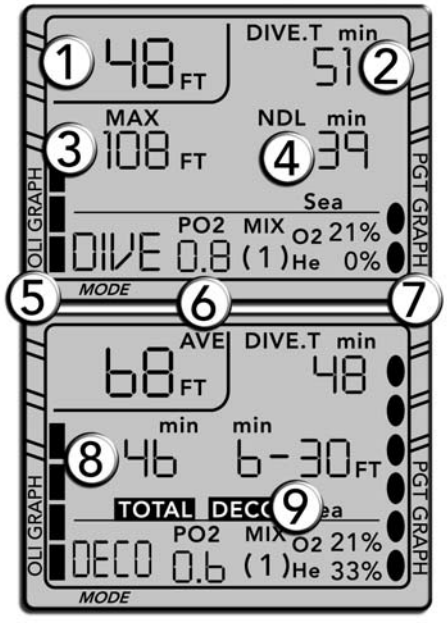
## log Mode




1. Date
2. Bottom Time
3. Descent Time
4. Ascent Time
5. O2 Limit at end of dive
6. Mix number and corresponding gas settings
7. PGT at end of dive
8. Average and max depths of dive
9. Coldest temperature during dive

The Nitek He Log Mode can store and display data from up to 30 hours or 60 dives/ This makes it possible for the user to make series of dives, then later transfer key dive data to a separate log book, or upload it to a personal computer using the NiTekLogic software and PC interface.

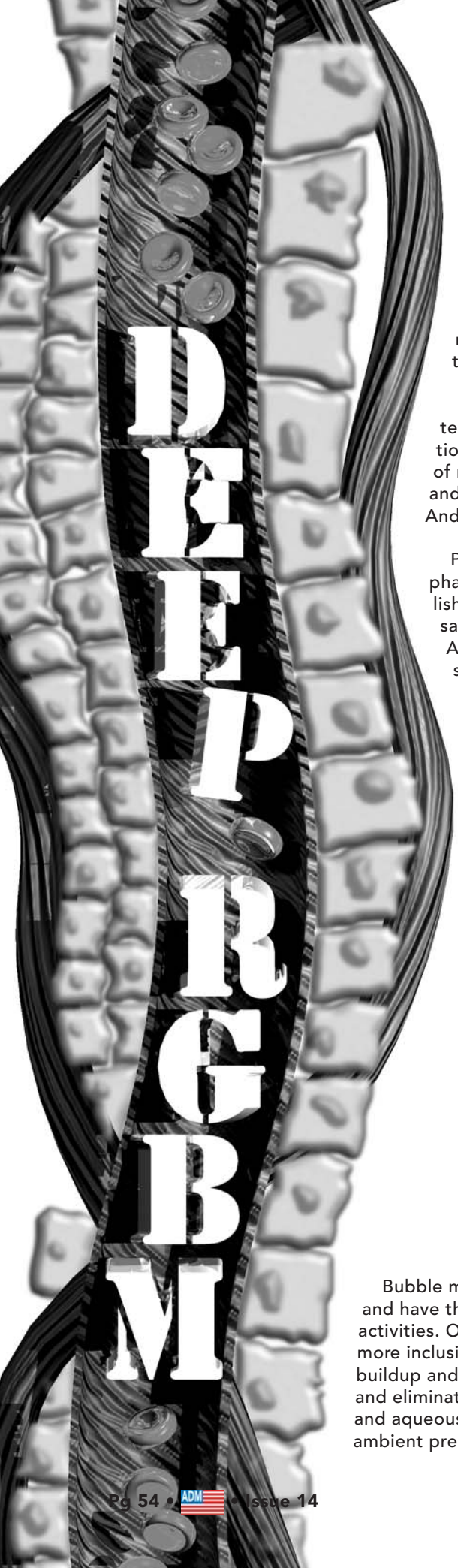
## Dive Mode




1. Current Depth
2. Current Bottom Time
3. Max Depth
4. Remaining NDL
5. Current O2L
6. Current PO2
7. Current PGT
8. Total ascent time, including minutes
9. First or current stop depth and stop time

The Nitek He enters the Dive Mode automatically. What you will see displayed on the computer's screen will depend on whether you are making a decompression or no-decompression dive.

www.DiveRite.com




## By B.R. Wienke and T.R. O'Leary
## NAUI Technical Diving Operations

The RGBM grew from needs of technical divers to more efficiently stage ascents consistent with coarse grain dissolved gas and bubble dynamics, and not just dissolved gas (Haldane) constraints. And the depth, diversity, mix variation, and self consistency of RGBM diving applicability has satisfied that need. And safely.

The RGBM has gained tremendous popularity in the recreational and technical diving worlds in just the past 2 - 3 years, due to meter implementations, Internet software packages, specialized Table releases, technical word of mouth, NAUI training testing and adoption, Internet traffic, chamber tests, and, most of all, actual technical and recreational RGBM diving and validation. And the reasons are fairly clear.

Present notions of nucleations and bubbles suggest that decompression phase separation is random, yet highly probable, in body tissue. Once established, a gaseous phase will further grow by acquiring gas from adjacent saturated tissue, according to the strength of the free-dissolved gradient. Although exchange mechanisms are better understood, nucleation and stabilization mechanisms remain less so, and calculationally elusive. But even with a paucity of knowledge, many feel that existing practices and recent studies on bubbles and nuclei shed considerable light ongrowth and elimination processes, and time scales. Their consistency with underlying physical principles suggest directions for table and meter modeling, beyond parameter fitting and extrapolation techniques. Recovering dissolved gas algorithms for short exposure times, phase models link to bubble mechanics and critical volume trigger points. The RGBM incorporates all of the above in all implementations, and additionally supports the efficacy of recently suggested safe diving practices, by simple virtue of its dual phase mechanics:

- reduced nonstop time limits;
- safety stops (or shallow swimming ascents) in the 10-20 fsw zone;
- ascent rates not exceeding 30 fsw=min;
- restricted repetitive exposures, particularly beyond 100 fsw,
- restricted reverse profile and deep spike diving;
- restricted multi day activity;
- smooth coalescence of bounce and saturation limit points;
- consistent diving protocols for altitude;
- deep stops for decompression, extended range, and mixed gas diving with overall shorter decompression times, particularly for the shallow zone;
- use of helium rich mixtures for technical diving, with shallower isobaric switches to nitrox than suggested by Haldane strategies;
- use of pure oxygen in the shallow zone to eliminate both dissolved and bubble inert gases.

Bubble models tend to be consistent with the utilitarian measures detailed above, and have the right signatures for diving applications across the full spectrum of activities. Or, said another way, bubble models are more powerful, more correct, and more inclusive. In terms of RGBM implementations, the mechanistic of dissolved gas buildup and elimination, inert gas diffusion across bubble interfaces, bubble excitation and elimination persistence time scales of minutes to hours from tissue friction, lipid and aqueous surfactant material properties, and Boyle expansion and contraction under ambient pressure change, are sufficient to address all of the above considerations.

## STAGING AND RGBM COMPARISONS

Here, we comparatively look at the coarse bases of both meter and diveware implementations of the RGBM algorithm, one with extended range of applicability based on simple dual phase principles. Haldane approaches have dominated decompression algorithms for a very long time, and the RGBM has been long in coming on the commercial scene. With recent technical diving interest in deep stop modeling, and concerns with repetitive diving in the recreational community, phase modeling is timely and pertinent.

### Nonstop Comparisons

So, the first question is how does the RGBM compare with classical Haldane models as far as staging ascents, limiting multiexposures, and treating mixed gases? Generally, for short nonstop air diving, the RGBM reproduces the Spencer limits. For multidiving in spans shorter than 1-3 hr, the RGBM reduces nonstop limits by 10% to 20% depending on surface interval, depth, altitude, and duration of present and previous dive, Multiday diving is impacted to lesser degree. Some comparisons appear in Table 1 for 3 days of repetitive air diving (120 fsw/10 min twice a day with 45 min surface interval). Computer choices are illustrative, not indictive.

**Table 1. Nonstop Limits For RGBM And Haldane Air Multidiving**

| | Day One | | Day Two | | Day Three | |
|---|---|---|---|---|---|---|
| Computer/Algorithm | Dive1 | Dive2 | Dive3 | Dive4 | Dive5 | Dive6 |
| VYTEC, EXPLORER/RGBM | 10 | 6 | 9 | 5 | 9 | 5 |
| COBRA/Spencer | 10 | 9 | 10 | 9 | 10 | 9 |
| DATA PLUS/USN | 12 | 6 | 12 | 6 | 12 | 6 |
| DELPHI/USN | 10 | 10 | 10 | 10 | 10 | 10 |
| ABYSS/RGBM | 6 | 6 | 6 | 6 | 6 | 6 |
| DC12/ZHL | 9 | 7 | 9 | 7 | 9 | 7 |
| ALADIN/ZHL | 8 | 8 | 8 | 8 | 8 | 8 |
| ALADIN PRO/ZHL | 10 | 7 | 10 | 7 | 10 | 7 |
| SOURCE/USN | 12 | 9 | 12 | 9 | 12 | 9 |

**Table 2**

Lists nonstop time limits for RGBM (first dive).

**Table 3**

Lists nonstop time limits for ranged trimix, that is, 13% to 17% helium, 61% to 53% nitrogen, and 26% to 30% oxygen, according to RGBM and ZHL (Buhlmann).

**Table 2. Air (first dive) Nonstop Limits For RGBM**

| Depth | Min |
|---|---|
| 40 | 120 |
| 50 | 69 |
| 60 | 51 |
| 70 | 36 |
| 80 | 28 |
| 90 | 22 |
| 100 | 17 |
| 110 | 13 |
| 120 | 10 |
| 130 | 9 |
| 140 | 7 |

**Table 3.**
**26-30% Oxygen**
**13-17% Helium**
**53-61% Nitrogen**
**Trimix Nonstop Limits For RGBM And ZHL (Haldane)**

| depth (fsw) | RGBM (min) | ZHL (min) |
|---|---|---|
| 80 | 28 | 26 |
| 90 | 23 | 22 |
| 100 | 19 | 18 |
| 110 | 16 | 15 |
| 120 | 14 | 13 |
| 130 | 12 | 11 |
| 140 | 11 | 10 |
| 150 | 10 | 9 |

These limits are used by NAUI Technical Diving for training purposes. While both sets of nonstop time limits are different in Tables 1 and 3, the more dramatic effects of the RGBM show up for deep staging, as seen in Table 4.

**Table 4.**
**16% Oxygen 33% Helium 51% Nitrogen**
**Deep Schedules According To RGBM And ZHL (Haldane)**

| | depth (fsw) | ZHL (min) (standard) | RGBM (min) (standard) | ZHL (min) (safer) | RGBM (min) (safer) |
|---|---|---|---|---|---|
| Depth 250 fsw Bt 30 min 16% $O^2$ 33% He 51% $N^2$ | 180 | 0 | 0 | 0 | 1 |
| | 170 | 0 | 1 | 0 | 1 |
| | 160 | 0 | 1 | 0 | 1 |
| | 150 | 0 | 1 | 0 | 1 |
| | 140 | 0 | 1 | 0 | 2 |
| | 130 | 0 | 2 | 0 | 2 |
| | 120 | 0 | 2 | 0 | 2 |
| | 110 | 0 | 2 | 1 | 2 |
| | 100 | 0 | 2 | 2 | 2 |
| | 90 | 2 | 2 | 3 | 3 |
| AIR | 80 | 2 | 2 | 4 | 3 |
| | 70 | 2 | 3 | 5 | 4 |
| | 60 | 5 | 5 | 8 | 6 |
| | 50 | 7 | 6 | 12 | 7 |
| | 40 | 12 | 9 | 18 | 19 |
| | 30 | 18 | 12 | 28 | 13 |
| O2 | 20 | 16 | 10 | 28 | 11 |
| | 10 | 28 | 16 | 48 | 18 |
| Total Minutes | | **93** | **77** | **147** | **98** |

### Deep Comparisons

Comparative deep schedules for a trimix dive to 250fsw for 30 min are contrasted, following a switch to air at 100 fsw and a switch to pureoxygen at 20 fsw on the way up. RGBM and ZHL are again employed, but with and without conservative safety knobs. In the case of ZHL, the outgassing tissue halftimes are increased by 1.5 in the conservative case, while for RGBM the bubble excitation radius is increased by 1.2 for comparison. Deeper stops are noticeably requisite in RGBM, but total decompression times are less than ZHL. The trimix is 33% helium, 51% nitrogen, and 16% oxygen.

### Helium Comparisons

On most counts, helium appears superior to nitrogen as a diving gas. Helium bubbles are smaller, helium diffuses in and out of tissue and blood faster, helium is less narcotic, divers feel better when they leave the water after diving on helium, and helium minimum bends depths are greater than nitrogen minimum bends depths.

**Table 5**

A comparison of enriched air and enriched heliair decompression diving, with a switch to 80% oxygen at 20 fsw. Dive is 100 fsw for 90 min, on EAN 35 O2 and EAH 35 O2/18 HE (nitrox 35/65 and trimix 35/18/47), so oxygen enrichment is the same. The decompression profile is listed Table 5. Descent and ascent rates are 75 fsw/min and 25 fsw/min.

**Table 5. Enriched Air and Heliair Deco Profile Comparison**

| depth (fsw) | Enriched Heliair EAH 35/18 stop time (min) | Enriched Air EAN 35 stop time (min) |
|---|---|---|
| 100 | 90 | 90 |
| 30 | 2 | 4 |
| 20 | 5 | 7 |
| 10 | 12 | 11 |
| | 119 | 122 |

Overall the enriched heliair decompression schedule for the dive is shorter than for the enriched air. As the helium content goes up, the decompression advantage for enriched heliair increases.

**Depth 400 fsw 10 min Bottom Gas**
**10% $O^2$ 65% He 25% $N^2$**

**Table 6. Comparative Helium and Nitrogen Gas Switches**

| depth (fsw) | stop time (min) | stop time (min) |
|---|---|---|
| | Tx 10/65/25 | Tx 10/65/25 |
| 400 | 10.0 | 10.0 |
| 260 | 1.5 | 1.5 |
| 250 | 1.0 | 1.0 |
| 240 | 1.0 | 1.0 |
| | Tx 18/50/32 | Tx 18/50/32 |
| 230 | 0.5 | 0.5 |
| 220 | 0.5 | 0.5 |
| 210 | 0.5 | 0.5 |
| 200 | 0.5 | 0.5 |
| 190 | 1.0 | 1.0 |
| 180 | 1.5 | 1.5 |
| 170 | 1.5 | 1.0 |
| 160 | 1.5 | 1.5 |
| 150 | 1.5 | 2.0 |
| 140 | 2.0 | 1.5 |
| 130 | 2.0 | 2.5 |
| 120 | 4.0 | 4.0 |
| 110 | 4.5 | 4.0 |
| | Tx 40/20/40 | EAN40 |
| 100 | 2.5 | 2.0 |
| 90 | 2.5 | 2.0 |
| 80 | 2.5 | 2.0 |
| 70 | 5.0 | 4.0 |
| 60 | 6.5 | 5.5 |
| 50 | 8.0 | 6.5 |
| 40 | 9.5 | 7.5 |
| | EAN80 | EAN80 |
| 30 | 10.5 | 10.5 |
| 20 | 14.0 | 14.0 |
| 10 | 21.0 | 20.5 |
| | 123.0 | 116.0 |

This may surprise you. But either way, now check out corresponding USN or ZHL decompression requirements for these dives. In the enriched heliair case, ZHL decompression time is 39 min versus 19 min above, and in the enriched air case, ZHL decompression time is 33 min versus 22 min above. This not only underscores helium versus nitrogen misfact in staging, but also points out significant differences in modern algorithms versus Haldane. Lastly consider a deep trimix dive with multiple switches on the way up.

**Table 6**

Contrasts stop times for two gas choices at the 100 fsw switch. The dive is a short 10 min at 400 fsw on 10/65/25 trimix, with switches at 235 fsw, 100 fsw, and 30 fsw. Descent and ascent rates are 75 fsw/min and 25 fsw/min. Obviously, there are many other choices for switch depths, mixtures, and strategies. Below, the oxygen fractions were the same in all mixes, at all switches. Differences between nitrogen or helium, even for this short exposure, are nominal. Such usually is the case when oxygen fraction is held constant in helium or nitrogen mixes at the switch.

Gradient Factor Comparisons

It is also of interest to compare RGBM profiles against other strategies, particularly modern ones. An interesting comparison is seen in Tables 7, 8, and 9, contrasting decompression protocols for the RGBM with those of the Global Underwater Explorers (GUE) DPlan, a decompression planner offering ZHL gradient factor (GF) modifications, Haldane deep stops, and hybrids. The extent of validation of the DPlan models is unknown here. The gradient factor method, or juxtaposing of arbitrary multiplicative factors to Haldane gradients, $G = M - P$, has also been used by DPlan to induce deep stops on Haldane staging. Simple amplification of $G$ in the deep zones will accomplish this.

**Table 7**

15/55 trimix (15% oxygen, 55% helium, rest nitrogen) dive to 250 fsw for 30 min. Descent rate is 99 fsw/min, and ascent rate is 33 fsw/min. A switch is made to EAN50 (50% nitrogen, 50% oxygen) at 70 fsw, and a final switch to pure oxygen is made at 20 fsw.

**Table 7. Deep Trimix RGBM & DPlan Comparison**

| | depth (fsw) | RGBM stop time (min) Tx 15/55/30 | DPlan stop time (min) Tx 15/55/30 |
|---|---|---|---|
| | 250 | 30.0 | 30.0 |
| | 170 | 0.5 | 0 |
| | 160 | 1.0 | 0 |
| | 150 | 1.0 | 1.0 |
| | 140 | 2.0 | 2.0 |
| | 130 | 2.5 | 2.0 |
| | 120 | 2.5 | 2.0 |
| | 110 | 2.5 | 3.0 |
| | 100 | 4.0 | 3.0 |
| | 90 | 5.5 | 6.0 |
| | 80 | 6.0 | 6.0 |
| EAN 50% | 70 | 2.5 | 4.0 |
| | 60 | 3.0 | 5.0 |
| | 50 | 6.0 | 7.0 |
| | 40 | 6.5 | 8.0 |
| | 30 | 9.0 | 15.0 |
| $O^2$ | 20 | 12.0 | 19.0 |
| | 10 | 17.0 | 35.0 |
| | Total | 113.5 | 148.0 |

Down to the first switch onto EAN50, both models track roughly the same. After that, the DPlan calculation requires increasingly more decompression time as the stop depth decreases. This generally occurs when deep stops are juxtaposed onto Haldane staging. Time at depth incurs more decompression time in the shallow zone. This does not occur in the RGBM.

Straightforward application of *ad hoc* gradient factors to the DPlan profiles in the deep zone can induce the deep stops shown. In the shallow zone, DPlan decompression times are more in step with conventional Haldane staging, that is, no gradient factor application and

| Table 8. Deep Trimix RGBM & DPlan Comparison | | | |
|---|---|---|---|
| | depth (fsw) | RGBM stop time (min) Tx 10/70/20 | DPlan stop time (min) Tx 10/70/20 |
| | 300 | 20.0 | 20.0 |
| AIR | 190 | 0.5 | 1.0 |
| | 180 | 0.5 | 1.0 |
| | 170 | 0.5 | 1.0 |
| | 160 | 0.5 | 1.0 |
| | 150 | 1.0 | 1.0 |
| | 140 | 1.0 | 1.0 |
| | 130 | 1.5 | 1.0 |
| | 120 | 1.5 | 1.0 |
| | 110 | 1.5 | 1.0 |
| | 100 | 2.0 | 1.0 |
| | 90 | 2.0 | 1.0 |
| | 80 | 2.5 | 3.0 |
| EAN 50% | 70 | 2.5 | 3.0 |
| | 60 | 3.0 | 4.0 |
| | 50 | 4.0 | 5.0 |
| | 40 | 6.0 | 8.0 |
| | 30 | 9.0 | 11.0 |
| $O^2$ | 20 | 8.0 | 14.0 |
| | 10 | 12.5 | 27.0 |
| | Total | 80.0 | 106.0 |

reduction of decompression times. Of course, in the shallow zone, gradient factors would need to be larger than one to reduce decompression times artificially over Haldane computed values. Gradient factors are neither model nor internally consistent and can be tweaked to fit any arbitrary profile after the fact.

The gradient factor, $\gamma$, is applied to the (Haldane) fixed gradient, G, with resulting critical tension, M, as before. $M = \gamma G + P$ for P ambient pressure. As  gets large, or is increased beyond 1, the required stop depth drops below the depth required for classical Haldane staging. Hence, a deep stop is imposed on the profile. Roughly in applications, $0:40 < \gamma < 1:40$ Though utilitarian to some, this begs the question of consistency and reproducibility across a spectrum of diving activities.

To most of us in the technical and recreational diving worlds, the bottom line is simple.  What works works, and what doesn't is discarded. RGBM works. It incorporates deep stops naturally, underscores the use of helium rich breathing mixtures, and has been tried and tested in the field with many tens-of-thousands of dives by seasoned divers and raw neophytes. Tables, software, meters have incorporated the RGBM. And the RGBM data bank (RGBMdiving.com) has been constructed to store technical mixed gas, deco, and extended range profiles for model tuning, statistical reporting and risk analysis. Without doubt, the RGBM has reshaped decompression horizons and will continue to do so in the future.

# NAUI Deep Stops And Modern Deco Strategies Workshop

The much-heralded NAUI Deep Stops and Modern Deco Strategies Workshop was held in Tampa on February 22, 2003, with 120 people in attendance. By all accounts, it was a very successful meeting, filled with questions and answers for the technical diving community at large.

Speakers included Bruce Wienke from LANL; Alf Brubakk from the University of Trondheim; Mike Powell from NASA; Charlie Lehner from the University of Wisconsin; Jean Pierre Imbert from COMEX; Tom Neumann from the University of California, San Diego; Wayne Gerth from NEDU (USN); George Irvine from WKPP; Rich Pyle from the University of Hawaii; and Tim O'Leary from NAUI Tec Ops.

Talks and papers will be collated by NAUI for distribution to the diving community in a special publication. NAUI also previewed the Tec RGBM Tables for air, nitrox, helitrox, plus trimix OC diving, plus nitrogen and trimix diluent constant $ppO^2$ RB diving. The new deep safety stops protocol for the Rec RGBM Tables was also uncovered, essentially halving the distance to the surface, making a one minute stop there, followed by two minutes in the 15 fsw zone.

The speakers' topics ranged from models and strategies to experiments and data supporting deep stops. The emphasis was on real diving in the real world, real experiments relating to diving, real data collection and field testing supporting deep stops and modern techniques. A backscape of deep stop technology and milestones were presented at the outset of the workshop. Speakers filled time slots with much supporting recent developments. The living laboratory tech community offered corroborative testimonies supporting field experience. Information came from the technical, military, scientific and recreational diving sectors.

Models, like the RGBM, VPM, and TBDM, are models that work, have been extensively employed and offer the best means to close theory, experiment and field validation. These models are all dual phase and treat dissolved gas and bubbles. Single phase dissolved gas models (Haldane) fall far short of sustained and predictive utility in the field.

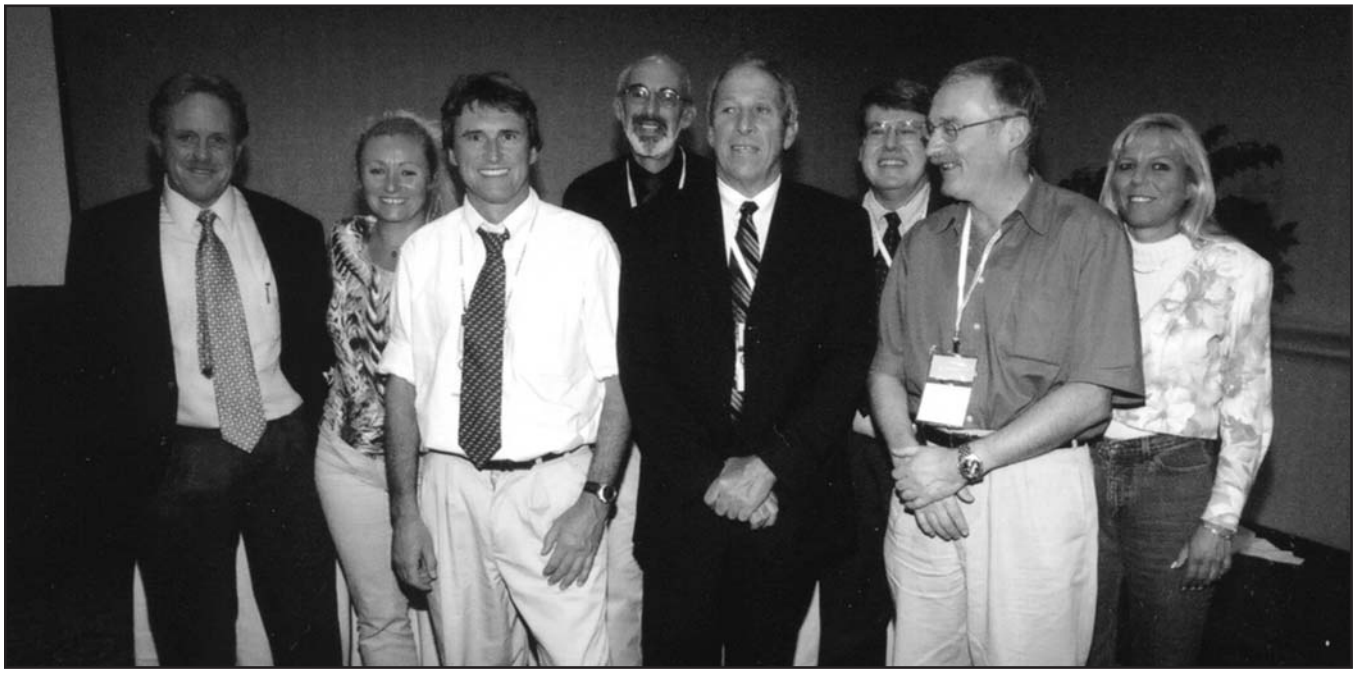
To support the synthesis of working models and data correlation, a technical RGBM Data Bank has been established on the Net. Models are just that, but recent dual phase ones are useful.

At the conclusion, two questions were posed to all:

1. Are deep stops a viable technique and has their validity been established from information provided at the Deep Stops And Modern Deco Strategies Workshop?

2. Is the diving community heading in the right direction as far as further testing, validation, and model correlations?

The answers to both were a resounding affirmative from speakers and attendees, but with admonition for careful examination of the experimental methods and tests applied to diving as a whole.



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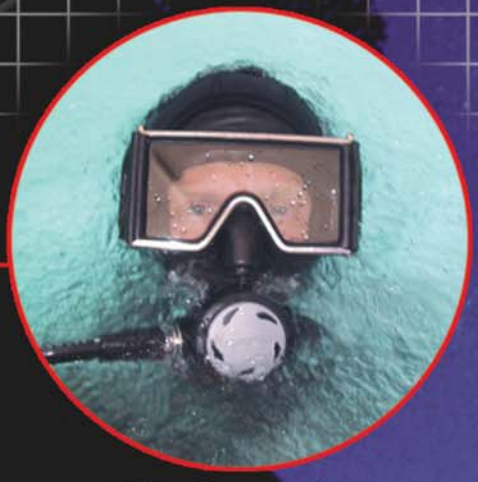

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# Swimming with Arctic Whales

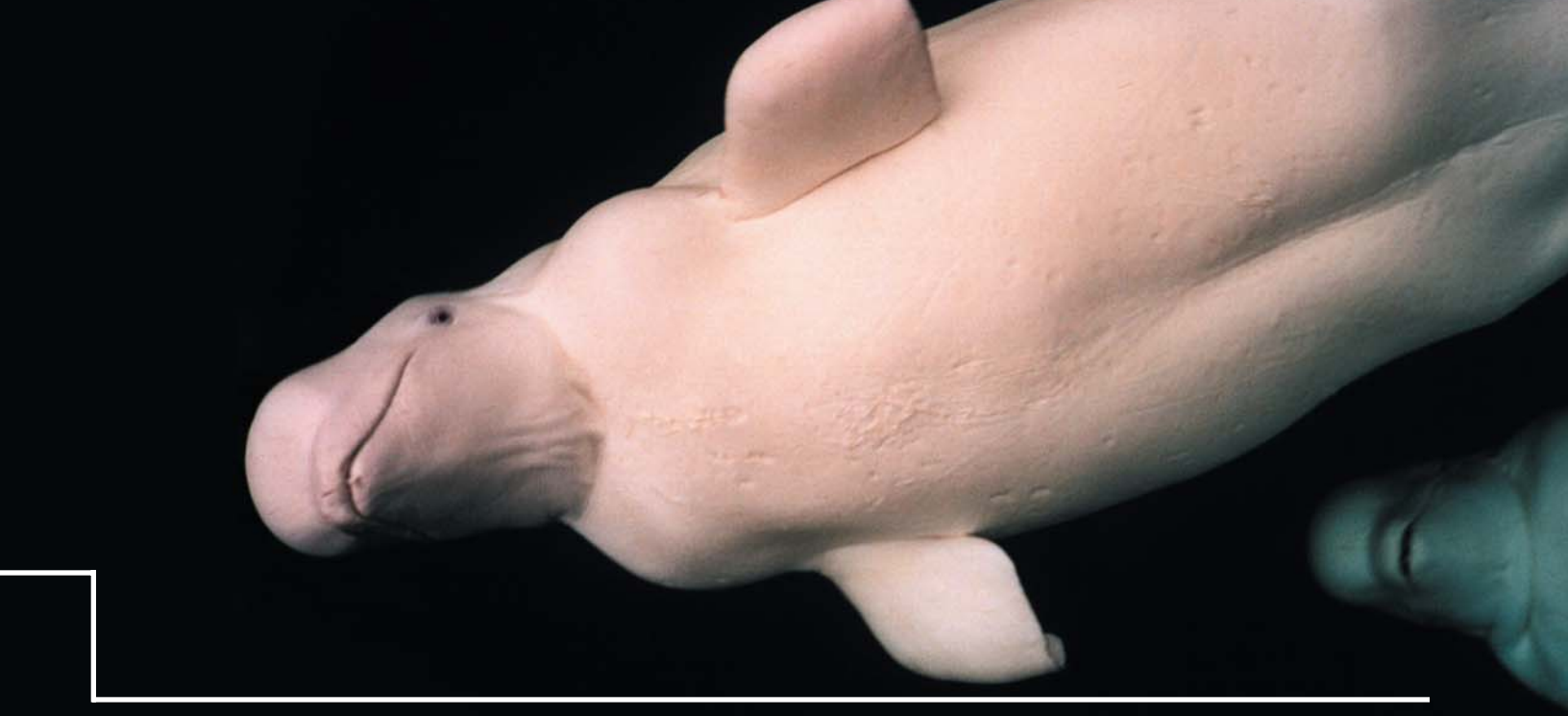
By Graham Dickson

***Dancing with Belugas***

*The Beluga whale and I stare deep into each other's eyes -- the Beluga upside down, facing the surface of the Arctic Ocean craning her neck to examine me with a seemingly permanent smile, and me, floating face down, with only a few feet of crystal clear icy water separating us. I float in the water, breathing gently through my snorkel, totally mesmerized by the dark pools of brown that make up the Beluga's eyes -- a stark contrast to her milky white body. I am oblivious to everything except the surreal world below me. Any direction I face, I see pods of white Beluga and charcoal speckled Narwhal whales swimming toward me from the black depths below -- all with necks angled towards me in unison. All I can hear, aside from my breathing, are their canary-like songs enveloping me from all sides - a virtual orchestra of clicks, whistles and flute-like notes. All I can feel is the icy arctic water pressing tightly against my drysuit. My lips are numb from the cold, but I don't care, this is a beautiful and magical world unlike any I've ever experienced before and I never want this to end.*

*As I turn away from my Beluga to look at the other 30 face-up Beluga whales surrounding her, she turns and follows. With a kick of my right fin, I turn left and she*

Many find the Beluga's wide, wrinkly smile endearing, but what humans may mistake for a charming personality is simply part of the Beluga's physical makeup. Belugas have soft, flexible blubber around their necks that make their faces appear to change expressions.



*follows my lead. I kick right, and she mirrors my move. I think to myself, "I'm dancing with a Beluga!" and from the depths of my soul, I let out an uninhibited laugh through my snorkel…a laugh of pure joy and exhilaration of having connected one to one with one of nature's most wonderful animals. I had never laughed so freely and spontaneously before until that moment.*

*I want to share the moment with the other expedition members and reluctantly break my gaze with my Beluga and lift my head to the surface. I squint in the sudden brightness of the arctic daylight and scan the blue mirror-like surface of the water for the others. A chuckle of laughter 20 feet away comes from Graham Dickson the expedition leader --snorkeling face down in the water and lazily kicking his fins. A little further over, Nell Battye from England makes cooing and chirping noises through her snorkel to answer back to the Belugas "talking" to her. I turn to the floe edge and see Paul Jackson an Australian adventurer sitting by the ice edge in a camping chair, head back, eyes closed, legs outstretched, and arms folded, basking in the warm spring arctic sun listening to the symphony of whales through his hydrophone. I decide there's no need to share my experience -- we each have our own -- and put my head back under and enter the world of the Beluga whale once again.*

***By Thomas Lennartz***

Whales are enormous, intelligent, friendly giants that have fascinated humans for centuries. Swimming with whales is one of the most celebrated diving experiences and is a fantasy shared by many, but lived only by a fortunate few. Although images of divers with whales may be much publicized, anyone with experience knows how difficult and rare such encounters are. Whales are unpredictable and difficult to pinpoint in broad areas. Even if successful, limited visibility may make capturing such encounters on film impossible. Most areas with large populations of whales also have strictly enforced regulations to limit contact and protect the animals from harassment. Such laws are unquestionably in the whales' best interests but make it more difficult for divers to find areas where personal interaction with whales is both possible and legal.

Divers who wish to swim with leviathans typically head to the Dominican or Tonga to see Humpbacks. Dolphin encounters in the Bahamas are reasonably certain and Whale Sharks merit an honorary mention for their relatively regular presence off Ningaloo Reef in Australia. One of the newest and least known areas for whale encounters is the high arctic, which provides some of the best circumstances for predictable encounters with playful whales.

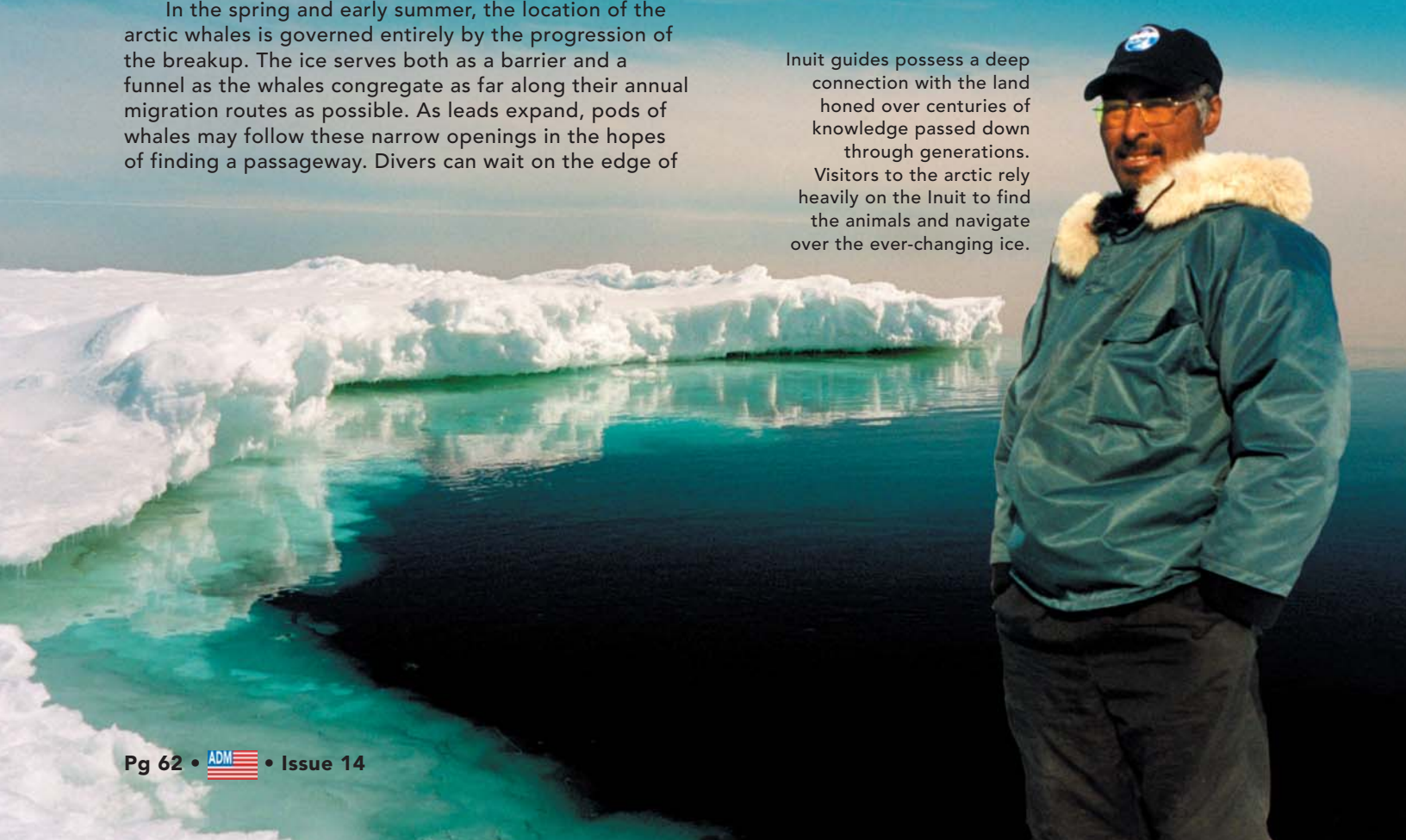
Three species of whales live permanently in arctic waters -- the mammoth 60-ton Bowhead Whale, the endearing white Beluga Whale and the mythical tusked Narwhal. Each species has its own distinct behavior and requires a slightly different approach to engage, play with and photograph. Although each whale's personality is unique, they all share the constraints imposed by the arctic environment; and it is precisely these factors which make the arctic such a favorable location for intimate whale encounters.

In the arctic, the formation and eventual breakup of the sea ice dictates the whales' movement. As the ice forms in the fall, the whales are gradually pushed further south to stay in open waters where they can surface to breathe. This migration pattern is generally reversed in the spring months as the ice breaks up and the arctic whales return to the higher latitudes for feeding, breeding and molting. The speed of the journey back North is governed completely by the gradual breakup of the ice, which can take months to open up completely.

In the Arctic Ocean, the thick sea ice thins slightly from the increasing spring temperatures and stress from wave action forms cracks called leads. The leads expand and eventually free large sheets of ice that drift away. Just as a beach divides land from sea, the floe edge is the boundary between ice and sea. Immediately beyond the edge lies the open Arctic Ocean while behind the floe edge solid sea ice extends all the way back to land. Unlike a beach, the floe edge does not mark the beginning of a gradual depth increment of either water or ice. The floe edge may sit over tens or thousands of feet of water and can range from a few inches thick to a small wall dropping over 20 feet. After a long winter, the sea ice is thick enough to support significant weight. It is possible to reach the floe edge by snowmobile at which point boats can be launched to travel beyond into the Arctic Ocean. As new ice sheets separate and float away, they create a new floe edge behind them on the land-fastened side of the lead. As the breakup progresses, the floe edge gradually moves closer to shore until the ice cover disappears completely.

In the spring and early summer, the location of the arctic whales is governed entirely by the progression of the breakup. The ice serves both as a barrier and a funnel as the whales congregate as far along their annual migration routes as possible. As leads expand, pods of whales may follow these narrow openings in the hopes of finding a passageway. Divers can wait on the edge of the lead and slip into the water as the whales approach. These whale 'highways' make encounters infinitely easier, as there are only a limited number of clearly identifiable 'roads' and so it is merely a question of waiting for the next pod to come along. Setting up camp next to an active lead makes for a very special experience. Just like a roadside motel, the traffic passes day and night along the whale thoroughfare!

Earlier in the breakup there are few leads that expand sufficiently to permit whale travel and the animals instead congregate along the floe edge where regular patrols search for newly formed channels the pod can follow. The floe edge not only marks the limit that the whales can travel but also provides safety. Apart from humans and the very rare threat posed by polar bears, killer whales are the arctic whales' only predators. Orcas do not pursue their prey under the ice because of the risk of suffocating. Unlike the Orca, the Beluga, Narwhal and Bowhead do not have a dorsal fin and can rise flush with the ice to breathe through small cracks or holes. The natural instinct to find a path through the ice and the protection the ice provides allows the arctic whales to gravitate towards the floe edge. As a result, whale encounters along the floe edge are quite regular and on a good day there may be hundreds of whales swimming along and around the edge. Camping next to the floe edge puts the whales literally at your front door! Tents must be set back a considerable distance from the edge as the breakup accelerates to prevent the camp from being carried away on a newly released free-floating ice sheet!



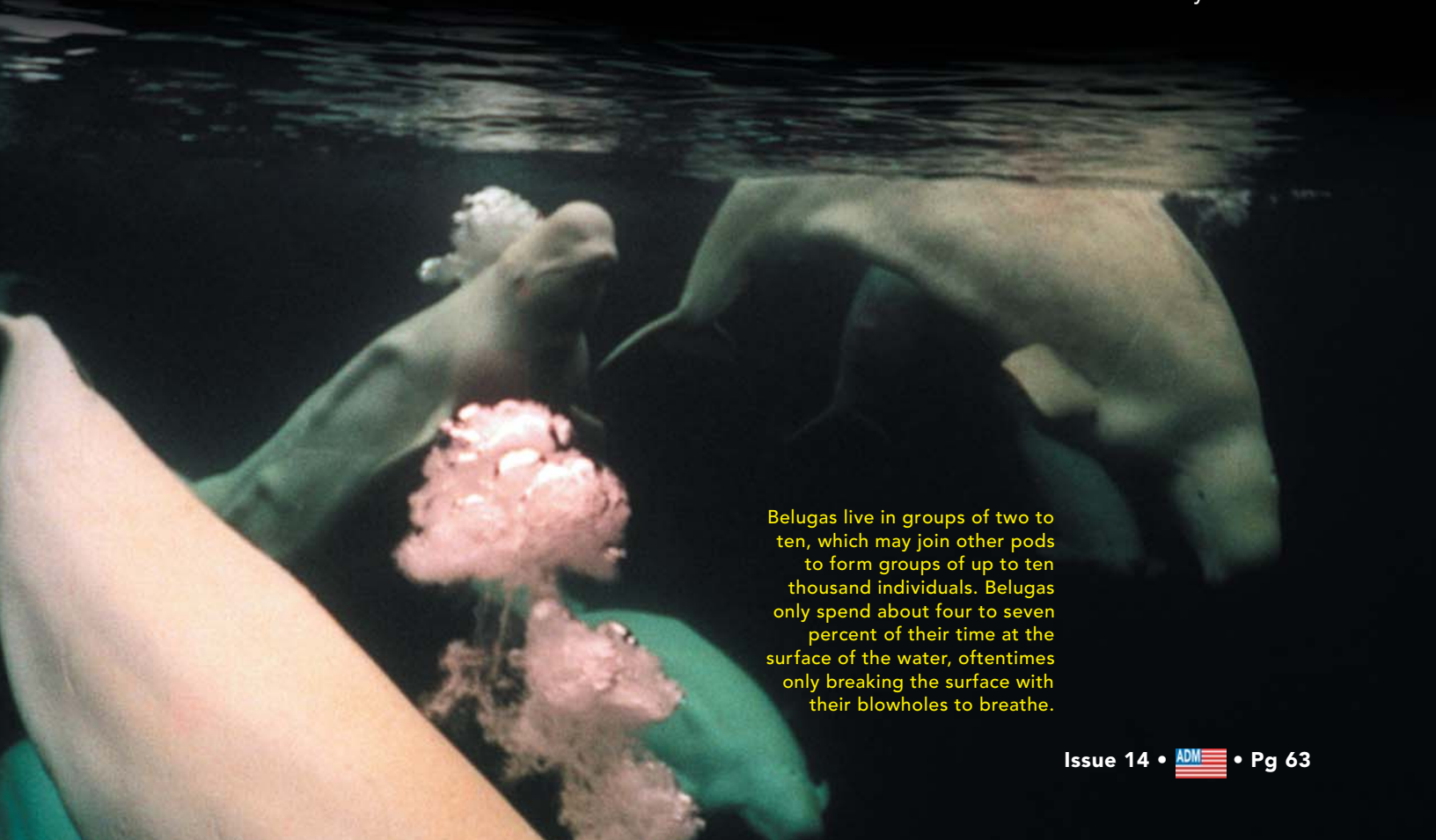
Inuit guides possess a deep connection with the land honed over centuries of knowledge passed down through generations. Visitors to the arctic rely heavily on the Inuit to find the animals and navigate over the ever-changing ice.

The number of whales tends to increase as the breakup progresses and so there is a tradeoff between the largest concentrations of whales and the difficulty moving over the ice. The water visibility is also directly related to the extent of the breakup. Sea ice is partly desalinated and creates a fuzzy halocline as it melts that reduces visibility. Algae grows on the bottom of the ice over the winter and is released in large amounts as the ice melts. The continuous 24-hours of sunlight provide an additional boost to algae growth, which can drop in visibility from hundreds of feet to less than ten. The trick to selecting the best time to dive with whales is to go late enough that the breakup has started while early enough that the camp site will not need to be moved frequently from the receding edge and that crystal clear waters are not reduced to the visibility of pea soup by the algae and fresh water mixing.

The depth of the water has an enormous impact on the willingness and interest of the whales to approach divers. Many whales congregate in large numbers at different times of the year in specific bays. Although these shallow waters make for amazing topside photos, it is impossible to swim or interact with the whales. The less room they have to maneuver and escape, the more skittish the animals are. Simply putting a toe in the water could trigger a mass exodus from the area. Conversely, the extremely deep waters of some passageways are particularly conducive to interaction. The whales approach from below and initiate the encounter out of their own curiosity. The best whale encounters are found at the floe edge in very deep waters where the whales are waiting for the breakup and are completely at ease with their ability to maneuver. The whales approach the divers and stay for as long as their interest holds. Playful encounters with whales zooming by and blowing bubbles from below can go on for hours and are occasionally ended by the diver rather than the whales that will follow the diver right back to the floe edge.

As the whales initiate contact, they decide how close they will come and when to make their exit. There is nothing a diver needs or can do to control the encounter. This has a profound impact on the choice of equipment and tends to lead to a simpler approach. Scuba diving adds additional equipment -- bulk and bubbles -- which are thought to scare some whales away. Free diving allows a much more rapid entry, faster swimming and improved maneuverability than scuba and the encounters tend to be closer. Rebreathers have been tried, but the whales kept the same distance as with free diving and the photographs taken using ambient light at the surface are far superior to those of whales maintaining the same distance in deeper waters.

Free diving in a drysuit in the frigid 31-degree arctic waters involves some special considerations. Crushed neoprene, trilam or rubber suits have the least inherent buoyancy at the surface and so are preferred to the neoprene drysuits for free diving. Harness weight systems are essential to distribute the 40 plus pounds most divers need with full insulation in salt water. When free diving in very deep waters it is important to consider the safety issues of over weighting, as once past a certain depth where the suit and undergarments are compressed the diver may struggle to ascend, especially if air has been vented from the suit on the way down.



Belugas live in groups of two to ten, which may join other pods to form groups of up to ten thousand individuals. Belugas only spend about four to seven percent of their time at the surface of the water, oftentimes only breaking the surface with their blowholes to breathe.

Suit squeeze when descending is not normally a problem, but if air is vented the suit will not be as warm once back on the surface.

There are three simple approaches to waiting for the whales. The most straightforward method is to simply enter the water and swim away from the floe edge. Belugas especially will come to one or two divers swimming on the surface. It is not uncommon for people to enter the water with no whales in sight and within minutes see separate pods of up to a dozen whales coming at full speed towards the divers from different directions. The whales will converge on and around the divers and begin their humorous antics of blowing bubbles from below the people to mirroring a diver's every change in direction to buzzing by less than two or three yards away. When they are satisfied they've had their fill of games for the day and move on the divers can float patiently waiting for the next pod to come along. Pulling out on an inflatable boat is an effective way to extend the total time on the water while maintaining proximity for immediate entries. Soar Inflatables makes a 16-foot canoe that can hold three divers in full gear and is stable enough for a diver to pull himself up into an empty boat. The boat was found to actually attract Bowhead Whales that like to play with it and rub their back on it. When not floating on the surface or relaxing in the inflatable, just sitting on the side of the floe edge allows for a rapid seated entry; sometimes even the simple act of putting fins in the water will attract inquisitive Belugas.

The arctic is not a region that comes to mind as a diving destination. Simply visiting the arctic offers an experience completely unlike any other part of the world. Adding a diving component to see below the ice further enhances the adventure, but the ultimate experience, perhaps the very essence of what diving is about, is to feel and be part of the ocean life. Amidst all the ice and apparent barrenness lies an ocean teaming with life. An ocean full of inquisitive friendly animals still very accepting and welcoming of human visitors. To play with these animals, to hear their sounds in the water, through the ice and through your body, to make eye contact and to connect in a way impossible to describe is a real privilege. The great expanse and solitude is broken only by the sounds of thousands of animals waiting for those intrepid enough to visit one of the few remaining places where life still flourishes today as it has for thousands of years.

About the Author

*Graham Dickson is the Chief Expedition Leader for Arctic Kingdom Marine Expeditions, the world's only company to specialize in the animals of the arctic and to have successfully led diving expeditions for all of the Arctic's marine animals. He has a driving desire to explore the arctic regions where there is such a great range of diverse and exotic animals, historically significant locations and unique geography. He successfully led the first sport diving expedition to Nunavut to dive with Walrus in 1999 and has since led expeditions for Bowhead whales, Narwhals, Belugas, Polar Bear and the Greenland Shark.*

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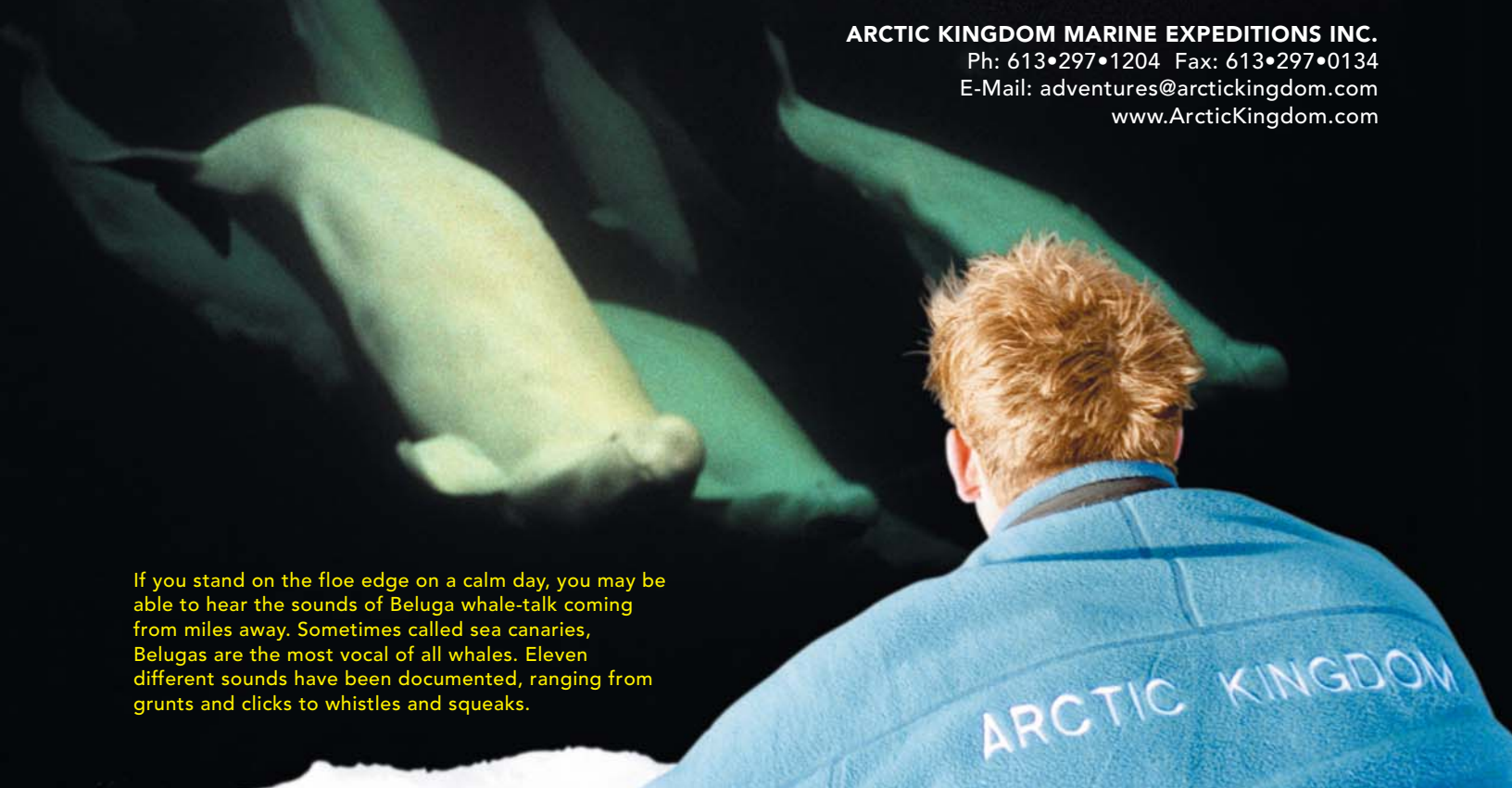


If you stand on the floe edge on a calm day, you may be able to hear the sounds of Beluga whale-talk coming from miles away. Sometimes called sea canaries, Belugas are the most vocal of all whales. Eleven different sounds have been documented, ranging from grunts and clicks to whistles and squeaks.

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# Exploration of the Italian Army CH47 Chinook Helicopter

**By Riccardo Malatesta & Simone Formica**

Last year the wreck of an Italian Army CH47 Chinook helicopter (also known as the E.I. 801), found at the depth of 104m/342ft of fresh water in lake Bolsena, located about 100 miles north of Rome. This is the story of its discovery...

**The Search For the Missing Aircraft**

With the help offered by Imperio, a local fisherman, Captain Paolo Monachello established the search area for the wreck of the E.I. 801. Using local charts, a GPS, and the help of Imperio, who was the only witness of the accident, Paolo started a detailed search aboard the Popeye, a solid wooden diving boat. The search was a bit laborious for Paolo and Imperio, because the wreck is relatively small and does not have a clear sign on the sounder. But patience paid off and the two kept plodding around the lake waiting to see something other than the flat bottom appear on their sounder display. At last, on a cloudy, December day, Paolo got something. The instrument showed a clear object rising for almost 10m/30ft from the bottom (106m/348ft to 96m/315ft). It was the only object to appear in the area, and the sign was clear and big enough. Paolo marked the place with a shot line. Was the hunt for the E.I. 801 finally over? There was only one thing left to do — dive!


***The History of the CH47 Chinook Helicopter (the E.I. 801)***

*During the spring of 1979, the E.I. 801 was on exercises above the surface of the lake of Bolsena when disaster struck. The E.I. 801 lost control during a training fight, the three-crew members tried to manage the situation but could not avoid the impact. Hitting the water caused the E.I. 801 to break the front side of the cockpit, cutting the Chinook in two and causing it to start rapidly sinking. Fortunately, the crew escaped from the damaged cockpit just in time.*

In the following days Paolo excitedly called Riccardo Malatesta, Simone Formica and Giorgio Caramanna, asking them to join him for the first dive on the wreck. They planned the first two dives for the next fortnight. Together with Simone and Giorgio, both experienced deep air and trimix divers, Riccardo arranged all diving elements and organized a complete working team. This was a demanding dive at depth around 105m/342ffw in low visibility conditions with the water temperature that was not best suited for extended deco stops.

Simone, Paolo and Riccardo were the first team — the exploratory team — set to dive the wreck. In the first dive their goal was to place the shot line, fixing it for future dives. Paolo was to take pictures of the wreck with a housed camera in order to have a good photographic record of the site, while Simone's job was to check the wreck, providing all available information on the Chinook.

Supporting the exploratory team was Giorgio Caramanna and Edoardo Malatesta, both experienced gas divers. This team's main function was to assemble the decompression station, positioning extra tanks on the shot line or the deco station. These support divers also had the task of carrying extra tanks and meeting the exploratory team during their ascent at a fixed depth. Another diver was to be in "stand-by" on the rigid inflatable boat (RIB). Led by Gianni Malatesta, the surface support team was comprised of Marco Ottaviani, Enzo Piergiovanni and Alen Rasiti.

Prior to diving the E.I. 801, the team planned two pre-expedition warm up dives in order to test their equipment and teamwork. The two dives were conducted in the same lake at a maximum depth of 65m/213ffw using air for bottom gas and Ean 36% and Ean 80% during the ascent and decompression. For the second dive they planned extra time for the last three deco stops to better simulate the environment conditions (with no argon for the drysuits). Everything was set to be complete by the end of January 2001.

A first dive date was organized for the first weekend of February, but misfortune fell on the expedition. Unfortunately, this was the beginning of a long series of cold, windy days. The lake of Bolsena is widely exposed to winds coming from the north, and in this season the temperature could fall well below 0 degrees Celsius. Several times they found themselves with tons of diving equipment on the dock, watching waves on the snowed lake shoreline.

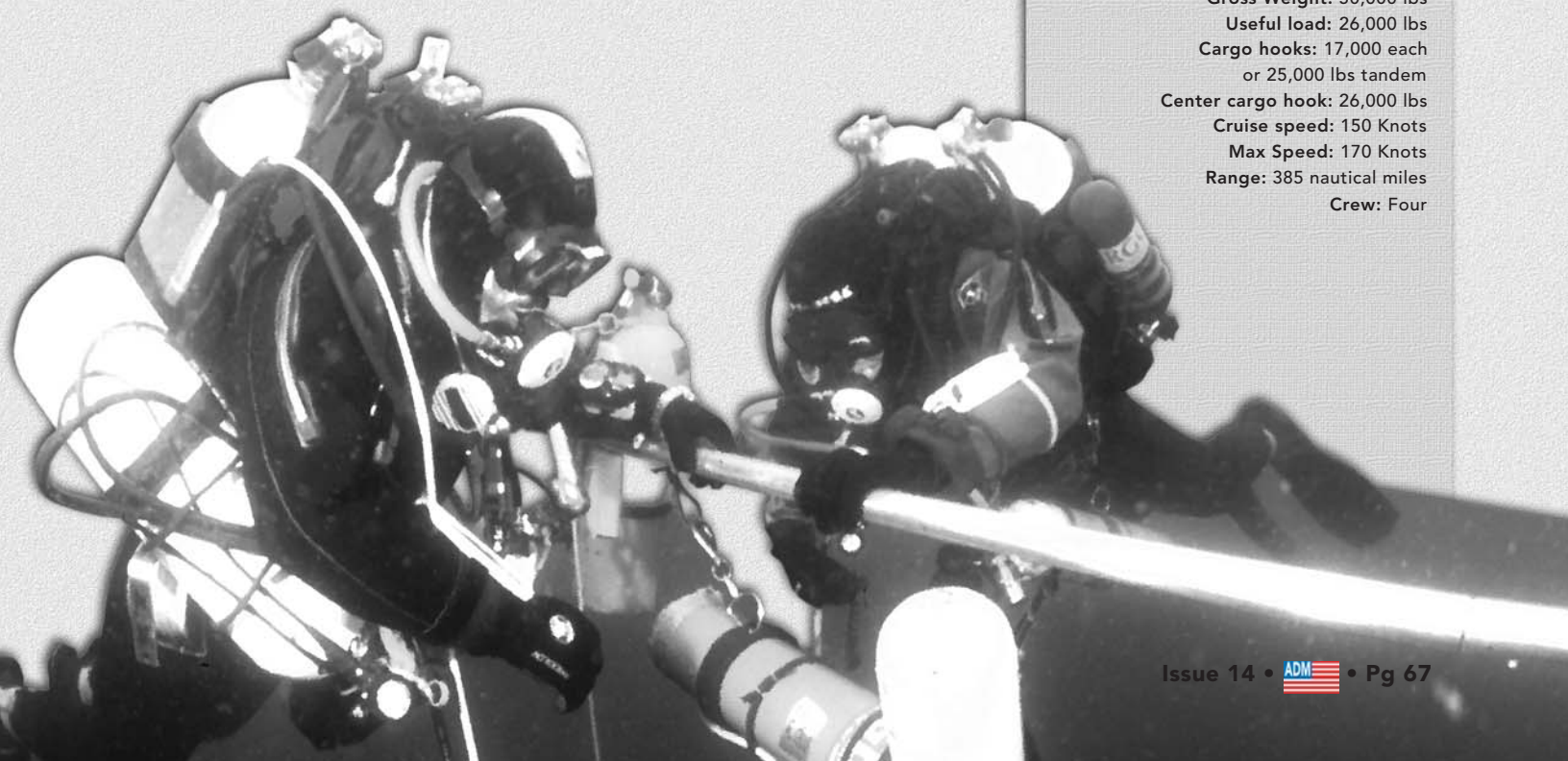
## Aircraft Description

The CH-47 is a twin-engine, tandem rotor helicopter, first delivered for use in Vietnam in 1962. The Chinook's primary mission was moving artillery, ammunition, personnel and supplies on the battlefield. It also performs rescue, aero-medical, parachuting, aircraft recovery and special operations missions.

The CH-47C has only a single cargo hook below the center of the aircraft. The load capacity of the fore and aft hooks is 10,000 pounds each. The Army's continued need for further performance improvements led to the development of the CH-47C. Designed to meet an Army requirement to transport a 15,000 pound sling load over a 30 mile radius, the C model boasted an increased gross weight to 46,000 pounds, increased fuel capacity, the Lycoming T55-L11 engine with 3750 shp and addition structural improvements. The first C model flew in late 1967 and became the mainstay of the Chinook fleet.

**CH-47 Chinook**
**General Characteristics:**

**Manufacturer:** Boeing Company
**Power Plant:** Two Textron Lycoming T55-L712 engines
**Length:** 99 feet (30.18 meters)
**Height:** 19 feet (5.79 meters)
**Rotor Diameter:** 60 feet (18.29 meters)
**Empty Weight:** 24,000 lbs
**Gross Weight:** 50,000 lbs
**Useful load:** 26,000 lbs
**Cargo hooks:** 17,000 each or 25,000 lbs tandem
**Center cargo hook:** 26,000 lbs
**Cruise speed:** 150 Knots
**Max Speed:** 170 Knots
**Range:** 385 nautical miles
**Crew:** Four



**The First Attempt**

On a cold morning the team found that the artic wind seemed to be lighter. "Let's go!" was the overwhelming cry of the group. After a short briefing they decided to attempt a dive, and the team started assembling the gear. The exploratory and support teams left the main dock of Marta's Harbor, heading for the CH47 dive site aboard the Popeye. Once on the site, they checked the position with GPS and the sign on the sounder. They changed the surface sign with a better and easier to locate big, orange buoy.

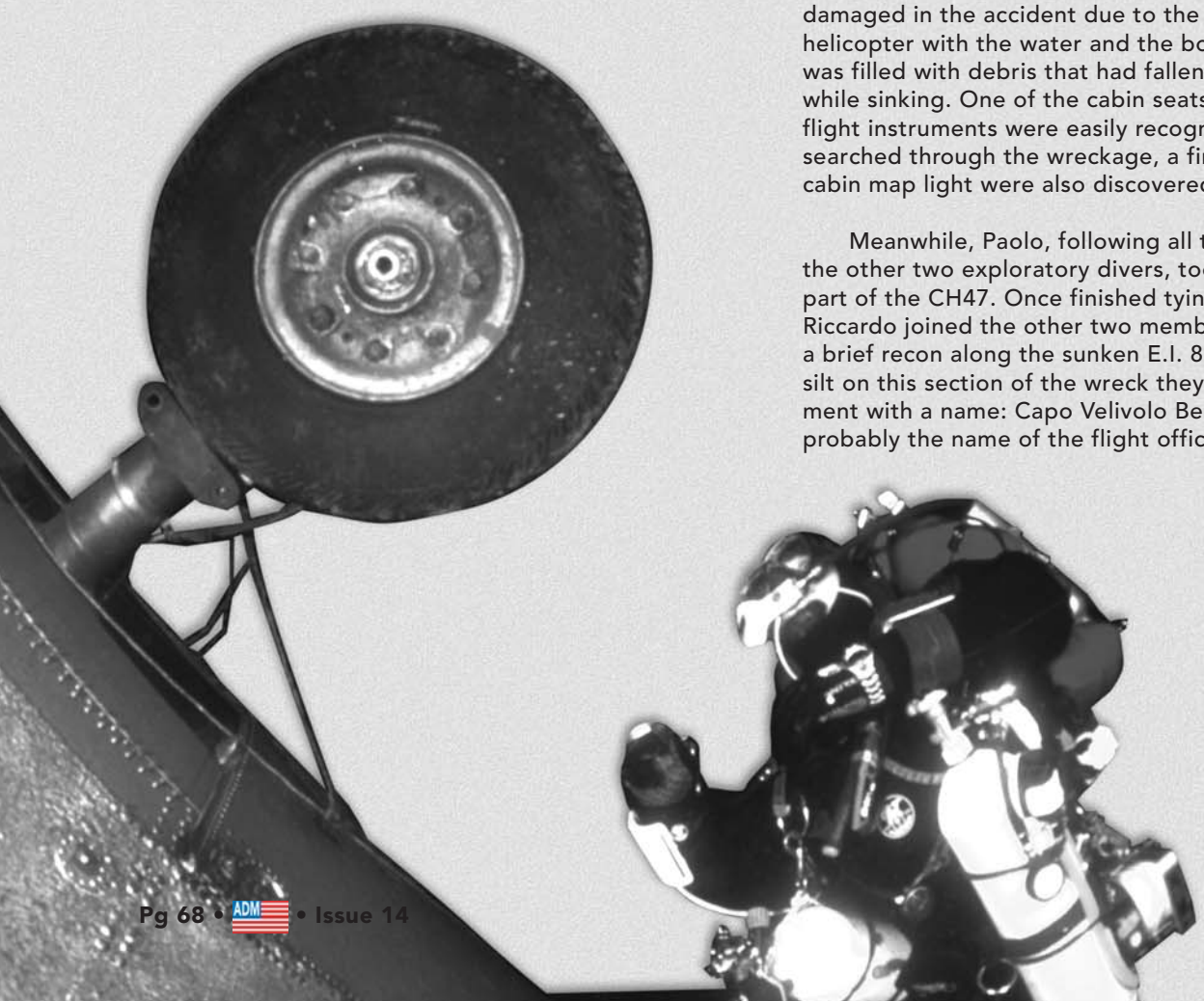
The Chinook is a huge chopper, but it is relatively small to locate once on the bottom of a lake. They dropped a second and heavier shot line, but the north wind was coming strong again. They decided to try anyway. The surface team was ready, the deco station was deployed and the support divers kitted up. The exploratory team began the dive, following the shot line down to the depths below in the cold lake water. Upon reaching the bottom at 103m/342ffw, it was obvious that the shot was off the wreck. The strong wind at the surface probably moved it away from the helicopter wreck site. The visibility soon lowered to 2-3m/6-9ft, and they decided not to start a bottom search even though they felt like the wreck was very close. After a long one and a half hour decompression, the three-member team arrived back topside and decided to re-deploy the main shot line.

**The First Dive**

On Saturday, February 26, a cloudy, windless day, the team left the dock with all their gear properly stowed on the Popeye. As planned, they dropped a second and heavier shot line and started gearing up. Support divers hit the water beginning their work on the deco-station and extra tanks. In a few minutes, Giorgio, one of the support divers, came to the surface giving the final "okay" sign. After a last check the trio jumped in the water to start the dive, leaving a gray, cloudy sky for the cold and dark water of the lake. While descending the shot line in low visibility, the team wondered if this could be the right dive and if the E.I. 801 was really down there. At 70m/230ft the water was dark green, but visibility was around 10m. Things then changed below 80m/262ft where visibility dropped to 4-5m/15ft in a completely black environment. As they approached the bottom, something came out of the darkness at 95m/311ft. One of the Chinook fiberglass rotor blades was rising from the bottom and was now coming parallel to the descent line with her unmistakable shape. The E.I. 801 had been found, and the shout of Paolo gave the final confirmation.

The team landed on the wreck in just under four minutes. Once they reached the cockpit, which was some 10m/33ft below, Riccardo began his job of securing the descent line to the wreck, which was found to be in the rear part of the wreck just under the front rotor gear. The bow area of the Chinook had been seriously damaged in the accident due to the impact of the helicopter with the water and the bottom of the aircraft was filled with debris that had fallen from the E.I. 801 while sinking. One of the cabin seats and some of the flight instruments were easily recognizable and, as they searched through the wreckage, a fire extinguisher and a cabin map light were also discovered.

Meanwhile, Paolo, following all the movements of the other two exploratory divers, took photos of this part of the CH47. Once finished tying off the line, Riccardo joined the other two members of the team for a brief recon along the sunken E.I. 801. Gently removing silt on this section of the wreck they noticed an ornament with a name: Capo Velivolo Bernardinetti. This was probably the name of the flight officer, one of the three



crew members that managed to escape after the incident. Unfortunately, the dive time was over and the group was forced to leave the larger, remaining section of the wreck for the next dive. Reaching the line, they began their ascent. As planned, they first stopped for one minute at a depth of 78m/255ft. They completed the rest of their deep stops suspended in the three-dimensional cold, black environment thinking about what they had just seen. Escorted by Edoardo and Giorgio, the support divers (who met the exploratory team at 50m/164ft), they completed their decompression in one hour and 40 minutes. After some 110 minutes spent in a six-degree Celsius water, the group reported barely being able to feel their hands. The nine-meter and six-meter deco stops were long and very painful on the hands. It would take the team hours to completely recover.

**The Second Dive**

Two days later they boarded the Popeye again and set off the Marta's main dock. This time, using another grapnel they attempted to hook the largest of the two sections of the wreck. Many times they missed hooking the wreck, due to the smooth wreck surfaces. When the shot finally tensed, one of the support divers immediately hit the water — finishing the surface tie-off. Now the team had two descent lines: one for the damaged pilot cabin and the other for the 18m/60ft-fuselage.

As they headed downward for the second dive, the dark waters parted in a cold welcome. This time, as planned, the exploratory trio landed on the back and much bigger of the two sections. This part of the Chinook was laying on its right side, almost upside-down. It had a 40/45-degree inclination with the back rotor as the lowest point and engine half buried in the ocean bottom. The visibility was still good and their dive lights showed the excellent state of preservation of the helicopter. Looking along the side the inscription reading ESERCITO (ARMY) was visible just above the four portholes of the fuselage. Once they removed the silt layer from the plates, the original army green paint was found — still perfectly painted on the side of the craft. Paolo began taking photos of the wreck just before the silt was stirred up and the visibility dropped to less than one meter. Continuing the external inspection, they soon noticed the center cargo hook, another ornament (representing the three color Italian flag), and the red anti-collision back light. For a closer inspection they opened an electrical power supply and found all components in a very good state. Fresh water, low temp and no water movements left the wreck almost intact. Some of the devices might even work again, they thought!

Reaching the back hatch used for entering troops or loading the aircraft, the team found it closed. Monitoring their dive instruments they knew this was deepest point of the dive 104m/342ft. Three of the landing gear wheels were still inflated and showed no signs of rust or time. They moved along the wreck toward the perfect cut in the fuselage. Here the Chinook showed the damage caused by the dramatic impact with the water surface. Carefully, Riccardo dropped inside, entering into the mid-section of the Chinook. Along the internal walls, cables and hydraulic pipes were visible from within some of the sound absorbent panels which had been moved form their original position. The light beam pointed to the brilliant orange, anti-crash net used for fixing the load. But time had taken its toll and they knew they must navigate back to the ascent line. Once it was reached, they started their ascent while still pointing their lights toward the wreck and watching the E.I. 801. From this point, Riccardo reflected, it looked like a big toy.

After just a few meters, the group was once again immersed in a complete ink black environment with no apparent boundaries, knowing that the long, cold decompression, the hardest part of the dive, was still to come. While navigating back, they answered all the curious questions made by support team members. Once on land, all expedition members headed to a local "trattoria" (a typical, little, Italian restaurant) for a hyper caloric pasta-based lunch to, of course, talk about the dives underway for the next spring season.

Note: This is a very serious, deep, cold-water dive and must follow meticulous preparation and complete 360-degree planning. Low water temp is a problem and in-water support (two or more divers) is a must.

**Tables and In-water Profile Box**

Gas plans were calculated on a VPM program: V-planner (Due to low water temp, they used the max safety factor.) Equivalent narcotic levels were maintained below 40m/130 feet and $PO^2$ on bottom mix was held slightly under 1.4 atm (at max planned depth of 106m/350ft) and boosted up only at gas switch depth.

Bottom gas - Trimix 12% $O^2$ / 55% He
Switch 42m/137ft - Eanx 32%
Switch 9m/30ft - Eanx 80%
Argon was their dry suit insulation gas.

The support team divers placed Ean 32%, Air and Ean 80% spare tanks along the ascent line and deco station. Extra oxygen tanks were available and geared either on the Pepeye or aboard the RIB.

**For more information, please visit the CH47 Chinook web site at www.techdivers.net.**

# Rancho Cenote Perdido

By Sam Meacham

On August 24, the first of what are hoped to be many dives was performed at Rancho Cenote Perdido, located 30 kilometers west of Playa del Carmen, Quintana Roo, Mexico. Owned by Ricco Merkle of Mom's Hotel in Playa del Carmen, Rancho Cenote Perdido is an immense 6,000-acre property situated on top of what may very well be the recharge zone for the coastal cave systems of the Riviera Maya. Land exploration of this area began more than five years ago. Thanks to the pioneering efforts of Doug Griffey and Brad Fitchett and the generous contributions of Dale Meadows, an infrastructure of two base camps and a system of rudimentary trails was put into place. In addition, four cenotes were located within the property limits.

In 2000, local explorer and director of CINDAQ A.C., Sam Meacham, was brought into the area by Merkle to improve camp and trail infrastructure and further explore the property's surface. Meacham was able to locate another four cenotes and a number of "collapse" areas of great interest. Using an aerial photograph acquired from the Mexican government, Meacham has been able to find any land feature seen on the photograph at a 100 percent success rate, greatly reducing fatigue and time spent in the field. This is a method he is applying in many area projects particularly the exploration of Sistema Ox Bel Ha.

As of August of 2002, access has been improved to the point that diving could take place in Cenote Southern Cross, the base camp closest to Playa del Carmen. Joining Meacham on the dive were local explorers and technical dive instructors Scott Carnahan and Moises Nava of Protec Advanced Dive Training Facility in Playa del Carmen. Diving sidemounted aluminum 80's, the team was able to explore, survey, and document using digital photography the major underwater features of Cenote Southern Cross.

Typical of inland cenotes on the peninsula, Cenote Southern Cross is a sinkhole with no associated cave passageway. The maximum depth encountered was 101 feet, all in fresh water. Due to the many logistical challenges that conspire against the movement of

people and heavy equipment through the area, the team will be making use of CCR units and the latest in lightweight long duration lights to further explore the cenotes of Rancho Cenote Perdido.

As diving operations progress, a comparison of all cenotes in the area will help to create an image of the fresh water lens gradient as it falls away from the coast. In addition comparative studies in cave biology, water chemistry and paleobotany will help to improve knowledge on this extremely critical hydrologic area and its past history. There is also interest in the use of some of the cenotes as stopover points by neotropical migrant birds as they travel back and forth from the United States.

It is the very ambitious goal of Merkle and his partners to create a private ecological reserve so that the precious fresh water hidden beneath the jungle floor and the many interesting surface features of Rancho Cenote Perdido can be studied, documented, appreciated and preserved for generations to come.

As always in our exploration efforts in this area, we owe a great deal of thanks to the people that really make it happen. A special thanks to trail boss and camp manager Eugenio Herrera Cano and his team of workers who have spent the last two years making an inhospitable environment more hospitable, teaching us tenderfoots about life in the Yucatecan jungle. Without their hard work and dedication, we would go nowhere.

Special Thanks
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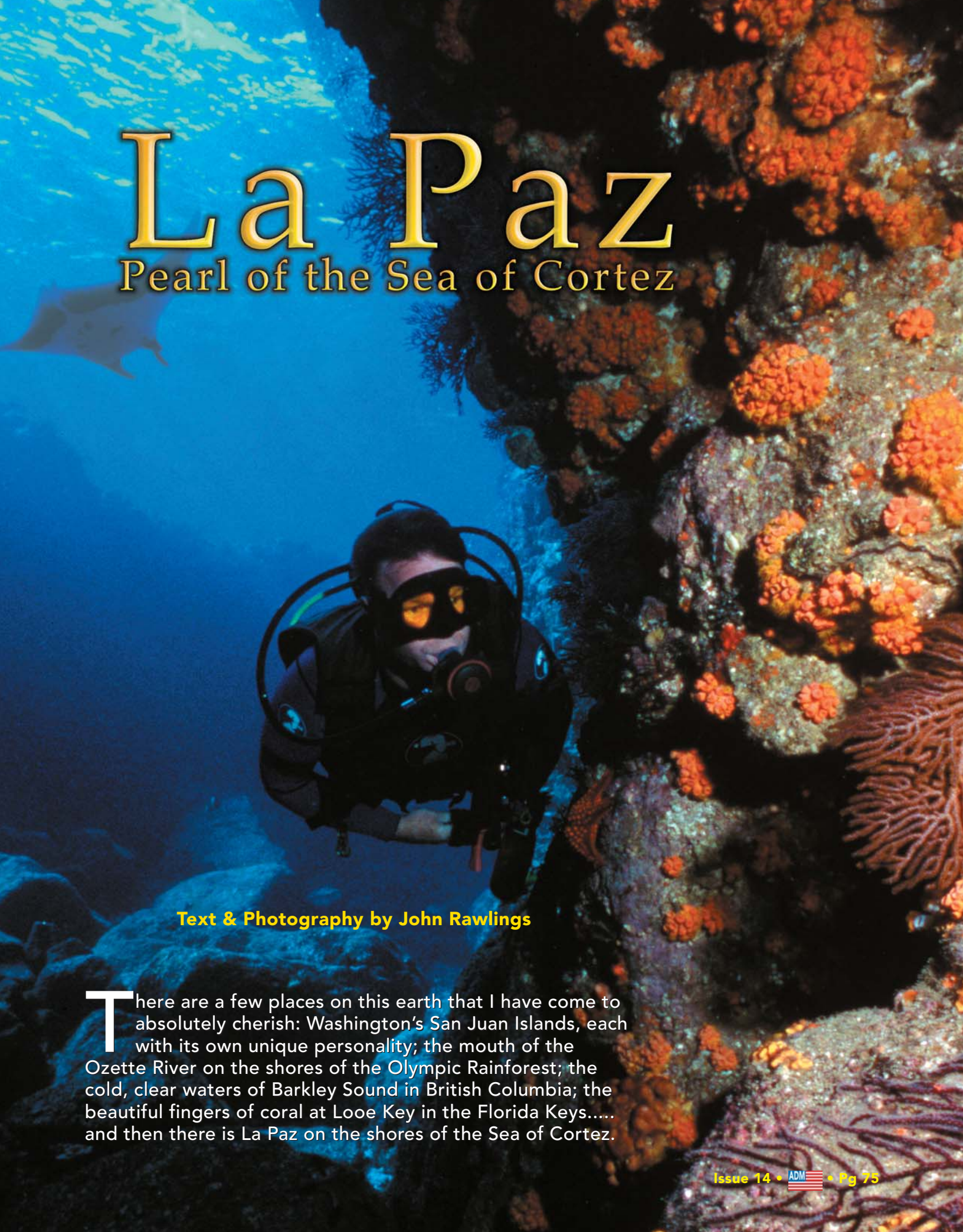
# La Paz

## Pearl of the Sea of Cortez



**Text & Photography by John Rawlings**

There are a few places on this earth that I have come to absolutely cherish: Washington's San Juan Islands, each with its own unique personality; the mouth of the Ozette River on the shores of the Olympic Rainforest; the cold, clear waters of Barkley Sound in British Columbia; the beautiful fingers of coral at Looe Key in the Florida Keys..... and then there is La Paz on the shores of the Sea of Cortez.

I dream of the Sea of Cortez whenever I feel the need to be both surprised and amazed to see things that I didn't plan for and to stare in awe when the wholly unexpected occurs. As I write these words, I'm thinking back to my son's 21st birthday in April of 1999. As a gift, we took him south to the Sea of Cortez and, in one marvelous five-day period of diving, we were treated to everything from tiny seahorses to the incredibly gigantic blue whale and virtually everything in between.

Each dive found us with our eyes bulging, gaping at sights and creatures that one typically sees on the Discovery Channel and wonders whether or not it's possible to see them in "real life." On the Seamounts we found tangles of morays, hoards of circling hammerheads and groups of giant pacific mantas dancing in the current as they fed on plankton. At the rookeries we laughed at the antics of juvenile sea lions as they whipped in and out, tugging on our fins and staring at us nose to nose. On the rocky reefs we found and photographed the hundreds of tiny, colorful creatures found there and then roared with joy on the return boat trip as we were accompanied by leaping dolphins and pilot whales. Most amazing of all for my son, we were treated to the ultimate snorkel experience swimming side by side with a whale shark just off the beach of our hotel. It was an amazing time.

**The History of La Paz**

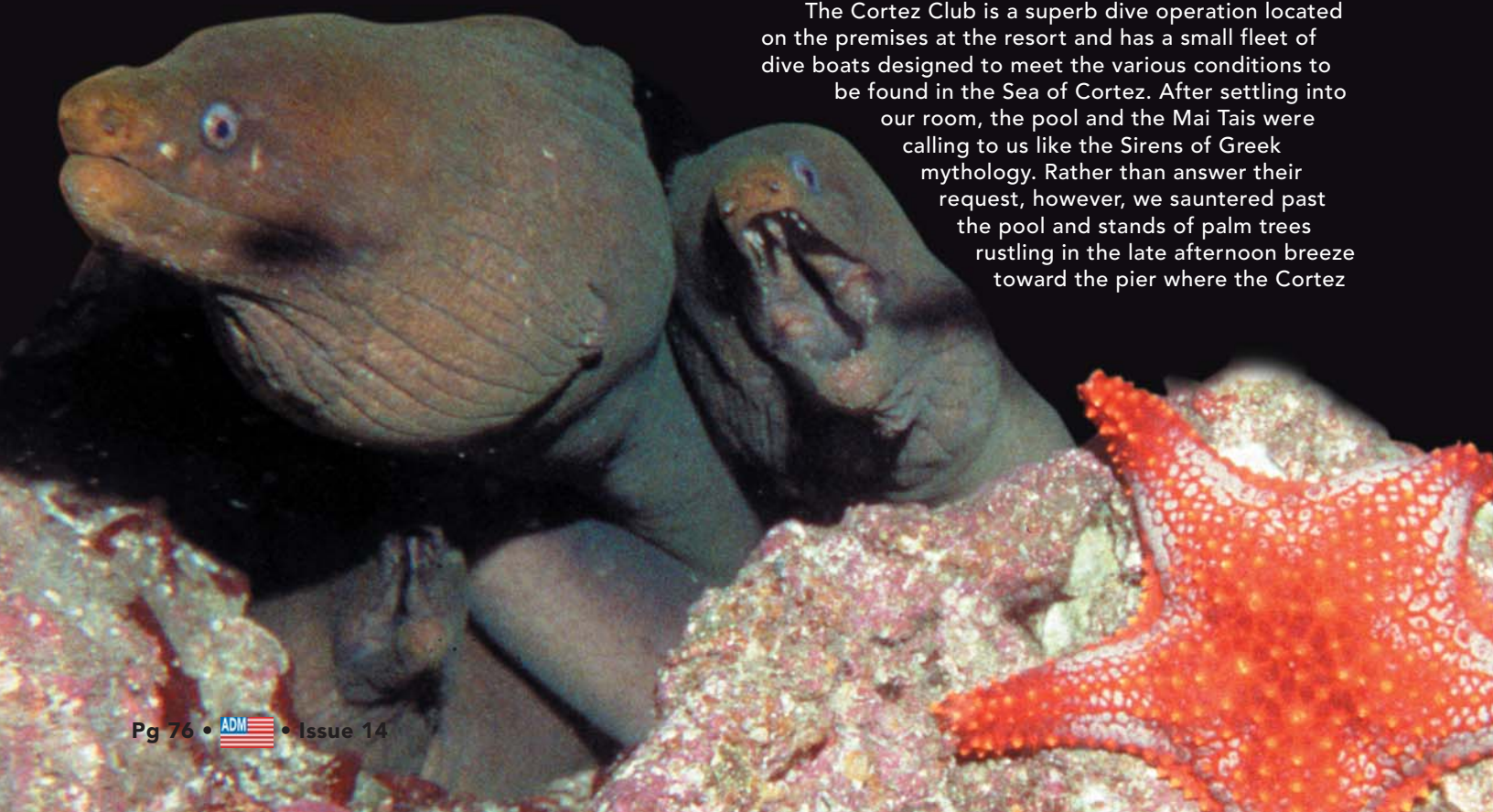
Founded in 1535 by the great Spanish Conquistador Hernan Cortez, conqueror of the huge Aztec empire, the city now known as La Paz was the first European settlement on the Baja Peninsula. Pearl oysters were found to be incredibly plentiful in the area. Despite that fact the settlement was frequently abandoned for extended periods due to shortages of food and water as well as conflicts with the local native tribes. Toward the end of the 16th century, British and Dutch buccaneers often used the area as a base from which to raid Spanish settlements, as well as the great Spanish treasure galleons sailing the Pacific to and from Spain's holdings in both the New World and Asia. In fact, immediately north of La Paz is the Pichilingue Peninsula, which is named after the Dutch pirates who frequently based themselves there and whom the Spaniards referred to as "Flexelingas."

As a means of discouraging piracy in the area, the Spanish increasingly attempted to encourage settlement, one of the results being the establishment of a Jesuit mission in 1720. Over time, pearling, fishing and mining came to the forefront as the economic staples of the settlement, and it gradually grew in prominence. In 1974, when Baja California Sur (BCS) was granted statehood within the United States of Mexico, the city of La Paz became its capital. Today La Paz is well known for its fabulous sportsfishing industry and as a Mecca for Bluewater Spearfishermen. Few, however, are aware of the marvelous opportunities available there for divers and, especially, those fanatics politely referred to as underwater photographers.

**Return to a Desert Paradise**

In late September of 2002, I traveled back to La Paz with my trusty sidekick and underwater model, John "Sparky" Campbell. It was my sixth trip and his first. We were to be based at a beautiful and friendly hotel (that I have fallen in love with) located just north of the city on its own small beach, the La Concha Beach Resort, and would be diving with my old friends at the Cortez Club.

The Cortez Club is a superb dive operation located on the premises at the resort and has a small fleet of dive boats designed to meet the various conditions to be found in the Sea of Cortez. After settling into our room, the pool and the Mai Tais were calling to us like the Sirens of Greek mythology. Rather than answer their request, however, we sauntered past the pool and stands of palm trees rustling in the late afternoon breeze toward the pier where the Cortez



Club crew was busily cleaning the boats and equipment after their long day on the water.

"Big John! Hola! Como esta?" rang out as we wandered out to the dive boat area. Several of my friends from past trips remembered the big gringo with the white beard.

The Cortez Club has made it a policy to develop and train local young people. That is why it is not unusual to see someone start there as a deckhand and work their way up to divemaster over time with their training supported every step of the way by the club directors, James Curtiss and Andrea Tomba. This not only inspires professionalism and loyalty on the part of the crew, it ensures that by the time they are leading trips out into the Sea of Cortez they are absolutely familiar with every aspect of the organizatio - the boats, equipment, and the various nuances of every dive site both above and below the water. As familiar faces came up to me with wide grins and extended hands, I almost felt that I had returned home.

**Our Week in the Sun**

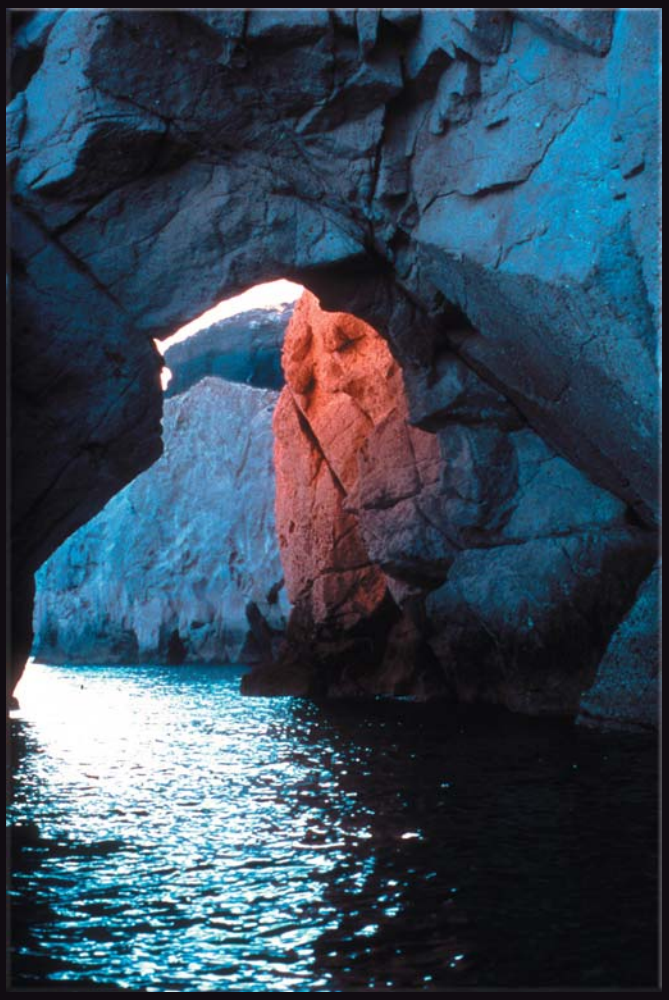
Since stormy conditions had prevailed prior to our arrival and high waves were still quite prevalent, rather than plunging right out to the far away Seamounts, our dives commenced with a trip to the Los Islotes sea lion colony. While the primary draw for most divers is the sea lions themselves, Los Islotes has a beautiful wall that drops down to approximately 100 fsw covered with orange and red soft corals, thousands of sea fans of all colors, and large numbers of fish of all sizes, shapes and colors. On this first day we had visibility approaching 100 feet and our excitement grew as we planned and executed our shots up the wall toward the sunlight that was glinting down from the surface. Occasionally, even though we were not close to the colony itself, a young sea lion or two would dart down to check us out, putting a wee bit of spice into our lives as they would spring unexpectedly into the camera's viewfinder.

Los Islotes also has a swim-through that can literally be used to swim through the island itself from one side to the other. This passageway extends both above and below the surface with the underwater portion covered with hundreds of animals and bright, flaming colors that Picasso would have envied. We planned our second dive of the day so that the sunlight would be glinting directly down into this passageway, allowing me to silhouette Sparky as he slowly moved along the wall. The sight was one that is etched in my mind forever. As we rocketed back to the Cortez Club in our panga, I had the inescapable feeling that I had just taken some of the best shots of my life.


Above: Home to incredible diving as well as gorgeous sunsets, the Cortez Club is located on the Bay of La Paz.

Lower Left Page: Panamic Green Morays (Gymnothorax casteneus) are so abundant in the Sea of Cortez that often clusters of them can be found sharing the same hole.

Below: Morning sunlight glistens off the face of an arch formation at the water's edge of Isla Parida Sur near Los Islotes.



The next day, along with four other divers from Scotland and Italy, we made our first attempt at the El Bajo Seamount, located approximately eight miles northeast of Los Islotes. The Seamount is known for both its physical beauty and for the fact that hammerhead sharks use it as a schooling location. While they are not present in the large numbers of the past, it is still common to view 20 sharks at any given time.

Finding them, however, is the problem. The El Bajo Seamount actually consists of three peaks: the northern peak, which rises to about 85 feet from the surface, the central peak, which rises to about 50 fsw, and the southern peak, which rises to about 70 fsw. Standard operating procedure is to descend to one of the three peaks, then dive down its slopes into deeper water searching for the hammerheads, often finding them between 120 and 150 fsw. They appear to prefer cooler water, meaning that as you descend, the feel of a thermocline on the skin of your face is a prime indicator that you are likely to see your quarry at any moment. On this day it was not to be, however. Due to the previously mentioned storms and the current full moon, the Seamount was current swept and run-off from the land (they had actually had floods the week before!) had reduced visibility to 15 feet or less below 70 fsw. The hammerheads could have been 20 feet away and we would have remained blissfully ignorant of their presence. My shutter finger remained itchy and the camera unused as we slowly approached the surface, disappointed but still game.

My old friend Nelson, our divemaster that day, suggested that we try something new. We sped off toward one of the two new "wrecks," sunk in late 1999 as artificial reefs west of Isla Espiritu Santo. The ships themselves are part of a unique story. Both of them were Chinese freighters that ironically were stopped by the Mexican Navy for attempting to smuggle illegal immigrants into the United States through our southern doorway. The immigrants were returned to China and the confiscated ships sat at anchor until the dive operators at La Paz hit on the idea of creating some new dive sites with the ships as their center pieces, similar to what has been done in the Florida Keys, off San Diego, and in British Columbia. We dived on the 185 foot (56 meters) Fang Ming and were amazed to see the amount of marine growth on her as well as the clouds of schooling fish pirouetting about her decks and railings. Resting in approximately 80 fsw, this ship provided fine opportunities for wreck photography, while the preparation done by

the La Paz dive operators allowed for full penetration from one end of the ship to the other. This site will only get better as time progresses and the marine life accumulates.

As the week progressed the dive sites varied, based on both sea conditions and the whims of the clients. Each morning we awakened with the knowledge that we could literally see anything that day and probably would! Leaping mobula rays were sighted on the surface near Punta Lobos, while we were able to photograph seahorses, moorish idols, and several species of moray eels underwater. Garden eels, jeweled and starry morays and a tiny colony of pike blennies were the highlights of our dive on Swanee Rock, a shallow reef that is virtually covered with life. The Salvatierra Wreck, a ferry that sank after striking the nearby Swanee Rock reef, offers outstanding photo opportunities when visibility is good. When she went down in 1976 she was carrying several large semi trucks, the remains of which litter the wreck itself and the sandy bottom around her. The Salvatierra's two large propellers are enshrouded with colorful marine life and it would take a blind man not to want to record them on film.

Our trip to the La Reina lighthouse proved to be particularly eventful. La Reina (the Queen) is a tiny rocky island off the northern tip of Cerralvo Island with a tiny unmanned lighthouse. A small colony of sea lions make their home there, but they are not reason enough to make the long boat trip to Cerralvo. The draw here is giant pacific manta rays and quite often there are LOTS of them! We entered the water on the northeastern side, descending to approximately 70 FSW and swam westerly around the rocky island. As we briefly ascended over a rocky finger in the underwater terrain, the first manta made its appearance, seeming to fly over us with gracefully slow beats of its mammoth wings as the huge lobes on either side funneled plankton into its monstrously gaping mouth. As it passed by, all eyes watched as it traveled on except mine. I turned to look again out into the blue only to find that a second manta was approaching on the heels of the first. For the remainder of the dive it was that way - one would swoop in and move on while another would soon put in an appearance. They appeared to be circling the small rocky island using the currents in their quest to consume plankton. Ultimately we were able to determine that at least four individuals were present by the differing designs on their undersides. The smallest manta appeared to be approximately 10 to 12 feet across with the largest at least 15 feet across. All of them allowed us to approach quite closely, only turning away when we were within a few feet. Sparky described swimming immediately behind one of them as similar to being in a "prop wash."

Our time with the Cortez Club was rapidly drawing to an end and it was agreed to try the El Bajo Seamount again to see if visibility had improved. After the long journey our patience was rewarded. I could feel my excitement building as we descended to the northern peak and realized that this day we would have approximately 100-foot visibility. Clouds of fish enshrouded the Seamount and the colors on the rocks seemed to leap out at me as I approached. In absolute amazement, with wide eyes Sparky pointed downward where we could clearly see groups of morays out in the open writhing like

Above Left: Drawn by the plankton-rich waters of the Bay of La Paz and its surroundings, Whale Sharks (*Rhincodon typus*) are frequent visitors to the area.

Above Left Below: An inquisitive Guineafowl Puffer (*Arothron meleagris*) approaches and considers its own reflection in the camera lens.

Back Drop: The rays of sun dancing off its back, an inquisitive Sea Lion darts down to play with the ADM team at the Los Islotes Sea Lion colony.

snakes on the bottom. As we descended past the slopes of the northern peak, it seemed as if every hole held a moray while hordes of cortez and king angelfish darted in and out of the rocky crags and amongst the sea fans, ignoring us completely. Pairs of tiny, colorful little barberfish fluttered about bearing the tiny little black "moustache" that gives them their name. As we plunged deeper, first one then another thermocline became readily apparent as the cold water made our faces tingle.

Suddenly, at approximately 130 fsw, Nelson's arm struck out, pointing out and down into the gloom where a line of whitish shapes were just beginning to appear slightly before and below us. Like huge ghostly apparitions, the Hammerheads appeared, sweeping in like a flight of bombers all on the same heading, appearing both pale and lethal. Dropping down to 140 fsw, Sparky and I attempted to swim slowly into the school, my camera extended and snapping away. The sharks weren't having any part of this, however. Hammerheads can be surprisingly shy and timid. At the approach of our bubbles they turned as a group and disappeared into the gloom, leaving me with a feeling of exhilaration at the marvelous sight we had just witnessed, but no useful exposures in my camera. Unable to approach them, we regretfully began our ascent, making a series of stops as a precautionary measure to avoid a "hit", but also with the hope that a wahoo or marlin would stop by for a look-see at these strange folks just hanging out in the "big blue." As we hung at our stop and I had time to reflect, I wistfully thought of how it might have been different had I dove among the Hammerheads with a rebreather.

That evening as I dismantled my camera equipment and we began packing our gear in anticipation of departure, our thoughts kept drifting back to the many amazing sights we had seen during the week. I was looking forward with anticipation to developing my film and laying it all out on my viewing table, anxious to see the images we had produced together. Our conversation was littered with comments such as "Did you see that little octopus?" and "How do you think that shot of that wall with the purple sea fans will turn out?" and "That was the most beautiful little moray I ever saw!" The excitement still hadn't left us. Hours later, as we lounged at the poolside, sipping on a marvelously prepared drink handed to us by the most polite bartender I'd ever met, Sparky turned to me with an overly-pleased look in his eye and said, "You know, I think that Mexico likes me!"

The Sea of Cortez has brought another convert to the fold.

Additional Information: Certain times of the year in which species are more likely to be sighted.

Whale Sharks May - Aug, also in Nov
Whales (Various Species) Apr - Oct
Giant Pacific Mantas July - Oct
Schooling Mobula Rays Feb - Mar, Aug - Oct
Schooling Hammerheads Year Round
Sea Lions Year Round

The Cortez Club is a full service dive operation that is Bajaís only PADI 5 Star IDC Gold Palm Resort. They offer numerous training courses up to and including the PADI Instructor Development Course (IDC). Nitrox training is also available with Nitrox fills available up to 100 percent. Underwater photography and video courses are available, along with occasionally scheduled photography clinics. Draeger Dolphin Semi-Closed Rebreathers are available for rental, and training for these units can also be provided through either ANDI or PADI. Trimix can also be provided with three to four weeks advance notice. Plans are currently being discussed to provide technical equipment as rental gear to qualified divers, as a series of deep wreck and Seamount dives are available to cater to this particular clientele.

ADM team member "Sparky" Campbell tries to keep pace with a Giant Pacific Manta, and quickly discovers that it's harder than it looks!

**For more information, please contact The Cortez Club:**
**Phone: 01152-612-12-16120**
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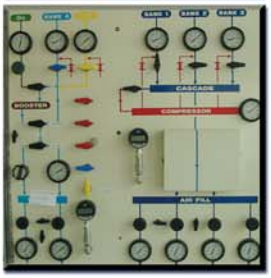

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