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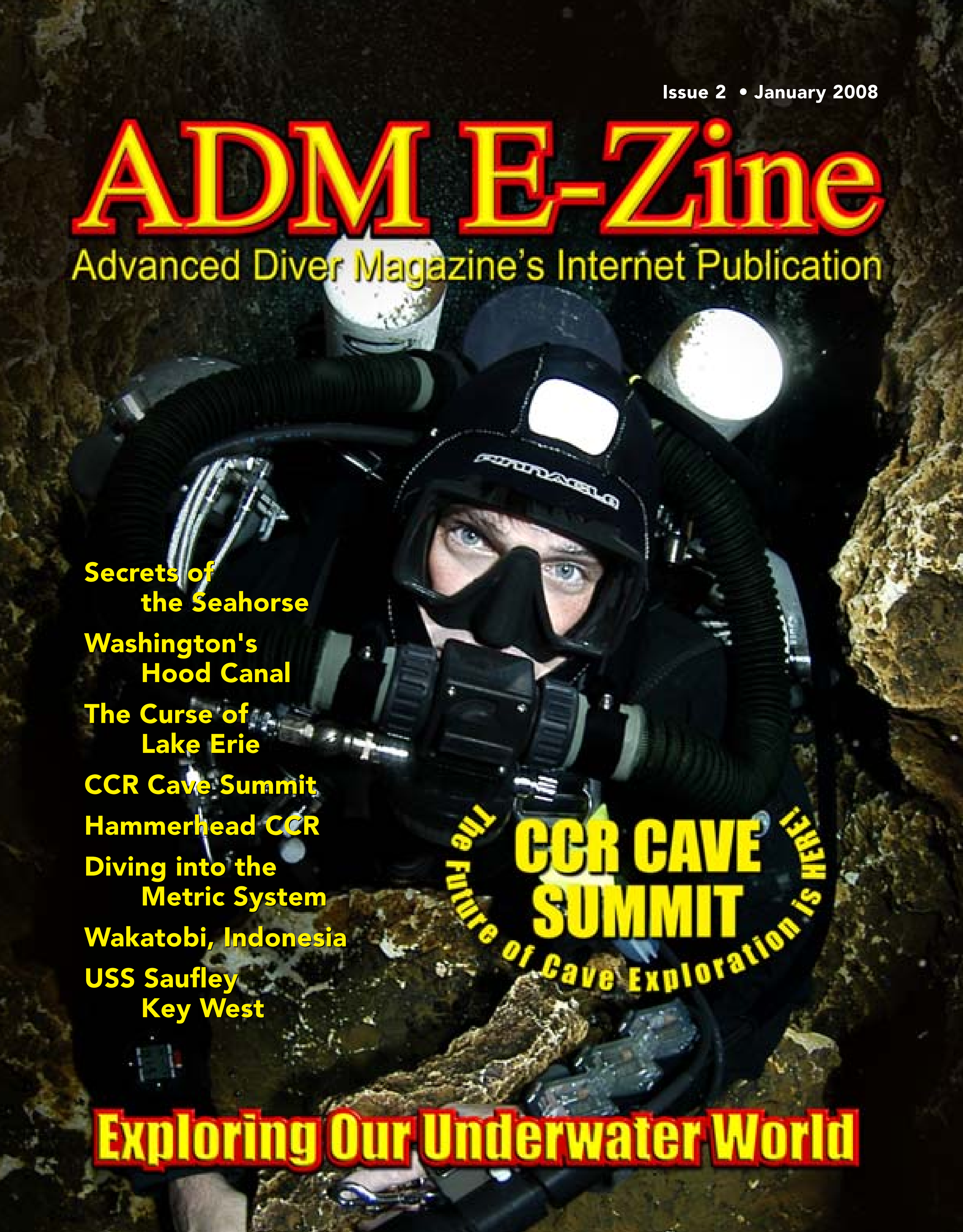

Secrets of the Seahorse

Washington's Hood Canal

The Curse of Lake Erie

CCR Cave Summit

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Diving into the Metric System

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ADM Staff Photojournalist
Mel Clark • Richard Harris
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Contributing Writers / Photographers
Keith Ambrose, Thaddius Bedford, Leigh Bishop
Joseph Dovala, Erik Foreman, Jill Heinerth
Brett Hemphill, Dr. Thomas Iliffe, Brian Kakuk
Cass Lawson, Jim Rozzi, Wes Skiles
Dr. Bruce Wienke

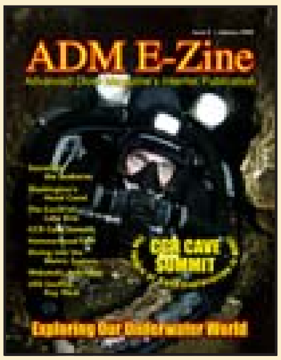
Editorial Contributors & Dive Assistants
Jack & Karen Bowen • Vlada Dekina
Rich & Doris Chupak • David Harasti
Kevin Juergensen • Barry Lawson
Scott Maclean • Kim Smith
Charlie Tulip • Bert Wilcher

Contact Information:

Write........... Advanced Diver Magazine
327 Snapdragon Loop
Bradenton, FL 34212 USA

Phone........... 941-748-3483 (DIVE)
E-Mail........... AdvDvrMag@gmail.com

ADM E-Zine FEATURES



Cover:

Brett Hemphill explores deep into a Florida Cave. CCR Cave Summit brings together serious questions about the use of rebreathers in a cave and specific rules for safety.

Photo by Curt Bowen

Publishers Notes

Thinking back to when I first got into deep diving, everything was completely different than it is today. It was over twenty years ago, and we didn't have rebreathers available, or trimix computers, or oxygen analyzers, not even nitrox. Air was *it* — and it came in steel 72's, aluminum 80's, or if you were lucky, heavy 104's.

And those were the days, as some might remember, when the dive master course took months of helping with classes, working in the shop for free, filling tanks, and carrying gear from dive boats, beach dives, etc.... I was trying to get my dive master, and helping out in the local dive shop, when one afternoon a new customer wandered in.

I was going over my PADI dive tables, but stopped to help him and to listen. He was talking crazy stuff about going to 200 feet in some hole in the ground that was filled with water and located just north of Tampa.

As I filled his double 80's with air, he turned and asked me whether I wanted to tag along. I was off the next day so I said sure, but I didn't own a set of doubles or know how to use them. No problem, he told me. We'll just band another aluminum 80 beside the single on your back with some long hose clamps from the local hardware store.

Early the next morning, we headed north to a secluded hole in the ground surrounded by large Florida oaks. It was called Ward's Sink. Using my standard open water BCD, we banded a second aluminum 80 onto its left side and attached a separate regulator. I added about eight pounds of weight on my right side to offset the weight of the extra 80 on my left, and into the water we went.

Holding a single Pelican light, we dropped into the round shaft and deeper into the ground. At a depth of 120 feet, deeper than I had ever been before, we landed on top of a silt mound containing one large oak tree that was lying on its side. With the small light beaming off into the darkness, I followed my new dive buddy down the sloping silt mound. 150, 160, 170, 180…then the wall came into view, and we landed in a cloud of silt right at 200 feet. With my bubbles sounding like wind chimes, I stared wide-eyed as he showed me his fancy Aladdin dive computer: *202 feet*! Returning to the surface, he made me do these strange things called decompression stops that the computer directed us to do.

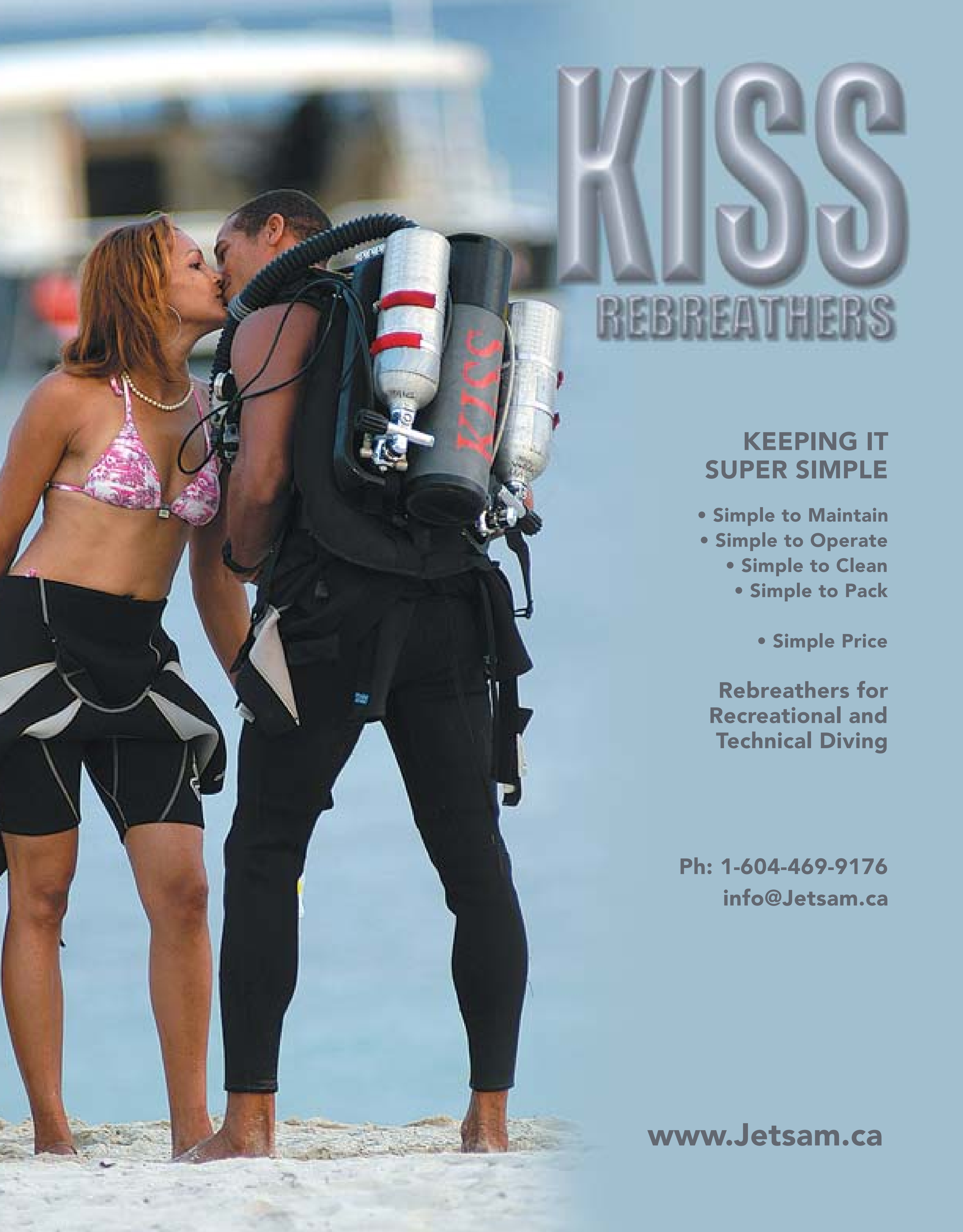
Charlie Tulip was the name of the wild guy who ventured into the shop that day and enticed me into my first deep dive. A lot of years followed that memorable day, and Charlie and I would venture into many caves, reefs, and even deep Lake Superior shipwrecks. If it were not for Charlie, introducing me to deep diving, most likely you would not be reading this publisher's note.

Charlie passed away on the morning of December 27th, 2007.

With the soft tones of a lone bugle whispering the call of Taps, we bid a final farewell to our friend, Charlie Tulip. He will be missed by the many whose lives he touched and changed.

May he rest in peace.

Curt Bowen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Secrets of the Seahorse

Text and Photography by David Harasti

There are many divers in New South Wales who have been fortunate enough to venture below the waters of Port Stephens or Sydney Harbour and encounter one of the ocean's shyest and most elusive animals... the seahorse.

Seahorses are bizarre and fascinating little marine creatures that belong to a family called 'Syngnathidae' which includes seahorses, pipefish, seadragons, and pipehorses. They are known to occur throughout the oceans of the world (except in the coldest seas), and can be found living in various habitats including seagrass meadows, sponge gardens, and coral reefs. They are closely related to ghost pipefish (*Solenostomidae*) and sea moths (*Pegasidae*), and all seahorses belong to the one genus, *Hippocampus*, which is derived from the Greek words 'hippos' (meaning horse) and 'campus' (meaning sea monster). Most species are found in shallow coastal habitats (less than 20 metres), but some species are known to occur in water depths of up to 150 metres.

There is considerable conjecture over the number of seahorses that are found worldwide with Project Seahorse recognising 33 species in ***A Guide to the Identification of Seahorses*** (2004), whilst Rudie Kuiter in his ***Comprehensive Guide to Syngnathiformes*** (2006) indicates that there are at least 60 different species worldwide, and the total figure could be higher than 100. The largest seahorse is considered to be the Australian Pot Belly Seahorse (*Hippocampus abdominalis*) that can be found on the protective swimming nets in Sydney Harbour, whilst the smallest is the Pygmy Seahorse (*Hippocampus denise*) that lives on gorgonian fans in the tropics. However, there may be even smaller seahorses yet to be discovered as indicated by a new, undescribed species recently found in Indonesia and Papua New Guinea. Commonly referred to as the Pontoh's Seahorse, it is incredibly small and proves to be very hard to photograph!

Seahorse habitats are among the most threatened in the world. More than 25 million dead and live seahorses are traded globally on an annual basis with around 95% of these being used in traditional medicines; aquarium and the souvenir trade make up the rest. In areas such as Vietnam, Indonesia, and the Philippines, populations of seahorses have noticeably declined. To help minimise the decline in seahorse populations, all species of seahorses (Genus Hippocampus) were protected under CITES (Convention on International Trade in Endangered Species) in May 2004. Listing means that exporting countries need to ensure that trade does not threaten wild populations of seahorses. Consideration is being given to list all species in the syngnathid family on CITES to ensure the trade of pipefish and pipehorses is ecologically sustainable.

There are at least 31 syngnathids (7 seahorses) and four solenostomids (ghost pipefish) species known to exist in NSW waters. Two of these species, the White's seahorse (*Hippocampus whitei*) and the pygmy pipehorse (*Idiotropiseis lumnitzeri*), are considered to be endemic to NSW (meaning they are only known to occur in NSW waters). Australia has taken several measures to protect seahorse populations with protection being afforded in New South Wales, Victoria, South Australia, Tasmania, and Commonwealth waters. All species in the Syngnathidae family became protected in New South Wales in July 2004, and it is illegal to take them from the wild or possess any of the species in the Syngnathidae family. Therefore, if a diver notices an activity occurring with seahorses being taken from the wild they should report it immediately to NSW DPI-Fisheries.

Seahorses are a very unique species as, unlike the rest of the animal kingdom, it is actually the male seahorse that becomes pregnant, carrying eggs in a pouch-like opening. The female deposits her eggs into the male's pouch, the eggs are then fertilised by his sperm. In seahorses, pregnancy lasts from two weeks to one month, and the male can then give birth to upwards of 150 babies. The babies are left to fend for themselves; after birth, the adults provide no parental care.

In Port Stephens and Sydney Harbour, the most common seahorse that can be found is the White's Seahorse (*Hippocampus whitei*). This shy and elusive animal likes to live in the sponge gardens and seagrasses of the Port, and is currently being studied by David Harasti from Project Seahorse and the University of Newcastle as part of his Ph.D. research. His study is currently in its second year; he is examining the habitat preferences of the seahorse, and assessing the effectiveness of marine protected areas for seahorse conservation.

In March 2007, David discovered the Thorny Seahorse (*Hippocampus histrix*), which was the first confirmed sighting of this tropical seahorse in Australian waters – a very unusual discovery as this species is generally found in the Philippines and Indonesia! The Australian Pot Belly seahorse (*Hippocampus*

abdominalis) has also been sighted during the seahorse surveys; therefore, at least three species of seahorses are known to occur within Port Stephens.

Additional elements to the seahorse research project include mark-recapture analysis by the tagging of seahorses, the role of artificial structures as seahorse habitat, and the potential for releasing captive-bred animals into the wild. The tagging involves injecting three small, coloured fluorescent implants (elastomer) into different sections of the seahorse that can be easily seen by a diver. These small tags are fluorescent, and are usually pink, yellow, orange, or green in colour.

As of June 2006, over 400 seahorses and 50+ pipefish have been individually tagged in Port Stephens. It is believed that the population of *Hippocampus whitei* within Port Stephens is much greater than originally thought, with initial mark-recapture estimates indicating that one of the dive sites could have as many as 1500 animals.

Over the past eight months, research has also been conducted on the protective swimming enclosure at Manly (located between the ferry wharf and Oceanworld Manly). Over 130 *Hippocampus whitei* have been tagged at this site, and surveys are conducted each month to examine growth rates, seahorse movements, and population size. This work will hopefully assist Manly Council with their management of the net, particularly in regards to net cleaning methods to minimise the impact on the seahorse population.

If divers are interested they can assist with the seahorse research by taking photos of any of the tagged animals within Port Stephens or Sydney Harbour, and recording the date, location, depth, and water temp. Don't forget that both sides of the tagged seahorse must be photographed, as all three tags must be seen to determine the individual identity.

This seahorse research has been supported with funding from the Sydney Aquarium Conservation Foundation and the University of Newcastle, and assistance has also been kindly provided by Ikelite and Mares through provision of equipment. For further information on seahorses and associated research or on marine life of New South Wales, visit www.daveharasti.com.

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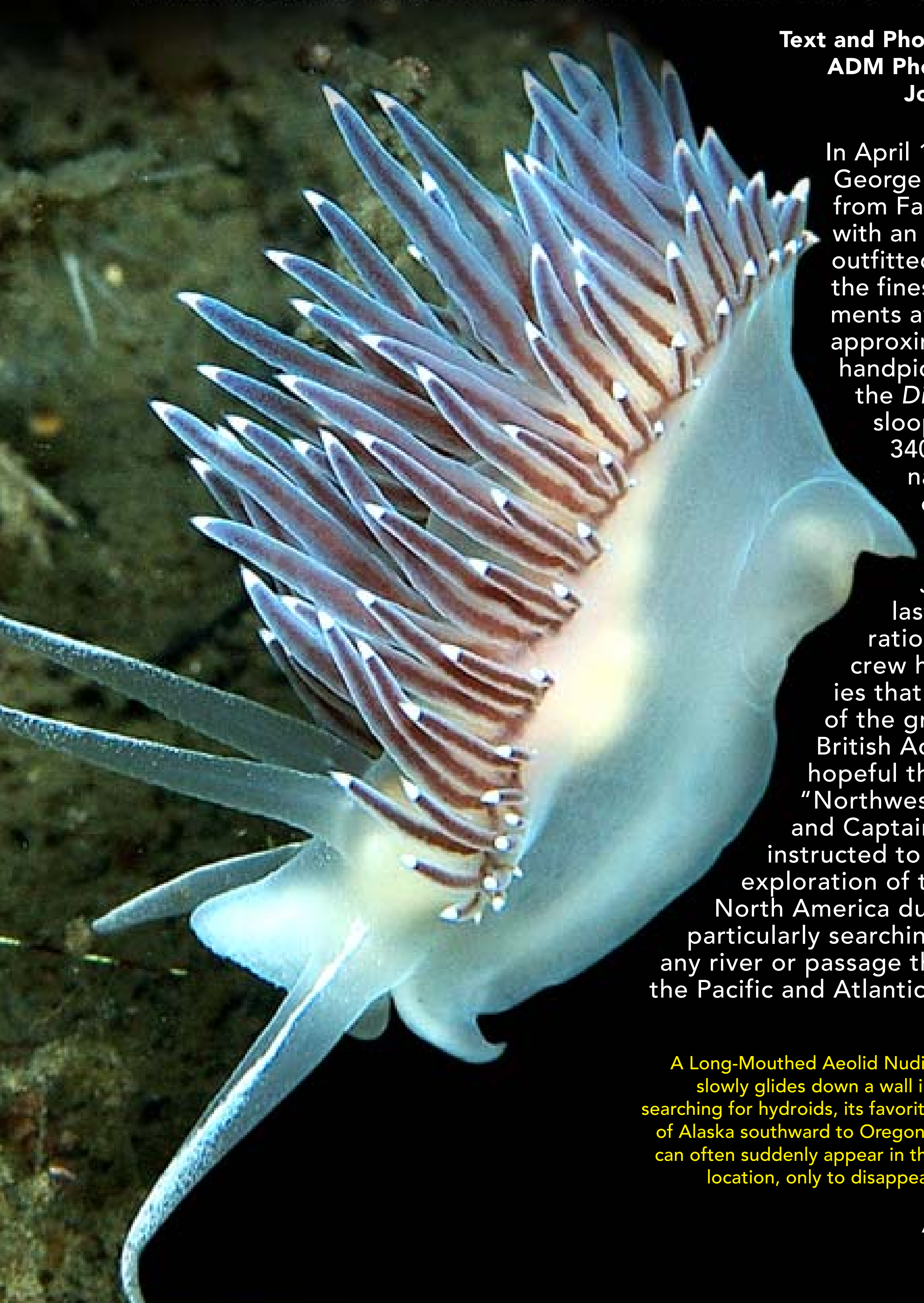
Testing the Waters
Washington's Hood Canal

**Text and Photography by
ADM Photojournalist
John Rawlings**

In April 1791, Captain George Vancouver sailed from Falmouth, England, with an expedition well outfitted and equipped with the finest scientific instruments available. His crew of approximately 150 men was handpicked. His flagship, the *Discovery*, was a sloop of war of some 340 tons. She was named after the ship on which Vancouver had accompanied the famous Captain James Cook on his last voyage of exploration. Both captain and crew hoped for discoveries that would rival those of the great Cook. The British Admiralty remained hopeful that the fabled "Northwest Passage" existed, and Captain Vancouver was instructed to make an extensive exploration of the Pacific Coast of North America during his voyage, particularly searching for evidence of any river or passage that might connect the Pacific and Atlantic Oceans.



A Long-Mouthed Aeolid Nudibranch, *Flabellina trophina*, slowly glides down a wall in Washington's Hood Canal searching for hydroids, its favorite prey. Found in the waters of Alaska southward to Oregon, this species of nudibranch can often suddenly appear in their hundreds at a particular location, only to disappear as abruptly as they came.

In April 1792, the *Discovery* entered the Strait of Juan de Fuca, excitement building on board at the thought that the entrance to such a passage might be found the further eastward they sailed. In mid-May, an entrance to a long, narrow body of water that was almost fjord-like was discovered. The formation of this narrow body of water began over three million years ago, and its current "fishhook" shape was created by glaciers around 15,000 years ago. This narrow body of water is 61 miles long and has 242 miles of shoreline…small wonder that it initially caught the attention of Vancouver and his crew.

"Early on Sunday morning the 13th, we again embarked; directing our route down the inlet, which, after the Right Honorable Lord Hood, I called Hood's Channel…." Log entry HMS *Discovery*, May 13, 1792.

Their initial exploration showed that the "channel" jutted southwestward. It was clearly not the great entrance they sought, and the expedition turned back northeastward in their quest. Interestingly, though he referred to it as a "channel" in his log, Captain Vancouver labeled it as a "canal" on the superb charts being created as part of the expedition of discovery, and "Hood Canal" it remains to this day. Hood Canal itself would remain a backwater of international events, not seeing much activity at all compared to other areas explored by *Discovery* and her crew.

Today, Hood Canal is welcoming another group of explorers. They are researchers and divers with a deep and abiding love for the body of water now known fondly as "the Hood." The discoveries they seek today, however, are not new lands to be claimed but answers to a perplexing scientific problem: Periodically, parts of the Canal will literally "choke" due to a lack of oxygen. Researchers from the University of Washington and other state and tribal agencies have joined hands with select teams of volunteer divers to gather data from specific locations within Hood Canal that have been particularly effected by the lower oxygen level phenomena. Human populations have grown dramatically around Hood Canal since the days of George Vancouver, and it has

It's extended dorsel spines clearly showing how it came by its common name, a Quillback Rockfish, *Sebastes maliger,* prepares itself to quickly dart away from me as I approach. Seconds after this photo was taken only a cloud of silt remained. One of the more common of the Rockfish species found in Puget Sound and Hood Canal, the Quillback prefers rocky reefs and crevices for habitat, but is also commonly found on wrecks as well.

become an area popular for waterfront vacation homes, boating, and fishing, as well as being home to the Bangor nuclear submarine base. It would be a simple thing merely to trumpet that the cause of oxygen depletion is due solely to the encroachment of humans in the ecosystem, but there is far more to the problem than that. Reports of "fish kills" in the Canal go back well over a hundred years, long before the advent of increased population and intense recreational and military use. While human activity surely must play a role, other extremely significant factors are also at play here.

The average width of Hood Canal is only a mile and a half, its narrowest point being only half a mile wide and its widest being around four miles. The Canal's deepest depths exceed 600 feet, and average 500 feet in the central channel for much of its length. A vast "sill" exists at the entrance of Hood Canal. The entrance to Hood Canal is relatively shallow, only around about 150 FSW. Immediately south of the entrance, it suddenly becomes very deep, between 500 and 600 FSW. This situation at the entrance creates a condition that prevents efficient water exchange seasonally or with changing tides. Instead, this physical "sill" at the entrance tends to retain the water, and estimates of <u>complete</u> water exchange rates are speculated to be in the range of years. This natural situation not only slows the flushing action of the Canal, it also negatively impacts deep water circulation. This situation causes Hood Canal to flush extremely slowly, taking around six months to complete the flushing process. This is one of the factors that have caused historic chronically low levels of oxygen, a situation that worsens with distance from the mouth to the head of Hood Canal.

Something as ordinary as the wind can also play a significant role in the lowered levels of oxygen within parts of Hood Canal. Research indicates that oxygen depletion may be partially due to simple changes in wind direction. The prevailing north wind generally pushes oxygenated water into the oxygen-depleted areas of the Canal. A sustained south wind can, in turn, cut off this source of oxygen. An extremely visible type of oxygen stress is the sudden appearance of dead fish and other marine life on beaches. Such "fish kill events" have been historically recorded in Hood Canal, and have been recently recorded in 2002, 2003, 2004, and 2006. While these events have been relatively localized and the severity of them has varied, they typically occur in the late summer and fall. They are associated with an

An extremely abundant creature in Hood Canal, a "Squat Lobster", *Munida quadrispina*, peers out at my camera lens from its hole. Not really a "lobster", this species is a member of the Galatheid crab family and can be found ranging from Sitka, Alaska in the North down to Baja, California, in the South - often in populations of high density.

upwelling of deep low-oxygen water to the surface. Such an upwelling can be gradual due to the addition of newer, denser ocean water at depth, or it can be extremely rapid due to southerly winds that push surface layers northwards, resulting in the upwelling of deeper waters. In fact, most of the recent fish kills were documented with a period of southerly winds immediately following a period of northerly winds. There has been some speculation that such fish kills may even be part of a natural 50-year cycle of oxygen levels in the Canal since there is historical documentation of such events in the past.

The waters of Hood Canal can also be highly stratified in terms of temperature and salinity, upper layers often having dramatically different temperature and salinity levels than those of deeper levels. Such greatly stratified water resists efficient mixing, further contributing to the oxygen depletion problem in parts of the Canal. In a nutshell, the waters of Hood Canal are deep, stratified, and exchange extremely slowly...none of which are good things for a marine environment experiencing a steadily increasing impact from human populations.

Increased human population, bringing with it "normal" run-off from homes, business, and population centers, causes increased levels of nutrients such as septic and sewer contaminants, salmon carcasses from fish hatcheries, herbicides, and fertilizers in the Canal. Such increases in nutrients in areas of poor water exchange can lead to massive algal blooms and huge increases in bacteria populations, leading to plunging levels of oxygen at local sites. This is particularly the case in the southern reaches of Hood Canal where there is normally such poor exchange. The human impact to the naturally "poorly-flushed" waters of Hood Canal is thus probably also a significant factor in oxygen depletion events over recent years.

A favorite fish species for divers in the Pacific Northwest, a Grunt Sculpin, *Rhamphocottus richardsonii,* appears to "walk" along the bottom using its tiny pectoral fins. Only a few inches long at most, this sculpin has evolved so that its face resembles a closed giant acorn barnacle, while its tail resembles the feeding tendrils of an open barnacle. This enables this tiny fish to hide inside a deserted barnacle shell with either its face or tail extended - perfectly camouflaged.

The Hood Canal Dissolved Oxygen Program (HCDOP), **www.hoodcanal.washington.edu/** , was formed as a coalition of groups jointly conducting research in an effort to determine the reasons why oxygen levels are so persistently low in Hood Canal, and whether human activities are a significant contributing factor to that depletion. Funding for the study is primarily federal, with additional funds and resources being made available from local tribes, Washington State, and private sources.

In June of 2007, it was my honor and privilege to dive with a few of those "private sources." After an early morning ferry ride and a long drive into the woods of the Olympia Peninsula, I found myself turning down a one-lane road toward the waters of Hood Canal and a beautiful little marina appropriately named Pleasant Harbor. It was there that I was to meet the team – a dedicated group of divers donating their time and skills to gather long-term data for the scientists and researchers of HCDOP. Most government agencies don't have the training or the resources to field teams of trained divers, and volunteers have stepped forward to fill that gap. The program, known as the Hood Canal Diver Observation program, (also called HCDOP), **www.hoodcanal.washington.edu/observations/diver_observations.jsp** , has an established goal to document the behavior and distribution of marine life as dissolved oxygen levels change at specific locations within Hood Canal during the year. The diver observation program provides a conduit for the teams' observations of marine life impacts to be systematically collected, compiled, and shared with the several scientific and governmental agencies attempting to understand the complex issues faced in Hood Canal. The data collected by the volunteer dive teams is used to track changes in marine populations over time – in terms of population

A juvenile Swimming Anemone, *Stomphia didemon*, extends its tentacles into the current. As an adult, this species is a glowing bright orange with distinctive stripes on the tentacles. In this photo a few of the orange stripes are just beginning to appear. Also known as the "Cowardly Anemone", this anemone can detach itself from the bottom as an escape mechanism, and by contracting each side of its column can literally "swim" away from predators. The Swimming Anemone is extremely common in Hood Canal and throughout much of the Pacific Northwest.

density and abundance, depth, and stress levels. Collected on an established time frame over an extended period, such data will be used to show both trends in abundance of various species as well as depth distributions, and how such trends may correspond with the dissolved oxygen levels in Hood Canal throughout the year.

The Diver Observation Program is coordinated by Janna Nichols, an extraordinarily active board member of the Washington Scuba Alliance, **www.wascuba.org/** , who leads each trip, and is literally the "heart and soul" behind the project. On the day that I was to dive with them, other team members on hand were Phil Green, Jackie DeHaven, Ty Hillebrand, and Sarah Hillebrand, all well trained by Janna in fish and invertebrate marine identification and briefed on the specific methods to be utilized in the gathering of data. Local dive charter operators, Don and Diane Coleman, of Pacific Adventures, **www.pacadventure.com/** , have donated both the use of their dive boat, *Down Time*, and their time for the on-going project, ensuring that Janna and her teams have high-quality surface support. I have been struck by the enthusiasm and professionalism of everyone associated with this endeavor, and the Colemans are no exception to this.

For the sake of accuracy, the methodology utilized for the HCDOP dives does not vary, and each dive team follows a strict regimen. Marine life is observed and documented within four different and specific depth zones. Upon entering the water, each team immediately descends to 80 FSW and will begin surveying at that depth. Depths are adjusted based on current tidal heights so that each team begins the dive at the same depth/location as each previous team over time. Each diver within the team then documents marine life observed within a three-foot wide swath directly in front of him/her as the team ascends through each zone, which are established as:

80 FSW – 60 FSW:	Zone 4
60 FSW – 50 FSW:	Sub-Zone 3B
50 FSW – 40 FSW:	Sub-Zone 3A
40 FSW – 20 FSW:	Zone 2
20 FSW – Surface:	Zone 1

Each diver is equipped with a pre-printed slate for numeric and anecdotal documentation of observed fish and invertebrate numbers. Additionally, each team carries at least one camera to accurately document any anomalies noted – particularly if irregular behavior or stressed animals

A tiny juvenile Giant Sea Cucumber, *Parastichopus californicus,* clings to a silty wall in Hood Canal. Though this photo shows a small one only a few inches long, adults can reach up to 20 inches in length and the color variations can seem almost infinite. This is another seemingly "lethargic" species, but when threatened by a predator, such as the Sunflower Star, the Giant Sea Cucumber can quickly writhe back and forth as an escape mechanism. Divers watching this predator/prey interaction for the first time are often stunned.

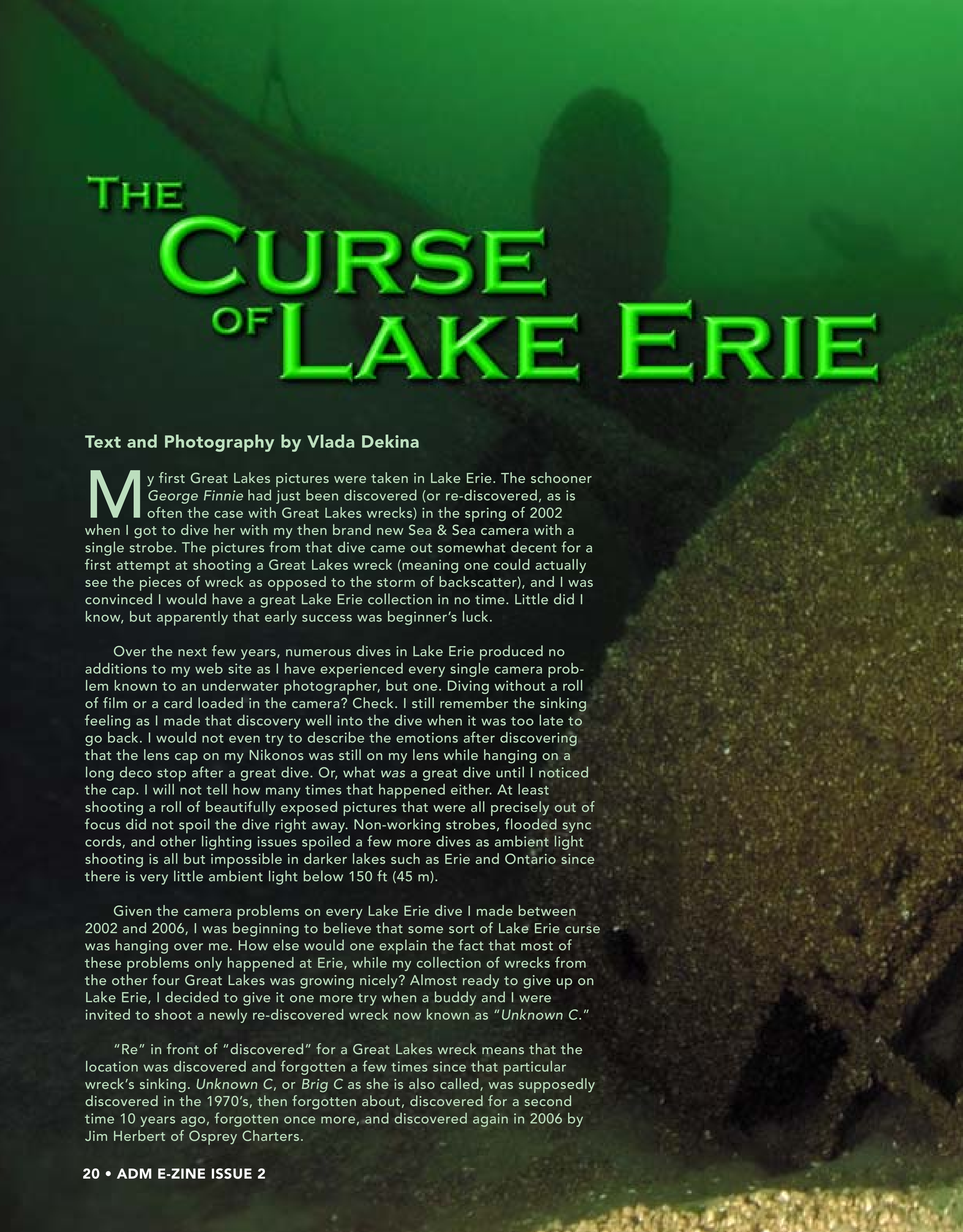
observed. Notes are also to be made of additional species sighted that are not included on the master list, and any other unusual sightings or developments noted during the dive. Upon surfacing, each team correlates their data and prepares it for submittal. Definitely mission-oriented and NOT your typical "let's get wet" kind of a dive. The team was both serious and enthusiastic…and it was infectious. I found myself grinning in anticipation of dives that would be both enjoyable AND scientifically important.

My buddy for the dive would be Jackie DeHaven, a vivacious school teacher with hundreds of cold-water dives to her credit. Together with Team Leader Janna Nichols and Phil Green, we would be the first group to enter the water. It felt good to dive with a team in which you can feel a strong sense of dedication and purpose. Striding off the stern of *Down Time,* I felt the blast of cold water on my face as the dive commenced and the team slowly sank into the rich emerald depths of Hood Canal. I was the tag-along...a rather large appendage whose sole assignment was to take photos of the team doing their job.

Freed of any requirements other than my own creativity, once the team reached the established depth and began surveying, I flitted around them like a rather large bee, snapping photos of the divers as they concentrated deeply on the tiny little portion of the rocky wall directly in front of their mask face-plates. After a very short while, I realized that so far as they were concerned I wasn't even there, so devoted to the task were they. Moving in unison almost glacially up the underwater slope of the wall, shoulder-to-shoulder, the team made note of anything that swam, crawled, or skittered down a hole, their pencils darting up and down and their slates gradually filling with data. These people really know what they are doing and why…I felt like a bit of a punk.

Upon surfacing, once again it was all business – each team member transferring the data from the slates onto permanent log sheets, and discussing any anomalies noted during the dive or unusual species that might have been noted. Captain Don Coleman turned *Down Time* toward the next designated survey site, and the second dive team began donning their gear in anticipation of descending to do their part. I stood and watched as the forested shoreline of Hood Canal swept past, and mused to myself about how satisfying the day had been – "Something worth doing is being done here…."

During the dive, I didn't see anything amazing in terms of rare species…no dramatic evidence or scenes of the impact of oxygen depletion…but I did see a solid team of volunteers doing a behind-the-scenes job that few people know or even care about. The task they have taken on is one that will make a huge difference in the scientific understanding of the challenges faced by a body of water that they dearly love – "the Hood."



The Curse of Lake Erie

Text and Photography by Vlada Dekina

My first Great Lakes pictures were taken in Lake Erie. The schooner *George Finnie* had just been discovered (or re-discovered, as is often the case with Great Lakes wrecks) in the spring of 2002 when I got to dive her with my then brand new Sea & Sea camera with a single strobe. The pictures from that dive came out somewhat decent for a first attempt at shooting a Great Lakes wreck (meaning one could actually see the pieces of wreck as opposed to the storm of backscatter), and I was convinced I would have a great Lake Erie collection in no time. Little did I know, but apparently that early success was beginner's luck.

Over the next few years, numerous dives in Lake Erie produced no additions to my web site as I have experienced every single camera problem known to an underwater photographer, but one. Diving without a roll of film or a card loaded in the camera? Check. I still remember the sinking feeling as I made that discovery well into the dive when it was too late to go back. I would not even try to describe the emotions after discovering that the lens cap on my Nikonos was still on my lens while hanging on a long deco stop after a great dive. Or, what *was* a great dive until I noticed the cap. I will not tell how many times that happened either. At least shooting a roll of beautifully exposed pictures that were all precisely out of focus did not spoil the dive right away. Non-working strobes, flooded sync cords, and other lighting issues spoiled a few more dives as ambient light shooting is all but impossible in darker lakes such as Erie and Ontario since there is very little ambient light below 150 ft (45 m).

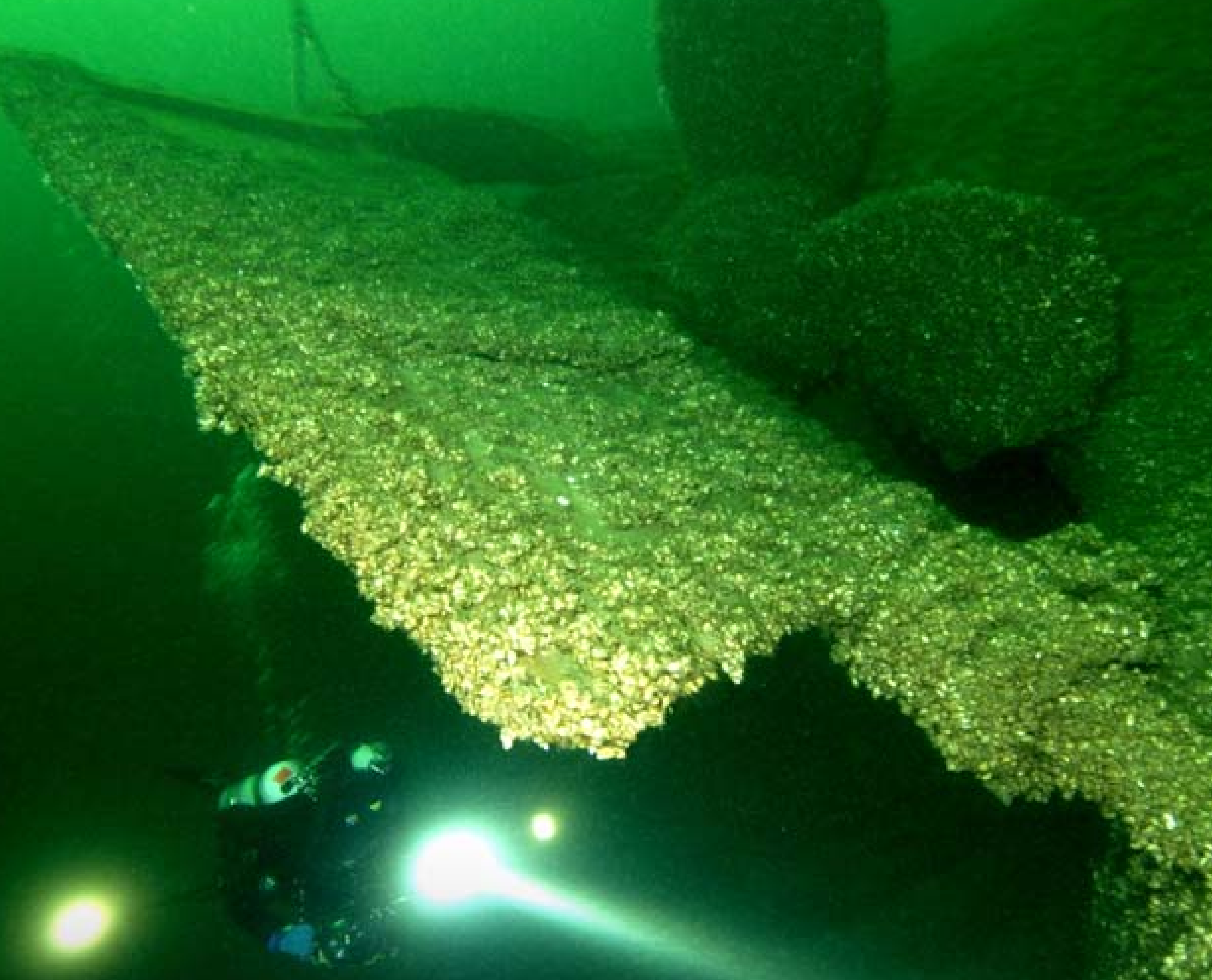
Given the camera problems on every Lake Erie dive I made between 2002 and 2006, I was beginning to believe that some sort of Lake Erie curse was hanging over me. How else would one explain the fact that most of these problems only happened at Erie, while my collection of wrecks from the other four Great Lakes was growing nicely? Almost ready to give up on Lake Erie, I decided to give it one more try when a buddy and I were invited to shoot a newly re-discovered wreck now known as "*Unknown C*."

"Re" in front of "discovered" for a Great Lakes wreck means that the location was discovered and forgotten a few times since that particular wreck's sinking. *Unknown C*, or *Brig C* as she is also called, was supposedly discovered in the 1970's, then forgotten about, discovered for a second time 10 years ago, forgotten once more, and discovered again in 2006 by Jim Herbert of Osprey Charters.

Rediscovered or not, she was a virgin wreck for me. Not seen in years, there were no pictures of her. Remembering my past issues, the camera got checked more times than a space shuttle before the mission. Everything was working perfectly on the surface. Until I decided to shoot RAW on that dive. Somehow a combination of slower card, older battery, and the very cold water resulted in extremely slow recording times and no preview. I only managed about 15 shots on an hour-long dive. Fifteen was vastly better than none, though. It meant that years after the *Finnie* shots were taken, I finally had the pictures of another Lake Erie wreck, and a virgin one at that.

I wish I knew more about her, but the identity of *Brig C* remains unknown. The number of deadeyes on the railing next to the mast was unusually large (eight in a row I believe), giving rise to a speculation that she was a brig as opposed to a more typical schooner type.

Unlike lost, forgotten, and re-discovered *Brig C*, the 220 ft (67 m) long *George Whelan* was a new discovery at the very end of the 2005 season. She sank in 1930 in a squall that first caused her to list to one side and then roll completely upside down before sinking. I got to dive her in 2006, and could barely believe it when I experienced absolutely no problems on that dive. Too bad there was not much to shoot on the outside as *Whelan* was one of those upside down wrecks that are much more interesting on the inside, where I am yet to go with the camera. I did enjoy shooting her huge prop and the rudder, and looking at the silt dunes that accumulated on



the lakebed near the stern area. The lifeboat, half buried in silt, was a silent reminder that only seven people of her crew of twenty-two survived the sinking.

With *Whelan* and *Brig C* added to my collection in 2006, I was looking forward to 2007 with a mixture of anticipation and trepidation. Would it be back to business as usual (lots of dives and no pictures), or was my luck about to change? Well, with four and a half wrecks added to the Erie page so far, it would appear that my streak of bad luck had finally ended.

While a vast majority of my previous Erie dives were to wrecks in technical depths, all the wrecks I visited this season were in the100 to 130 ft (30 to 40 m) range as I was also getting up to speed on a new rebreather. Although not as intact and full of artifacts as their deeper sisters, *Acme* (*Propeller*), *Washington Irving*, *Indiana*, and *Dean Richmond* all had something to offer.

Acme (*Propeller*) was a 190 ft (58 m) long package freighter with the twin hogging arches that went alongside the vessel from bow to stern providing structural support. *Acme* apparently was such a popular name that there is another wreck named *Acme* in Eastern Lake Erie, hence the (*Propeller*) addition. Since sinking in a gale in 1867, *Acme* has been slowly consumed by the lake and silted out to above the deck level so that only the arches and the engine remain above the lake bottom. Those arches were quite a sight rising a dozen feet above the lake floor. Almost nothing, save a few planks of wood, was left of the stern, but the bow was slightly more intact, including the large winch. Cabins blown off during sinking, the engine and boiler were sitting in the open.

Washington Irving was a very small 80 ft (24 m) schooner that sank in 1860. She was leaning to port and covered by silt so much that only the starboard side remained above the lake floor. The bowsprit was intact and the masts were still standing, albeit on an angle. Very nice, but a very tiny wreck, so small that when I swam off the stern it took me a few seconds to realize that I had literally run out of wreck.

I would like to revisit *Indiana* someday. An unusual type for the Great Lakes, she was a 140 ft (43 m) long three-masted wooden bark. She sank in 1870 in a storm while carrying a cargo of paving stones. Given her heavy cargo, she must have gone down fast and furious. The bow probably absorbed most of the impact of meeting the lake bottom and broke pretty badly, making the task of determining where the "pointy end" was among the tangled mess almost impossible.

Bow damage aside, the rest of the wreck was rather intact with remainders of masts still standing, little bilge pump still in place near one of the masts, the cargo of stones in the holds, and various rigging details and artifacts on top of the railings and on the deck. Unlike the bow, the stern was in one piece, but the rudder was flat on the bottom.

My dive on the 253 ft (77m) long steel steamer John J. Boland was filled with anxiety, for she was one of those wrecks that I spent the whole dive on with the lens cap still on my lens. That discovery was so disturbing, I did not remember the dive itself and was not expecting much.

I knew my expectations were going to be blown away when I descended bellow 100ft (30m) to find a beautiful wreck laying on her starboard side and the visibility so good, I could see almost half of her. For the next half hour I occupied myself by taking pictures of the front superstructure with its very inviting but very narrow doorways; spacious cargo holds with some resident link cod (local fish); stern structures with the boat divots still in place and of course her stunning four-bladed propeller and massive rudder.

My favorite Erie wreck this season was the *Dean Richmond*. Built in 1864, four years after *Washington Irving* had sunk, she was a 236 ft (72 m) long two-screw wooden package and passenger steamer. Loaded with zinc ingots, barrels of flour, and other general goods, she sank in a gale in 1893 taking all her crew with her. Rumors that she was carrying copper or gold that had circulated for years after she was lost were put to rest when she was located in 1984, and no valuables found. One of her propellers was salvaged at that time.

She landed on the bottom completely upside down, which normally means a pretty boring dive as one travels from rudder and prop to the bow. Not in this case. While the rudder with the remaining prop and the bow are definitely worth visiting, there is also a huge debris field surrounding this wreck that contains some zinc ingots and large pieces of the ship. The sides have a few openings inviting one to go and play inside. I have to come back to do exactly that.

And I even got to see another virgin Erie shipwreck before this season was over, but the lake did have the last laugh. Having been blown out once before, we did get to the wreck and my camera was working perfectly… except shooting was all but impossible in 3-6 ft (1-2 meter) visibility. It looked like the wreck was another very small, and likely previously salvaged, schooner. The best pictures of her were those from the side-scan sonar.

Scrubber Duration Study

Jetsam Technologies, manufacturer of the Classic KISS and Sport KISS rebreathers is delighted to announce the results of recent scrubber duration testing. The testing reinforces our previous beliefs regarding how long scrubber will remain effective during diving. This is great news for KISS rebreather divers everywhere!

Jetsam Technologies has opted to release all its scrubber duration data, including testing methodology, via paid media. At Jetsam Technologies, we believe it is important for divers to have as much information as possible.

Testing was done at ANSTI Test Systems who are based in the United Kingdom. This independent testing agency, utilizing established, strict scientific standards tested both the Classic KISS and the Sport KISS rebreathers. ***The criterion below utilizes a constant rate of CO2 which is well beyond what any human could produce, for the duration of time listed below.*** These tests were conducted in accordance with the EN14143 European CE Standard and utilized Sofnolime 797 grade.

Data for the Classic KISS

Depth (meters)	**Temperature** (degrees C)	**CO^2 Generation** (litres)	**Breathing Rate** (litres / min)	**Duration** (min) 5 mbar CO^2 Point
40m	4 degrees C	1.6 litres	40 litre/min	157 min - 5 mbar CO^2

Data for the Sport KISS (several sets of data were studied, with positive results)

Depth (meters)	**Temperature** (degrees C)	**CO^2 Generation** (litres)	**Breathing Rate** (litres / min)	**Duration** (min) 5 mbar CO^2 Point
40m	4 degrees C	1.6 litres	40 litre/min	65 min - 5 mbar CO^2
18m	4 degrees C	1.6 litres	40 litre/min	87 min - 5 mbar CO^2
18m	12 degrees C	1.6 litres	40 litre/min	116 min - 5 mbar CO^2

When comparing this data with information provided by other rebreather manufacturers, it is important to ensure you are comparing "apples to apples." It is vital that the durations are based on the same depth, temperature, CO2 generation and breathing rate.

Why is Jetsam doing this? Because we believe all divers should have as much information as possible to ensure their safety. For more detailed information, we invite you to visit www.jetsam.ca.

With a KISS Rebreather, you will ***always*** know where you stand.

Kim Smith, Director
Jetsam Technologies, LTD.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ADVANCED DIVER MAGAZINE Back Issue Directory

ADM Issue 1

4 Hands 2 Brains	by: Curt Bowen
Artifact Preservation - Bones	by: Curt Bowen
Cave Softly	by: Shelly Orlowski
The Death of Technical Diving	by: Jarrod Jablonski
Dragons Lair - Crystal Beach Cave	by: Michael Garman
Liftbag Ops	by: Curt Bowen
One Hand Numbering	by: Curt Bowen
Ponderosa	by: Nancy DeRosa
Remembering Sheck Exley	by: Jim Bowden
Submarine Coast	by: Stephen Brady
Terrence Tysall	by: ADM
Vienna	by: Curt Bowen

ADM Issue 2 *Additional articles not listed*

N.E.S.T.	by: Joseph Kaffl
XlacahExploration	by: Jesse Armantrout
Tank Marking for Multiple Mixtures	by: J. Jablonski & G. Irvine
Hydro Atlantic	by: Curt Bowen
Lake Invaders	by: Joe Rojas
Beneath Cloud Mountain	by: J. Bowden & A. Kristovich
Truk	by: A. White & C. Bowen
World Record Traverse 14,000 feet	by: ADM
Equipment Configuration	by: ADM
Northern Lights - Key Largo Florida	by: ADM
Drift Decompression	by: Curt Bowen

ADM Issue 3 *Additional articles not listed*

Sidemount Diving	by: Lamar Hires
Grand Cayman Carrie Lee Wreck	by: ADM
Oxygen Enriched Trimix	by: ADM
HID High Intensity Discharge	by: Curt Bowen
Methox!	by: ADM
Halcyon Rebreather	by: Curt Bowen
Fantastico	by: K. Sweeney & J. Rozzi
S-16 WWI US Submarine	by: James Rozzi
Sabak-Ha	by: Andreas Matthes
Extreme Depth	by: B. Vestol & J. Bowden
Advanced Nitrox Dive Planning	by: Curt Bowen
Lake Erie's Mystery X Schooner	by: Chris Laughrey
DNAx Denitrogenated Air	by: ADM

ADM Issue 4 *Additional articles not listed*

In Search of New Life	by: Curt Bowen
Cis-Lunar Rebreather	by: Richard R. Nordstrom
Cenotes of the Riviera Maya	by: Steve Gerrard
Scientific Diving	by: Joe Rojas
GUE - Britannic Expedition	by: Anthony Rue
Artifact Preservation - IRON	by: Andrew White
Duane & Bibb - Key Largo Florida	by: C. Williams & L. Bowen
Cannon Ball Cave	by: Joe Rojas
RGBM Deep Stop Modeling	by: T. O'Leary & B. Wienke
Cave Survey Techniques	by: Curt Bowen
Cave Diving Group - John S. Buxton	by: Jim Rozzi
Wes Skiles - Capturing Nature	by: Wes Skiles
Survival at Sea	by: Andrew White

ADM Issue 5 *Additional articles not listed*

Antarctica	by: Henrik Lovendahl
Arrested for Shipwreck Diving!	by: ADM
Beneath the Top of the World	by: Dr. Brett Cormick
Daniel J. Morrell Lake Huron	by: Richard J. Reichenbacher
Larry Curtis Photography	by: Larry Curtis
Lost Mines of Wisconsin	by: T. Ebert & K. Meverden
Back Mount / Side Mount	by: Brett Hemphil
Recreational Wrecker	by: Ed Dilger
RGBM Full Up Phase Tables	by: B. Wienke and T. O'Leary
Silver Bank Humpback Whale	by: Curt Bowen & Wes Skiles
Yonaguni Pre-Ice Age Temple?	by: Gary Hagland

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ADM Issue 6 *Additional articles not listed*

Steven J. Auer Cave Photography	by: ADM
Beacon Woods Cave Exploration	by: Tony Hyatt
Diving into the Kauhako Crater Lake	by: Michael Garman
Dzonote Maya	by: Curt Bowen
ADM Gas Fill Charts	by: ADM
GUE Global Underwater Explorers	by: Tina Rhea
Journey Beneath Jurassic Park	by: M.Salvarezza
Lowrance Pompano Beach Florida	by: Curt Bowen
Featured Photographer / William M. Mercadante	
Neon Photography	by: ADM
The Pit Sistema Dos Ojos	by: Jill Heinerth
RESOR New Jersey Shipwreck	by: ADM

ADM Issue 7 *Additional articles not listed*

Altitude Diving	by: Bruce Weinke
Bonito Brazil	by: Curt Bowen
Into the Abyss	by: Jeffrey Bozanic
Jungle Mix Gaining Access	by: Curt Bowen
Straits of Mackinac	by: ADM
Oxygen Mathematical Computations	by: Dr. Bruce Wienke
Roatan Honduras	by: ADM
Roatan Express	by: Rusty Farst
USS Saufley DD-465	by: B.Lawson
Southern California	by: Michael Kane
Featured photographer - Steve May	by: ADM
U-352 Class VII-C German Submarine	by: Jeff Barris
Lake Huron's Elusive Wexford?	by: Steve Lewis

ADM Issue 8 *Additional articles not listed*

Lake Erie's Schooner C.B. Benson	by: Georgann Wachter
Stolt Dagali - Manasquan New Jersy	by: Jeff Barris
Dive Planning	by: Eric Fine
Dzonot-Ila	by: Roberto Hashimoto
The Furtive Frogfish	by: Tom Isgar
Hole in the Wall	by: Varesha Ives
Return to the Ice Queen's Palace	by: Brian Kakuk
Medical Concerns for the Tech Diver	by: Bruce Wienke
OXFORD - Lake Erie	by: Mike Wachter
Brett Seymour - Photography	
Gulf of Mexico Oil Rig Diving	by: Michael Salvarezza
Continous Nitrox - Trimix Blending	by: Bart Bajorkman
Warm Mineral Springs	by: Curt Bowen

ADM Issue 9 *Additional articles not listed*

Deep Into the Abyss	by: Joel Silverstein
USS Algol - New Jersy	by: Jeff Barris
Armadillo - Side Mount Rig	by: Brett Hemphill
Expedition Bacalar	by: Linda Bowen
CUBA - Liveaboard Oceanus	by: Rusty Farst
Diamond Knot Wreck	by: John Rawlings
Jungle Mix II - The Ascent	by: Linda Bowen
MS Rhein - Dry Tortugas Florida	by: Michael Barnette
Pipefish	by: Tom Isgar
William Dooley - Featured photographer	by: ADM
Yonaguni - The Stage	by: Gary Hagland
Where White Sharks Fly	by: Chris Fallows
In Search of Virgins - Yucatan 2001	by: Curt Bowen

ADM Issue 10 *Additional articles not listed*

Exploration Beyond the Sump	by: Jason Richards
Reduced Gradient Bubble Model	by: Bruce Wienke
Cave Diving and Conservation	by: Jeffrey Bozanic
Coral Sea Trio	by: Bob Halstead
Wild Dolphin Filming Expedition	by: Dan Malone
Cities Service Empire	by: Mark Zurl
Looking Deeper into the Florida Keys	by: Michael C. Barnette
Oxygen Clean is a Myth	by: Bart Bjorkman
Speleo Plongee	by: Jon Bojar
Pacific Northwest Photographer	by: ADM
RMS Oregon	by: Jeff Barris
Side Scan Sonar	by: Curt Bowen
Silty Secrets	by: Jitka Hyniova

ADVANCED DIVER MAGAZINE

Back Issue Directory

ADM Issue 11 *Additional articles not listed*

Angelita Q.Roo H2S	by: Curt Bowen
Bikini Atoll	by: Jeffrey Bozanic
John J. Boland - Lake Erie	by: Jeff Barris
CDG Britain's Cave Diving Group	by: jon Bojar
DZIBILCHALTUN Exploration XLACAH	by: Michael Garman
Giant Pacific Octopus	by: John Rawlings
Deep in Grand Cayman	by: Leroy McNeal
Hidden Worlds Cenotes	by: Brain Renton
Paddlewheel Wreck	by: Jim Rozzi
Sistema de Paraiso - Cozumel Mexico	by: Scott Carnahan
Diving the Salem Express	by: John Duggan
Sting of the Scorpionfish	by: Tom Isgar
USS Wilkes-Barre	by: Jim Holt

ADM Issue 12 *Additional articles not listed*

USS Atlanta Revisited	by: Miria Denlay
Tulamben Bali	by: Tom Isgar
Deep Stops	by: Bruce Wienke
Dornier 24	by: Aldo Ferrucci
Wreck of the Eber Ward	by: Robert Underhill
The Emerald Sea	by: John Rawlings
USS Emmons	by: Gary Hagland
Fossil Diving on the Cooper River	by: Curt Bowen
Galloping Gertie	by: John Rawlings
High-Tech Diving in a Low-Tech Era	by: Rob Polich
Pozzo Del Merro	by: Dr. Giorgio Caramanna
PWLL-y-Cwm	by: Duncan Price
Wings - Tools of the Trade	by: Scott Carnahan

ADM Issue 13 *Additional articles not listed*

The Steam Barges of Whitefish Point	by: Robert Underhill
Canada's Barkley Sound	by: John Rawlings
Deep Helium	by: Bruce Wienke
Interview with Martyn Farr	by: Jon Bojar
Gavin Newman Photography	by: ADM
Ice Island	by: Jill Heinerth
Return to the Lusitania	by: Leigh Bishop
Diving into a 72 Year-Old Mystery	by: John Rawlings
NASIM II	by: Aldo Ferrucci
Beacon Woods / Waynes World Cave	by: Beth Somers
Endangered Cave - Bermuda	by: Thomas M. Iliffe
The Discovery of the SS Keilawarra	by: Kevin Denlay
Diving the Moravian Karst	by: Jitka Hyniova

ADM Issue 14 *Additional articles not listed*

Wolf Eels	by: John Rawlings
NAECO Wreck	by: Jeff Barris
Fiat BR20 Cicogna	by: Aldo Ferrucci
Kamloops	by: Rob Polich
Seventy Fathoms Deep	by: Leigh Bishop
Cave Diving for Science	by: Brian Kakuk
Sea Fever - Bahamas Diving Adventure	by: Curt Bowen
Deep RGBM	by: Bruce Wienke
Swimming with Arctic Whales	by: Graham Dickson
CH47 Chinook Helicopter	by: Riccardo Malatesta
Rancho Cenote Perdido	by: Sam Meacham
La Paz - Pearl of the Sea of Cortez	by: John Rawlings

ADM Issue 15 *Additional articles not listed*

Armadillo Sidemount	by: Curt Bowen
Tony Karacsinyi Photography	by: ADM
Boiling Spring on the Casconade	by: Tamara Thomsen
The Sydney Project	by: Samir Alhafith
SS Tahoe - The Mile High Challenge	by: Martin McClellan
Megalodon CCR	by: Curt Bowen
St. Lawrence River Diving	by: Jeff Barris
Puget Sound King Crab	by: John Rawlings
Jesse Cancelmo Featured Photographer	by: ADM
Zero Gravity 3.0	by: Curt Bowen
Grenada	by: Tom Isgar
Gaby Nenadal Featured Photographer	by: ADM
Discovering Ligpo	by: Nonoy Tan

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ADM Issue 16 *Additional articles not listed*

Isla de Coco	by: Jim Rozzi
Inspiration CCR	by: Ron Benson
Sixgill Shark	by: John Rawlings
Diamond Rock Cave	by: Eric Osking
Cruisers for Breakfast	by: Kevin Denlay
B29A Superfortress	by: Gregg Mikolasek
David Evans Photography	by: ADM
Exploration Discovery	by: Jill Heinerth
Bianca C	by: James Rozzi
Dissecting a Hammerhead	by: Jakub Rehacek
SS Cumberland Expedition	by: Samir Alhafith
Featured Photorgapher Ziggy Livnat	by: ADM
Exuma Cave Expedition	by: Curt Bowen

ADM Issue 17 *Additional articles not listed*

A Tale of Two Schooners	by: Robert Underhill
Dive the Deep Blue Utila	by: Tom Isgar
Dark Images	by: Richard Harris
Isobaric Counter Diffusion	by: B.R. Wienke
Land of Clouds	by: John Rawlings
Yucatan Expedition 2004	by: Curt Bowen
Wreck of Vanlene	by: John Rawlings
Cave diving on Merritts Mill Pond	by: Jitka Hyniova
Deep into the Apex of Hell	by: Curt Bowen
Wreck of the Mairi Bhan	by: John Rawlings
Great Lakes Graveyard	by: Tom Wilson
Identity Crisis	by: Michael C. Barnette
Wreck of the MS Lubrafol	by: John Coffey

ADM Issue 18 *Additional articles not listed*

Wreck of the Capilano	by: John Rawlings
Bonaire	by: John Rawlings
No Limits - Zero Gravity 4.0	by: Curt Bowen
Beyond Megadome	by: Eric Osking
Sport Kiss Rebreather	by: Curt Bowen
Wookey to the Max	by: Duncan Price
Wreck of the William Young	by: Tamara Thomsen
From Bali to Komoto	by: Tom Isgar
Kissing the Lady	by: Richard Harris
Looking thru the Oxygen Window	by: B.R. Wienke
Diving the Titanic	by: Leigh Bishop
Thresher Sharks of Malapascua	by: Tony Karacsonyi
The Loss of the Holstein	by: Michael Barnette

ADM Issue 19 *Additional articles not listed*

Return to the Mystery	by: John Rawlings
Siberia's Frozen Underground	by: Phill Short
The Cave – The Movie	by: Jakub Rehacek
Crocodile Cave	by: Brian Kakuk
Wreck of the John B. Osborne	by: Vlada Dekina
Wreck of the Carl D. Bradley	by: John Janzen
Thermal Cave Diving in Hungary	by: Peter Schneider
The Scow Ocean Wave	by: Tamara Thomsen
HMS Repulse	by: Greg Doyle
The Discovery of Sacred Waters	by: Rusty Farst
CCR - SCR Calculations	by: B.R. Wienke
The Wreck of the Lakeland	by: Rob Polich
In Search of Prehistoric Relics	by: Andreas Kerner

ADM Issue 20 *Additional articles not listed*

Extreme Shooters	by: Dan MacMahon
Jewel of Roatan	by: By John Rawlings
Pirates Cove Dominican Republic	by: Jill Heinerth
Diving the Dubnik Opal Mines	by: David Cani
Araby Maid	by: Michael Barnette
RGBM - Nitty Gritty Issues	by: B. Wienke & T. O'Leary
The Vandal & the Jury	by: Leigh Bishop
St Kitts / Diving off the Beaten Path	by: Cass Lawson
SS Wisconsin	by: Keith Mererden
Dive Venezuela	by: Tom Isgar
Hyenas of the Sea	by: John Rawlings
Nautilus Explorer	by: Cass Lawson
KISS Classic Rebreather	by: Curt Bowen

ADM Issue 21 *Additional articles not listed*

Shipwrecks of Crimea	by: Leigh Bishop
SS Metropole	by: David Trotter
Newfoundland's Diving Deversity	by: Bernie Chowdhury
Queen of Nassau	by: Curt Bowen
USS Curb Wreck	by: Curt Bowen
Good Luck comes in Threes	by: Richard Harris
HIJMS Amagiri	by: Kevin Denlay
Doorway to Bloody Bay Wall	by: John Rawlings
The Helmet Wreck	by: Jim Rozzi
Bermuda High	by: Jill Heinerth
The Walls of Quadra Island	by: John Rawlings
Diverite's O2ptima CC Rebreather	by: Jeff Gourley
Ouroboros CCR	by: Leigh Bishop

ADM Issue 22 *Additional articles not listed*

Hidden Passage Expose Mayan History	by: Tracy Raz
Emerald Immersion	by: Kim Smith
Gashkiria Cave Expedition / Russia	by: Phil Short
The Sarakata Resurgence	by: Richard Harris
Featured Photographer Radek Husak	by: ADM
Featured Photographer Petr Vaverka	by: ADM
Diving OC like a CCR	by: Bruce R. Wienke
Raja Ampat Islands	by: Tom Isgar
Wreck of the North Wind	by: Rick Kruzel
Schooner Daniel Lyons	by: Tamara Thomsen
P4Y-2 Privateer Bomber	by: John Rawlings
The 1000 Islands, Brockville, Canada	by: Cass Lawson
X-Scooter by Dive Xtras inc.	by: ADM

ADM Issue 23

Wreck of the Selah Chamberlain	by: Tamara Thomsen
Evolution CCR	by: Cass Lawson
The Ghosts of Sunda Strait	by: Kevin Denlay
Rebreather Piracy	by: Jill Heinerth
Diving Northern Sulawesi Indonesia	by: Tom Isgar
Operation Hailstorm CCR Invasion	by: Curt Bowen
Where Currents Collide	by: Peter Pinnock
Exploring the Blue Holes of Abaco	by: Curt Bowen
UNEXSO	by: Curt Bowen
Lingcod / Queen of Northwest Predators	by: John Rawlings
Thaddius Bedford	by: ADM

ADM Issue 24

Warren Lo Photography	by: ADM
Shearwater GF	by: Curt Bowen
Bonaire	by: Cass Lawson
San Salvador	by: John Rawlings
Guadalupe Island	by: C.J. Bahnsen
New kid on the block. COPIS MCCR	by: Mel Clark
Video Shipwreck Photo Mosaics	by: Tamara Thomsen
Featured Photographer • Dos Winkel	by: ADM
CCR Sidemount	by: Curt Bowen
Anatomy of a HIT	by: John Rawlings
Kija Blue	by: Richard Harris
All Hands Lost • Kamloops	by: Curt Bowen

ADM Issue 25

Coelacanth Fever	by: Jitka Hyniova
The Wreck of the SS William Dawes	by: Richard Harris
Getting the Shot	by: Jill Heinerth
Inca Gold Lake Titicaca, Bolivia	by: Erik Foreman
Featured Photographer Becky Kagan	by: ADM
Wreck Divers Paradise Manitowac	by: Tamara Thomsen
Discovery of the USS Perch SS	by: Mel Clark
Tobago	by: Tom Isgar
War and the Thistlegorm	by: Jill Heinerth
Transition to Rebreather Diving	by: Howard Packer
2007 Yucatan Expedition	by: Jeff Toorish

ADM Issue 26

Mayans, Myths, Monsters, & "Maximon"	by: Jeff Toorish
British Virgin Islands BVI	by: Curt Bowen
Dave Harasti Photography	by: ADM
Deeper into the Pearse Resurgence	by: Richard Harris
Diving the RMS Niagara	by: Richard Harris
Exploration of Rodham Lead & Zinc Mine	by: Tamara Thomsen
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CCR CAVE SUMMIT

The Future of Cave Exploration is HERE

By ADM Staff Photojournalist Jeff Toorish

A man and a woman are sitting next to each other at a bar. The man looks at the woman and says, “Would you make love to me one time for a million dollars?”

The woman says, “Yes I would for a million dollars.”

So the man says, “Well, how about for a hundred bucks?”

The woman says, “What do you think I am?”

The man says, “We’ve already established that, now we’re just negotiating price.”

Photo by Jill Heinerth

Infancy to Adulthood

This old joke illustrates the current state of rebreathers in cave diving. It’s a matter of negotiating the protocols to move things forward. The question is no longer *if* closed circuit rebreathers will become common among cave divers, only when.

That is in stark contrast to the predominant industry view as recently as a couple of years ago when some instructors actively warned their students against using closed circuit rebreathers (CCR) or semi-closed circuit gear in overhead environments. I recall during my early cave training seeing a rebreather diver heading into a cave. A nearby instructor was openly critical, suggesting that rebreathers simply had no place in cave diving.

That view is changing rapidly as evidenced by a recent CCR Cave Diving Summit sponsored by the oldest cave diving organization, the National Association of Cave Divers (NACD). Organizers originally intended the summit as an information tool for instructors but eventually decided to include the general public as well.

Closed circuit and semi-closed circuit rebreathers have been used in cutting edge exploration diving for years. The Woodville Karst Plain Project (WKPP) expedition explorers have used semi-closed gear and the recent push to nearly seven thousand feet in Weeki Wachee Springs employed closed circuit equipment. In both cases, open circuit SCUBA was simply not adequate for the extreme long range and extended bottom times necessary for the projects. It now appears general cave divers, those not necessarily involved in advanced exploration, are beginning to consider rebreathers a viable tool.

Renowned cave diver, explorer and underwater photographer and videographer Jill Heinerth organized the NACD event. Heinerth, a veteran CCR diver said in welcoming the roughly 150 attendees to the Devil's Pavilion at Ginnie Springs, "rebreather cave diving is still in its infancy, but it *is* emerging."

What emerged from the presentations by several major rebreather manufacturers and a subsequent panel discussion is that rebreathers in caves are here to stay.

Lamar Hires, Founder of Dive Rite Manufacturing, maker of the Optima rebreather summed up the views of many, "We've crossed a line, but the line is no different from debates we've had, and still have, about DPVs in caves."

"More and more people are diving rebreathers and they're showing that it can be done safely," said NACD Board Member Richard Dreher.

According to Dreher and others, the purpose of the NACD CCR summit was to begin the necessary dialogue that will eventually result in formal training standards. As any introduction to cave diving student knows, standardized procedures are critical to safety in overhead environments. But introducing rebreathers to general cave diving dramatically changes equipment configurations, requiring new protocols.

And like any significant change to the status quo, the widespread introduction of rebreathers into caves comes with some inevitable controversy.

One point of dispute involves bailout procedures. Two distinct schools of thought are emerging: The traditional view is that each member of a team must carry enough bailout gas to ensure he or she can make it safely back to open water from the deepest point in the planned dive. The competing theory is "team bailout," in which the dive team divides the bailout gas among themselves, essentially carrying enough gas to ensure a team member in trouble can make it out of the cave safely.

Esteemed cave and CCR diver Tom Mount is a powerful advocate for the team bailout notion. He suggests that, in many cave dives, for each team member to carry all the gas necessary for bailout is an unnecessary redundancy that can actually have a negative effect. Mount is a formidable authority with thousands of hours on a variety of rebreathers in many different diving environments.

Using standard formulas to calculate bailout requirements, Mount suggests that each CCR cave diver on a team will be required to carry so many bottles of bailout gas that he or she may wind working too hard, becoming fatigued faster, and causing a greater internal buildup of CO2.

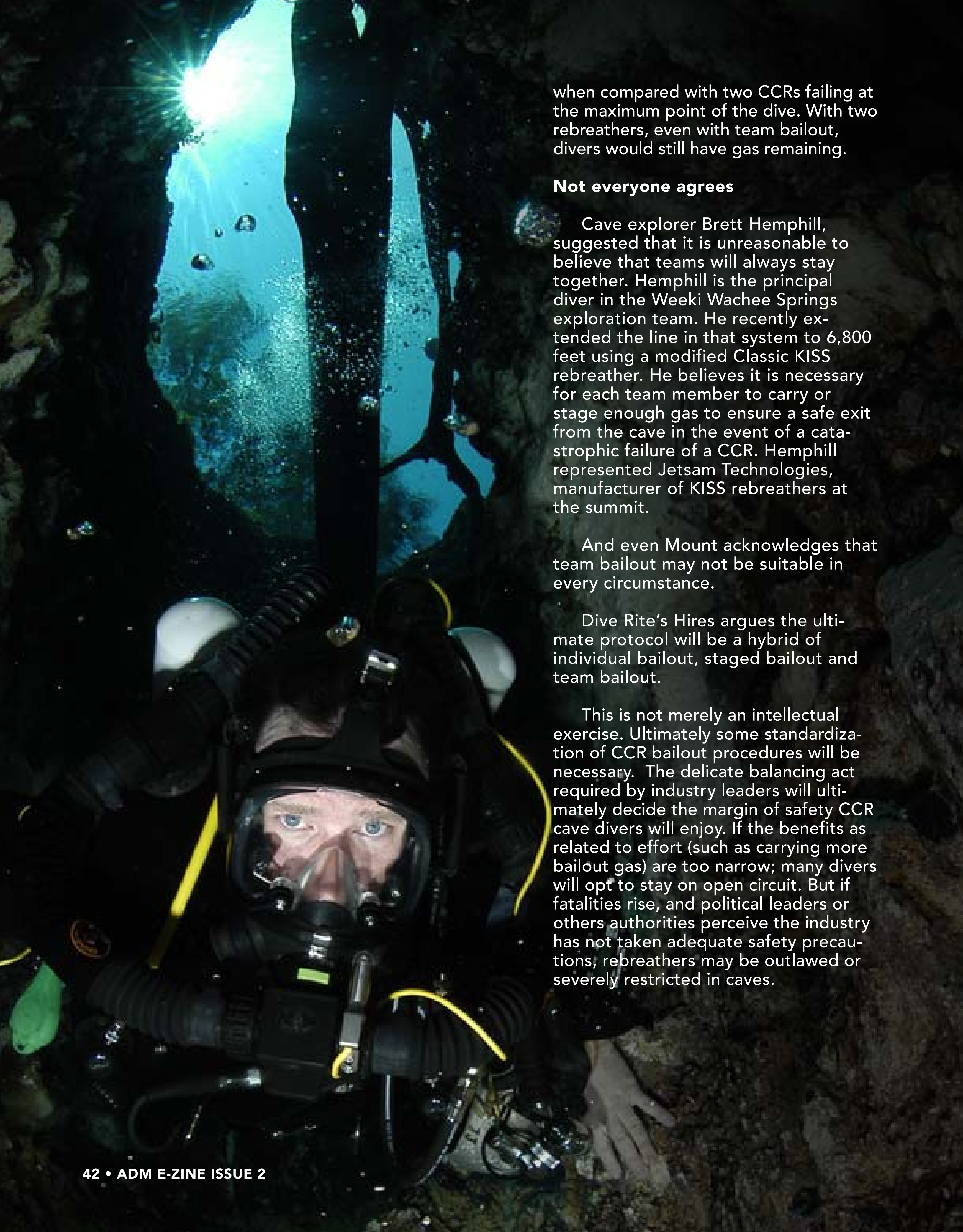
Mount, Board Chairman of the certifying agency International Association of NITROX and Technical Divers (IANTD), Dismisses the concern that team members may become split-up in a cave, leaving a member in trouble with not enough bailout gas in an emergency. Mount argues team members will stay together and jointly carry the necessary bailout gas. The concept is called team bailout.

"Take 1.5 times the necessary bailout gas for the highest need diver and divide by two" for a two person team, suggests Mount. That means two divers will have enough emergency gas to exit the cave from the furthest point in the planned dive. That is the official position of IANTD and has been for several years.

Mount maintains this approach is actually affords greater protection to cave divers on CCR who suffer a catastrophic failure at the furthest point in a penetration. "You get away from the long hose because that slows you down, I don't care how good you are, that slows you down," says Mount.

If a single diver has a failure, there will be 33% more air than needed in a team bailout scenario.

Mount continues with a caution about two divers on open circuit with failing units, If both open circuit units quit at the maximum point of penetration you die at the maximum point of penetration. There's a little difference there,"



when compared with two CCRs failing at the maximum point of the dive. With two rebreathers, even with team bailout, divers would still have gas remaining.

Not everyone agrees

Cave explorer Brett Hemphill, suggested that it is unreasonable to believe that teams will always stay together. Hemphill is the principal diver in the Weeki Wachee Springs exploration team. He recently extended the line in that system to 6,800 feet using a modified Classic KISS rebreather. He believes it is necessary for each team member to carry or stage enough gas to ensure a safe exit from the cave in the event of a catastrophic failure of a CCR. Hemphill represented Jetsam Technologies, manufacturer of KISS rebreathers at the summit.

And even Mount acknowledges that team bailout may not be suitable in every circumstance.

Dive Rite's Hires argues the ultimate protocol will be a hybrid of individual bailout, staged bailout and team bailout.

This is not merely an intellectual exercise. Ultimately some standardization of CCR bailout procedures will be necessary. The delicate balancing act required by industry leaders will ultimately decide the margin of safety CCR cave divers will enjoy. If the benefits as related to effort (such as carrying more bailout gas) are too narrow; many divers will opt to stay on open circuit. But if fatalities rise, and political leaders or others authorities perceive the industry has not taken adequate safety precautions, rebreathers may be outlawed or severely restricted in caves.

Bailout not the only contention

The other contention is training. Leon Scamahorn, of Innerspace Systems Corporation, manufacturer of the Megalodon rebreather stunned summit participants by openly criticizing instructors, suggesting that CCR makers and certifying agencies must do a better job of monitoring and policing who is teaching the next generation of rebreather divers.

"Everybody needs to take responsibility for his own product," said Scamahorn, who went on to predict the demise of rebreathers in diving if things don't change. Scamahorn said Innerspace Technologies has "gotten rid of" instructors who are not up to snuff.

And while clearly not everyone agrees with Scamahorn's dire predictions, there appears to be general consensus that rebreather instructors should limit themselves to teaching only those units they themselves dive because of the great variances among rebreathers themselves.

More remains to be done

All this is, of course, complicated by the fact that no certifying agency actually has an exclusively CCR version of even their basic cavern course, let alone a cave course. While rebreathers are clearly on the rise, NACD or some other certifying agency will eventually have to create a certification program for CCR cave divers. When that happens CCR cave diving will move from its infancy to adolescence and eventually adulthood.

Jeff Toorish is the Chief Photojournalist for Advanced Diver Magazine and ADM E-zine. He is fully cave certified and dives a KISS rebreather.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Juergensen Marine Hammerhead CCR

By Kevin Juergensen and Jakub Rehacek, Ph.D.

Excerpt from ADM Issue 27

It all began with an idea: How could we build a new Closed Circuit Rebreather that would incorporate some of the best ideas of the last twenty years, yet be simple and elegant?

Building such a machine was made easier by the knowledge base that spawned the new Juergensen Marine "Hammerhead" CCR. Long the leader in electronic control systems for practically every major rebreather in the world, Kevin Juergensen had just successfully collaborated with Lamar Hires of Dive Rite and Tom McKenna of Micropore to design and build the new Dive Rite Optima, which in less than eighteen months has sold over three hundred units worldwide.

Rebreathers, like the divers who use them, are a varied bunch, and there were still those who wanted what they considered an "expedition grade" machine – one that could be taken long and taken deep, with a loose-fill scrubber of high volume, rugged, yet simple to fill and maintain.

Designing a rebreather is no mean feat. For the Hammerhead CCR, Juergensen brought in Jakub Rehacek of Golem Gear as well as a relative newcomer to the rebreather field, Ing. Bretislav Vaisar, a Czech diver, designer, and machine shop wizard.

The new machine incorporates several innovations in a unit of its type, including a unique six-lug quick bayonet-style mount, which is backed by a spring-loaded mechanism. This ensures a secure attachment, while eliminating any sharp-edged fasteners for ease of removal, and minimizes entanglement hazards.

The internals of the Head hold true to the time-proven "Hammerhead" design of up to four oxygen sensors (three primary, and a fourth for third party monitoring).

HAMMERHEAD CCR SCHEMATIC

A. Integrated BOV (Bail Out Valve): The Dive/Surface valve includes a fully adjustable high-performance Open Circuit Regulator that can be supplied with diluent, or an off-board gas source. The OC regulator can be removed for streamlined DSV configuration. Oversized crush-proof hoses are supple enough for comfortable diving.

B. Exhalation counter lung T-piece has a water trap to ensure that even if there is water in the loop it gets captured in the counter lung. Rugged exhalation counter lung with puncture-proof inner bladder has a swiveling manual O_2 add valve (L) with quick connect fitting and over-pressure valve/water trap exhaust (M) at the bottom.

C. Threaded fittings on T-pieces and CCR head are specifically keyed for inhalation or exhalation side to ensure correct assembly. Unique six-lug spring-loaded quick bayonet mount ensures secure attachment of the head to the stack, with no entanglement hazards. On top of the head is a swiveling oxygen port with a 60-micron filter and quick connect for easy removal. Next to it are hard-wired ports for flood-proof cables of primary and secondary electronics, Fischer Connectors for DIVA, and a port for an optional fourth sensor monitor (VR3, HS Explorer, Pursuit) with Fischer Connectors at the monitor end. The time-proven "Hammerhead" design with up to four oxygen sensors (three primary, and a fourth for third party monitoring). Pre-scrubber injection of the oxygen ensures uniform mix through the scrubber before it reaches the sensors located on the inhalation side.

D. Revolutionary new radial scrubber with a built-in floating compression ring, the system constantly "packs" itself, preventing channeling. Large annular opening allows easy pouring of the adsorbent material. Capacity: 7.8 lbs of loose-fill sorb on standard scrubber, expedition and travel-size scrubbers are also available.

E. Generous water trap at the bottom of the stack, though the radial scrubber design and t-piece water traps will allow the Hammerhead CCR to operate even with a partially flooded stack.

F. Water trap spacer

G. Oxygen addition solenoid

H. Inhalation counter lung T-piece has a water trap to ensure that even if there is water in the loop it gets captured in the counter lung. Rugged counter lung, with puncture-proof inner bladder, has ADV (I) and a swiveling manual add valve (J)

I. Automatic Diluent Valve (ADV) is located in the inhalation counter lung. It gets triggered on counter lung collapse, or it can be activated manually. Flow stop for minimum loop volume operation is included as standard equipment.

J. Swiveling add valve for on/off-board diluent gas addition has a standard quick connect.

K. Display Integrated Vibrating Alarm (DIVA) – patented heads-up display in ratcheting adjustable holder. The DIVA can be set up in "user set point" mode so that a green LED flashes when user defined set point is maintained, and red flashes when PPO_2 deviates from it. The other option is "1.0 PPO_2 mode" where DIVA flashes orange when PPO_2 is at 1.0 PPO_2, and one green blink for each 0.1 PPO_2 above 1.0 and one red blink for each 0.1PPO_2 below 1.0. The DIVA vibrates when loop PPO_2 is at life threatening level.

L. Swiveling manual O_2 add valve with quick connect fitting.

M. Over-pressure valve (OPV) also serves as water trap exhaust at the bottom of the exhalation counter lung.

N. Oxygen manifold/gas distribution block has 6 3/8"-12 ports (one equipped with 9/16 adapter).

O. Diluent manifold/gas distribution block has 7 3/8"-12 ports (one equipped with 9/16 adapter).

P. Wing inflation quick connect.

Q. Diluent 1st stage regulator.

R. Oxygen 1st stage regulator.

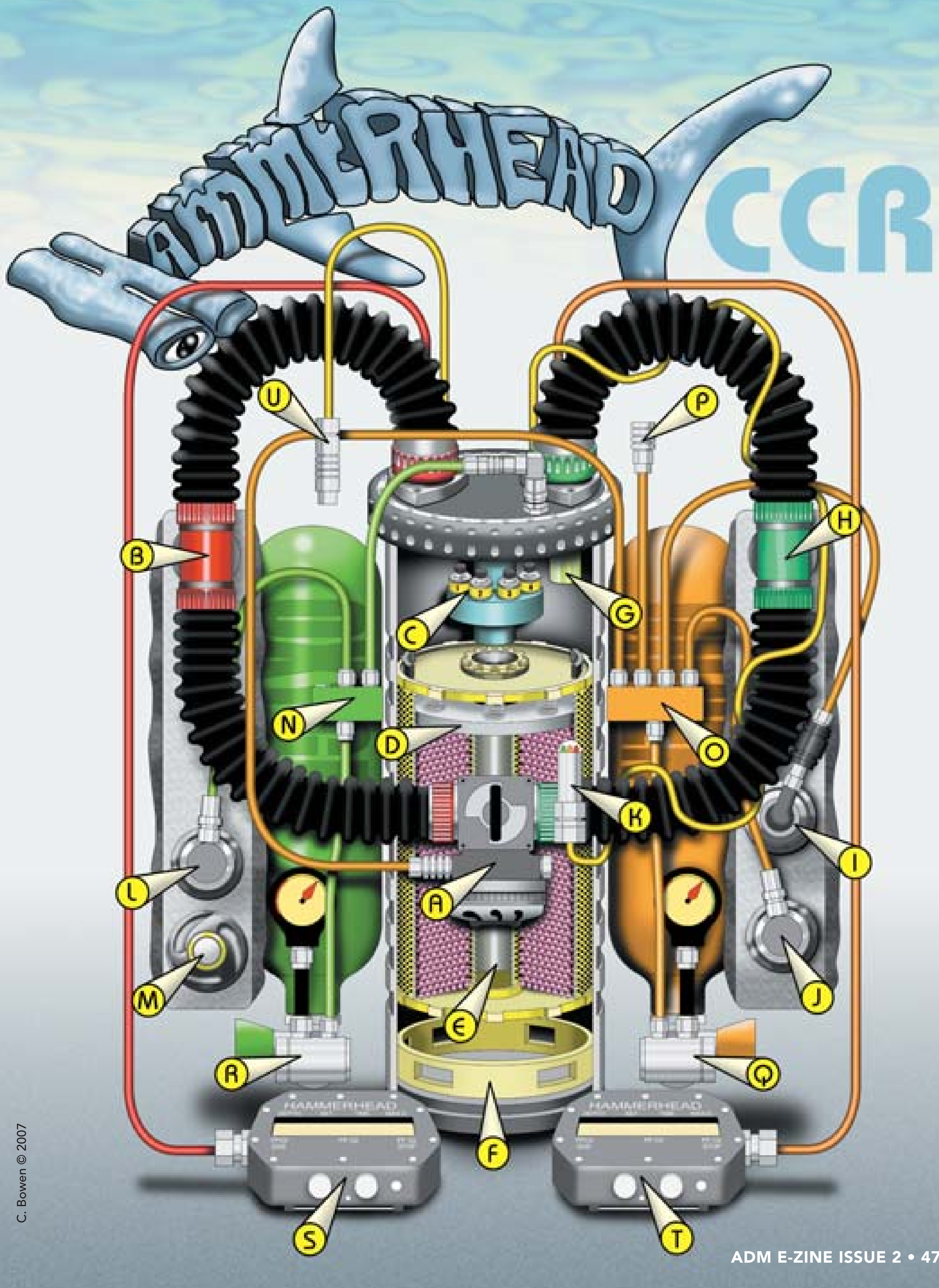
S. Secondary display provides the diver with a completely redundant, independently powered PPO_2 monitor.

- Full trimix decompression computer with GF (independent from the primary deco computer)
- Integrated depth/timer
- Integrated barometer
- Temperature display
- Integrated stack timer
- Alarms for end of stack life
- Two heads-up display modes
- User definable set points for average display
- LED "buddy" light on the handset

T. Hammerhead primary controller has a revolutionary Integrated Decompression Program, including gradient factors, selectable solenoid modes (including a proprietary algorithm for controlling the bolus of O_2 delivered to the system).

- User definable set points
- User definable gradient factors
- Ten user definable gas mixes
- User definable solenoid firing
- User definable backlight illumination
- User definable auto-shut down
- Built-in barometer
- Built-in temperature display
- Built-in battery monitor
- Full trimix decompression computer
- LED "buddy" light on the handset

U. Fischer Connector for independent third party PPO_2 monitoring.


HAMMERHEAD CCR
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The Banana Block O2 sensor coupling system is still to be found on Juergensen's newest product, ensuring that the only electronic assembly exposed to the harsh environment of the breathing loop is easily replaceable.

With four available oxygen sensors, plus pre-scrubber injection of the oxygen (ensuring a uniform mix through the scrubber), the Hammerhead CCR takes its place as the most advanced unit on the market today.

Every Hammerhead CCR comes with the legendary Hammerhead Rev. C+ Control System - twin fully independent monitoring systems, the patented "DIVA" Heads Up Display (HUD), and Dual Trimix Decompression Computers - all in one sleek package.

Power consumption is so low on the Rev. C+ Electronic Systems that they only require a single AA alkaline cell for each computer to run for the full six-hour duration of the system.

Yet another first for the Hammerhead CCR, the unit can be configured with a Constant Mass Flow (CMF) Orifice, i.e. **M**anual **O**rifice **O**xygen **D**elivery system – MOODs. The MOODs can replace the electronic solenoid oxygen injection, or it can be used in combination with the solenoid to provide a "belt and suspenders" solution, where the MOODs supplies basic O2 metabolic needs to the diver, and the solenoid acts as a "parachute" delivering oxygen at the time of increased O2 consumption – hard work, stress, rapid ascent when the diver is too preoccupied to manage his PPO2.

The Hammerhead CCR offers unprecedented freedom of configuration. It can be set up as a fully electronic CCR (eCCR), or a manual CCR (mCCR) or a combination of both, manual CCR with electronic injection backup (meCCR). The mCCR version of the Hammerhead CCR comes with the legendary secondary Hammerhead display, including the DIVA and an integrated decompression computer option. An independent handset with a simple three-sensor readout is also included, making it the most sophisticated mCCR on the market.

Configuration with back-mounted counter lungs – **JZ System** – is another unique option available in the Hammerhead CCR. The JZ System back-mounted counter lungs are a "drop-in" option; no modification to the base system is necessary. The over-the-shoulder counter lungs and hoses are removed, and the JZ System is put in their place. The back-mounted counter lungs are "sandwiched" between the back plate and the wing, keeping them as close to the diver's centroid as possible, thus offering the best work-of-breathing available with back-mounted counter lungs. The JZ-System is equipped with water trap/dump, making it suitable for overhead environment and long/deep exploration dives.

The unique design of the JZ System opens up new configuration possibilities, including a dual rebreather setup option. Two independent scrubber stacks are worn on the diver's back; one is set up with the back mounted JZ System, while the other has standard over-the-shoulder counter lungs. A streamlined kit for those extreme expedition dives made possible by Hammerhead CCR.

At the heart of the Hammerhead CCR is a revolutionary new radial scrubber. The base model can hold up to 7.8 lbs (3.5 kg) of loose-fill 8-12 sorb. With a built-in floating compression ring, the system constantly "packs" itself, thus preventing channeling. A large annular opening allows easy pouring of the adsorbent material.

The team decided upon the use of Metalsub® quick connects for the tanks. In the USA, the unit comes pre-configured with Faber 3-liter steel tanks, but can be set up with any size bottles.

It is extremely easy to remove and replace the tanks with larger ones for extended range; and higher density batteries can be used in the Hammerhead controllers, giving up to fourteen hours of continuous use. Soon it will also be possible to install even larger scrubbers for expedition-level dives: Up to two extra pounds can be filled into the Expedition Scrubber that will be offered by the end of 2007.

A smaller, travel-friendly version (**The Hobo**) of the Hammerhead CCR is also available. The scrubber stack is shorter, and the smaller radial scrubber holds approx 3.5 lbs of loose-fill sorb, enough for a day of diving in recreational destinations. The Hobo still comes with all the bells and whistles of the "expedition grade" Hammerhead CCR.

Thoughtful ideas for protecting your gear during penetration dives come standard on the Hammerhead: O2 fittings that are right-angled to prevent damage in caves or overhead environments. Built-in filters keep salt water and debris from entering your solenoid. A unique water trap design on all counter lung fittings ensures that even if you do get water in your system, it stays where it should. Super tough Cordura® wraps around a puncture / tear resistant internal bladder to protect the breathing loop from damage.

Simple, yet elegant - our ADV works in any position, flows like a champ under the most rigorous conditions, and is equipped with a shut-off valve as standard equipment.

One more standard feature that is not found on anything but a Hammerhead is an integrated BOV (Bail Out Valve). The diver can feed the fully adjustable high-performance Open Circuit Regulator with diluent, or an off-board source, gaining unprecedented convenience, safety, and the security of being prepared, no matter what the situation.

The Juergensen Marine Hammerhead CCR is, simply put, the finest commercially built rebreather in the world. Long the industry leader for Electronic Control and Decompression Computer systems, the bar has now been raised by one of the most trusted names in Technical Rebreather Diving.

www.rebreather.us

Rebreather World 2007 Awards

By ADM Staff Photojournalist Jeff Toorish

Amid the presentations, vendor booths and Halloween festivities at the recent Dive Equipment Manufacturer's Association (DEMA) convention here in the heart of Disney Country, rebreather divers honored some of the pioneers of bubble-free diving.

The RebereatherWorld.com awards dinner honored some of the leading innovators in CCR diving. The coveted awards were presented by Stuart Schford from RebreatherWorld.com, the leading online CCR portal.

Those honored in various categories are among the elite of CCR diving –each of whom has demonstrated leadership in some aspect of rebreather technology.

The envelopes please…

Advanced Diver Magazine Publisher and Editor Curt Bowen received the award for his unflagging support and promotion of closed circuit rebreathers for not only technical but also recreational diving. Bowen's ADM, and

newly published online version ADM E-zine, are regarded as the leading publications on rebreather technology. Both feature not only articles about recreational and advanced rebreather dives and expeditions, but also reviews of rebreathers and related technology.

Advanced Diver Magazine also presented an award; the ADM CCR Exploration Award which went to master explorer Brett Hemphill.

Hemphill is a principal diver/explorer on the Weeki Wachee Karst Project, the team that recently extended the line in Weeki Wachee Springs to 6,800 feet at a depth of nearly 400 feet.

Hemphill drew laughs from the audience when he referred to his Classic KISS rebreather as 'slightly modified." To accommodate the rigors of the Weeki Wachee project, Hemphill refitted his rebreather with dual oxygen tank and slung diluent.

The modifications and Hemphill's skills and experience as a diver allowed him to run for nine hours on a single exploration.

The Rob Davie Customer Care Award went to Silent Diving Systems, manufacturer of the Inspiration and Evolution rebreathers.

The Gordon Smith Innovation Award was awarded to the English company, Narked@90 for their aftermarket products including rebreather stands.

The prize for best rebreather accessory went to Delta P, maker of the famed VR3 technical dive computer. Accepting the award for Delta P is Kevin Gurr, the president of Delta P and the designer of the VR3, as well as the Ourbororos and newly released Sentinal Rebreathers.

Diving legend Tom Mount was honored with RBW's lifetime achievement award commemorating his decade's long dedication to exploration and rebreather diving. Mount thanked the assembled crowd. In his remarks he spoke about the will to survive and how critically important that is to divers everywhere, especially in technical CCR dives.

He took time to introduce famed diver Don Shirley who survived a DCS hit while diving to retrieve a body from Bushman's Hole in Africa. Shirley spent 12 hours wildly swinging on a line, suffering vertigo because a small bubble of helium had formed in his inner ear.

Mount urged every diver in the room to consider Shirley's survival against incredible odds an inspiration.

For the members of the audience, many of them experienced CCR divers, cave divers and explorers, each award winner is inspiring, each is a teacher and each holds an important place in the history of closed circuit diving.

Jeff Toorish is the Chief Photojournalist for Advanced Diver Magazine and ADM E-zine.


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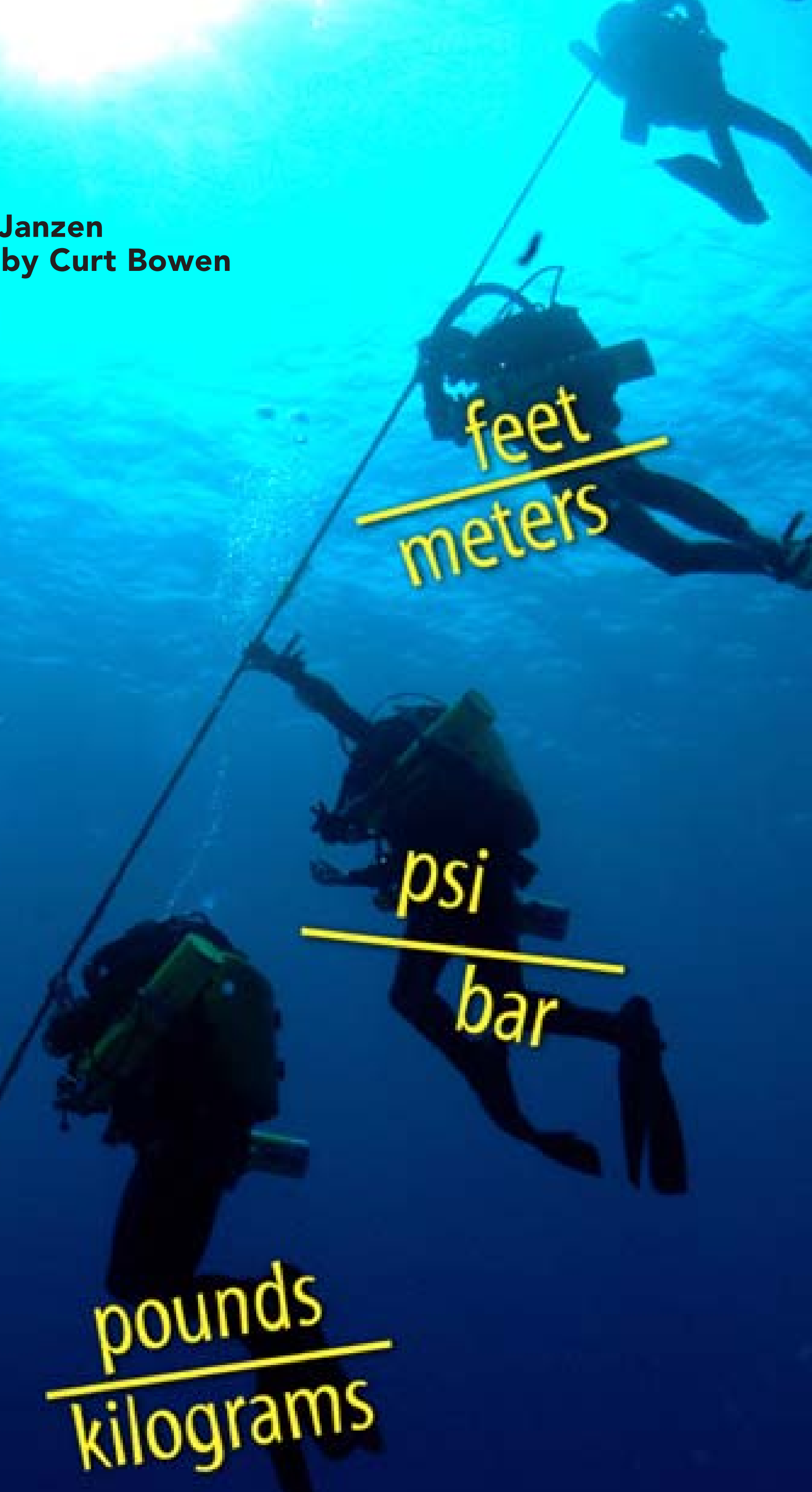
Diving Into the Metric System

Text by John Janzen
Photography by Curt Bowen

Concerned about writing an article too dry for divers, I began this project with reluctance. In a magazine filled with awesome stories about deep shipwrecks and mysterious underwater caves, who will read an article about the metric system? Bear with me for a few minutes and keep an open mind. With metric units, dive-planning calculations like ambient pressure, PO_2 and gas supply are so simple, you can toss your calculator overboard.



When I raise the subject of the metric system for diving, invariably I get two responses. From divers outside the U.S., most of whom are already metric, I get laughing remarks about those Yankee divers, still suffering with feet and PSI. Conversely, divers from the U.S. typically give a contemptuous look, release a grunt, then change the subject.

Why do most Americans hold such animosity toward the metric system? It certainly couldn't be from experience because American society has never used metric. There was a governmental campaign promoting metric in the 1970's but it was vigorously ridiculed and lasted about as long as the pet rock. In 1988, feeble legislation was passed pledging assistance to industries that would voluntarily go metric. Pledging assistance to volunteers however, is not terribly effective without volunteers. There were essentially none. This effort's only legacy is the appearance of metric units on product labeling, placed discreetly next to the Imperial units. According to the U.S. Metric Association, the United States is among very few countries not officially adopting metric. Only the United Kingdom, Ireland and Myanmar accompany the U.S. in its metric-proof bunker. The European Union has been seeking metrification of all domestic and international trade, but the United Nations, under anti-metric pressure from the U.S. and the UK, has recently dropped its requirement that its members go metric.

Although the U.S. government and general public shun metric, the vast majority of its scientists, engineers, medical personnel and military have been proudly metric for decades. Why would practically every nation on Earth and the majority of technical people working in a anti-metric country use metric? Is it because the metric system is awkward and confusing? No! The metric system truly is better designed and easier to use than the Imperial system. It is also the worldwide standard.

The metric system, properly called Systemé International (SI), emerged in Europe in the 1790's. Very few standard measurement units then existed and it was common for units of length, weight and area to vary from country to country and even between regions within a single country. Scientists, merchants and manufacturers, who relied upon common and accurate measurements, recognized a uniform system was needed. The disarray provided by the French Revolution created a political means by which the new system could be imposed, although considerable resistance ensued. Once the system was adopted however, its simplicity and universality were obvious.

At the foundation of the metric system, are just three units: the *meter* for length, the *gram* for mass and the *second* for time. These are called the *fundamental units* because absolutely everything in the universe from the magnetic field of a neutron star to the temperature of the water on your next dive can be expressed using only these three units. For the sake of convenience, *derived units* are often used, such as watts, volts, bar and degrees Celsius, but these all boil down to the three fundamentals. Consider the many units used just for length in the Imperial system. There are inches, feet, yards, nautical miles and statute miles to name but a few. Converting among these is a nuisance. With metric, all you need is the meter.

To express multiples or fractions of SI units, standard prefixes are used. For example, the prefix *kilo* means 1000, so a *kilo*meter is 1000 meters. By the same rule, a *kilo*gram is 1000 grams and a *kilo*second is 1000 seconds. The prefix *milli* means 1/1000 or 0.001, so a *milli*meter is 0.001 meter, a *milli*gram is 0.001 gram and a *milli*second is 0.001 second. SI prohibits reporting measurements in fractions, requiring all values to be in decimal format. For example, a quarter of a meter is expressed as 0.25 meter rather than 1/4 meter. Keeping things in decimal format makes conversions and arithmetic easier. The metric system was designed from the foundation to be consistent, concise and simple. In comparison, the Imperial system seems absurd. To exemplify; the Imperial unit ounces, has four variations that depend upon the material being measured and what country it is measured in. Ridiculous!

To dive metric, you need only to learn meters for depth, bar for pressure, liters for volume and kilograms for weight. In metric, the only difference in the dive planning formulas is the units. The arithmetic is so simple that a calculator is often not needed. If a desperate situation arose that required some quick re-planning while underwater, the metric system would serve you well.

Metric System Prefixes

Prefix	Symbol	Value	Notation
Exa	E	1 000 000 000 000 000 000	10^{18}
Peta	P	1 000 000 000 000 000	10^{15}
Tera	T	1 000 000 000 000	10^{12}
Giga	G	1 000 000 000	10^{9}
Mega	M	1 000 000	10^{6}
Kilo	k	1 000	10^{3}
Hecto	h	100	10^{2}
Deca	da	10	10^{1}
-	-	1	10^{0}
Deci	d	0.1	10^{-1}
Centi	c	0.01	10^{-2}
Milli	m	0.001	10^{-3}
Micro	µ	0.000 001	10^{-6}
Nano	n	0.000 000 001	10^{-9}
Pico	p	0.000 000 000 001	10^{-12}
Femto	f	0.000 000 000 000 001	10^{-15}
Atto	a	0.000 000 000 000 000 001	10^{-18}

Depth in Imperial and Metric

Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters
10	3	100	30.5	200	61.0	300	91.5
15	5	110	33.5	210	64.0	310	94.5
20	6	120	36.6	220	67.1	320	97.6
30	9	130	39.6	230	70.1	330	100.6
40	12.2	140	42.7	240	73.2	340	103.7
50	15.2	150	45.7	250	76.2	350	106.7
60	18.3	160	48.8	260	79.3	360	109.8
70	21.3	170	51.8	270	82.3	370	112.8
80	24.4	180	54.9	280	85.4	380	115.9
90	27.4	190	57.9	290	88.4	390	118.9

Depth in Metric

Using meters to measure depth is the foundation of diving with the metric system and it will greatly simplify all technical diving calculations. One meter equals 3.28 feet.

Labeling a gas cylinder simply with a number indicating the maximum operating depth (MOD) in feet is often considered the right method. If the foot was the worldwide standard for depth measurement this would be plausible. But since the majority of the world's divers use meters, confusion from such marking is possible and the consequences potentially lethal. Since universal adoption of metric remains for the future, markings should conspicuously indicate whether the MOD is in feet or meters.

Ambient Pressure in Metric

All technical divers will be familiar with the following formula providing ambient pressure in atmospheres.

$$\text{ambient pressure in atmospheres} \quad \left(\frac{\text{Depth in Feet}}{33}\right) + 1$$

The derived metric unit *bar* is about equal to an atmosphere (only 1.3% difference) and the two are considered interchangeable in application to sport diving. A tremendous advantage of metric is that 10 meters of depth equal 1 bar of pressure. Thus, ambient pressure can be calculated simply by taking the depth in meters, dividing by 10, then adding 1.

$$\text{ambient pressure in bar} \quad \left(\frac{\text{Depth in Meters}}{10}\right) + 1$$

For example, to calculate ambient pressure at 37.5 meters, move the decimal one place to the left (giving 3.75) then add 1 for the result of 4.75 bar. No calculator required!

PO^2 in Metric

With bar and atmospheres interchangeable, all of the PO_2 rules for atmospheres are identical in bar. In terms of ambient pressure and PO^2, going metric is nothing more than exchanging the word "bar" for "atmospheres".

The CCR divers at hand will be familiar with the *diluent flush*, a procedure for flushing the breathing loop with diluent gas. This is considered by many, purely a reactionary method to deal with problems after they are suspected. As important however, is the proactive use of the diluent flush as a means of testing oxygen sensor cell calibration. A diluent flush at depth is the only means (without special equipment) for testing the cells at ambient pressures significantly above 1 bar. Generally, current CCR practice is to calibrate at 1 bar PO^2 and assume linear performance of the cells during the higher ambient pressures encountered while underwater. It is therefore good practice to perform a diluent flush cell calibration check at depth early on in every dive. As shown previously, metric units make calculation of ambient pressure easy. Multiplying this by the fraction of oxygen in the diluent gas gives the PO^2 reading the cells should display.

$$\text{Cell reading in bar} = \left(\text{Ambient pressure in bar}\right) \times \left(FO^2 \text{ in diluent gas}\right)$$

Cylinder Pressure in Metric

In metric diving, bar is used for all pressure measurements, including cylinder pressure. One bar is 14.5 PSI.

Cylinder Pressure in Imperial and Metric

PSI	Bar	PSI	Bar
2000	138	3000	207
2015	139	3250	224
2240	154	3300	227
2400	165	3400	234
2475	171	3600	248
2650	183	4000	276

Gas Volume in Metric

Among the markings stamped on most cylinders produced outside the U.S. is the internal volume (also called liquid capacity). This is not the volume of gas contained at some pressure, but the internal dimensional volume of the cylinder. If a cylinder has the internal volume given in cubic feet, multiply by 28.3 to convert to liters. Combining the metric units of bar and liters allows for a simple determination of the volume of gas in a cylinder as follows.

$$\text{Liters of gas in cylinder} = \left(\text{Cylinder internal volume in liters}\right) \times \left(\text{Gas pressure in bar}\right)$$

For example, a 15 liter tank at 100 bar contains 1500 liters of gas (15 liters x 100 bar).

Gas Consumption in Metric

If your surface consumption rate is expressed in liters per minute, gas supply and consumption are easily calculated.

Surface Consumption Rates

ft^3/min per atm	L/min per bar	ft^3/min per atm	L/min per bar
0.1	2.8	1.1	31.1
0.2	5.7	1.2	34.0
0.3	8.5	1.0	36.8
0.4	11.3	1.4	39.6
0.5	14.2	1.5	42.5
0.6	17.0	1.6	45.3
0.7	19.8	1.7	48.1
0.8	22.6	1.8	50.9
0.9	25.5	1.9	53.8
1.0	28.3	2.0	56.6

$$\text{Liters of gas consumed} = \left(\text{Surface consumption rate in liters per min}\right) \times \left(\text{Ambient pressure in bar}\right) \times \left(\text{Time}\right)$$

For a CCR diver, the rate of oxygen consumption is governed by metabolism and is independent of depth. A rate of 1 liter per minute is a general guideline. With this in mind, if the oxygen supply volume is expressed in liters, that same number is also the theoretical maximum minutes of oxygen remaining. For example, consider a 3 liter oxygen cylinder on a CCR. If the oxygen pressure is 100 bar, there are 100 x 3 = 300 liters of gas in the cylinder, giving a theoretical maximum 300 minutes of gas (at 1L/min metabolic rate). This calculation also works for estimating gas requirements. If a CCR diver is planning a 120 minute dive, based on metabolism the oxygen consumed would be 1 liter per minute x 120 minutes which equals 120 liters.

Weight in Metric

A kilogram is 2.2 pounds, so an object's weight in kilograms is a little less than 1/2 its weight in pounds. A two pound diver's weight is about one kilogram.

Buoyancy in Metric

Although less common than the calculations described previously, applications such as commercial or recovery diving often use buoyancy calculations for lift bags. The buoyant force of a lift bag is calculated from the volume of water it displaces via the following formula.

$$\text{Bouyant force in pounds} = \left(\text{Lift bag volume in cubic feet}\right) \times \left(\text{62.4 pounds per cubic foot for fresh water or 64.0 pounds for sea water}\right)$$

The calculations are simplified in metric because the water weight constants are more intuitive. One liter of fresh water weighs 1 kilogram, and 1 liter of salt water weights just a bit more at 1.1 kilogram. Notice that the volume of a lift bag in liters is also the exact lifting force in kilograms for fresh water and for salt water add 10%.

$$\text{Bouyant force in kilograms} = \left(\text{Lift bag volume in liters} \right) \times \left(\text{1 kilogram per liter for fresh water OR 1.1 kilogram per liter sea water} \right)$$

Learning the Metric System

The wrong way to learn the metric system is to continue to employ Imperial units and convert to metric each time. This is helpful in the beginning, but to master the metric system, you must learn to visualize directly in metric. Start by learning important depths such as MOD's for your common mixes, typical decompression stop depths and depths of your favorite dive sites in meters. Making a written list of these depths in both feet and meters often helps the learning process. When you are comfortable knowing your common depth waypoints in meters, start using metric depth gauge. Many dive computers have user adjustable settings to display metric. It may help to use two depth gauges, one showing feet and the other meters. Cylinder pressure gauges that show both PSI and bar units are common and an excellent way to learn metric pressure measurements. Each time you check a gauge, read Imperial first, then compare to the metric reading. As you gain experience, transition to reading the metric units first, then use the Imperial reading only as a verification check. It will take time, but as you gain metric experience, you can eliminate use of the Imperial system all together.

A few years ago, on a dive vacation in Cozumel, our dive master gave his pre-dive briefing in metric. The Australian, German and Dutch divers in our group were all in tune, but the Americans were clueless. As an American, it embarrassed me, but also raised concern because metric and non-metric divers were paired, each unskilled in the other's system. The Americans arrogantly bickered that everyone should conform to their Imperial system, but the others teasingly asked if us Yanks would ever get it together. It was obvious who was right. The world has already conformed to a uniform and superior system and its time for America to abide. A shining example is NASA's Mars Climate Orbiter, a $125 million dollar spacecraft, lost over Mars in 1999 due to a mix up of Imperial and metric units.

Dive training agencies might serve their students better by universally teaching the metric system from the start. Teaching metric at the very beginning would add no difficulty for the student, who must learn all the basics in some kind of measurement system. It might as well be metric. As a result, diving calculations would be easier and there would be adherence to a worldwide standard. Safety requires simplicity and consistency and the metric system delivers.

Metric Conversions			
Depth	Imperial Metric	foot (ft) meter (m)	1 ft = 0.305 m 1 m = 3.28 ft
Pressure (ambient)	Imperial Metric	atmosphere (atm) bar (b)	1 atm = 1.013 bar 1 bar = 0.987 atm
Pressure (cylinder)	Imperial Metric	pounds per square inch (PSI) bar (b)	1 PSI = 0.0689 bar 1 bar = 14.5 PSI
Volume	Imperial Metric	cubic foot (ft^3) liter (L)	1 ft^3 = 28.3 L 1 L = 0.0353 ft^3
Weight	Imperial Metric	pound (lb) kilogram (kg)	1 lb = 0.455 kg 1 kg = 2.20 lb
Buoyancy	Imperial	pounds (lbs) force per cubic foot of water	1 ft^3 FW = 62.4 lbs 1 ft^3 SW = 64.0 lbs
	Metric	kilograms (kg) force per liter (L) of water	1 liter FW = 1 kg 1 liter SW = 1.1 kg

The author wishes to thank the U.S. Metric Association, Cindy Kennedy, John Scoles and Greg Such for contributions to this article.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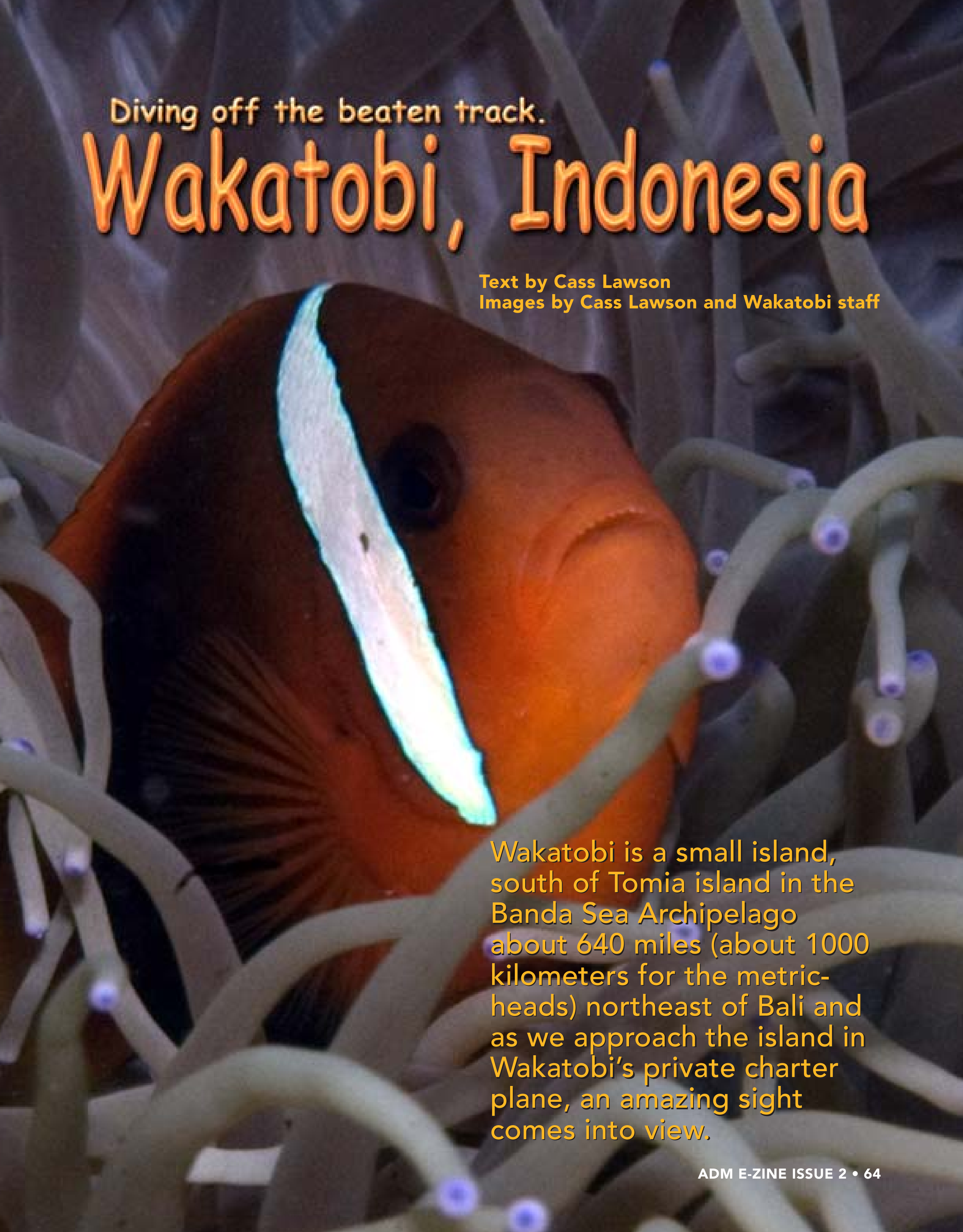
Diving off the beaten track.

Wakatobi, Indonesia

Text by Cass Lawson
Images by Cass Lawson and Wakatobi staff



Wakatobi is a small island, south of Tomia island in the Banda Sea Archipelago about 640 miles (about 1000 kilometers for the metric-heads) northeast of Bali and as we approach the island in Wakatobi's private charter plane, an amazing sight comes into view.

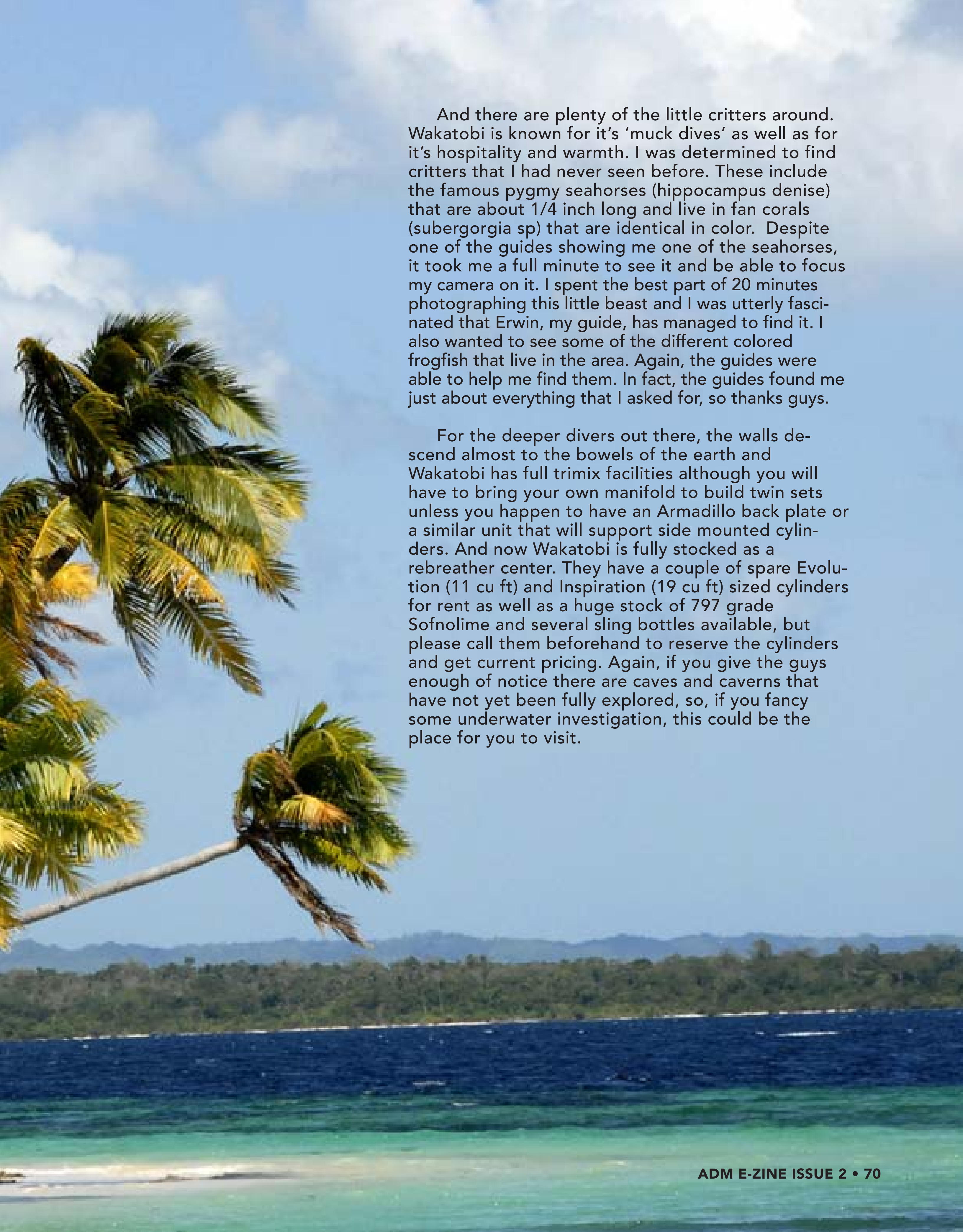
The almost virgin-like airstrip appears as a gray band-aid on the rough green skin of the island. The approach over the sea is spectacular and breath taking as we see atolls of all shapes and sizes disappear past the aircraft's windows. I'm thinking, "Wow, if this is the view from the air, what is the diving going to be like?' I guess I'll know soon enough, well as soon as my body clock has adjusted to the time differences and about 13000 miles I've flown, to say nothing of the zero 'Michelin Star' rated airline food I've consumed to keep body and soul together. Things promise to get better and better. And here's a useless bit of information that might come up on Trivial Pursuit, Wakatobi is named after the islands WAngi-wangi, KAledupia, TOmia and BInongko. Pink cheese and game to me.

We land on Wakatobi's private airstrip and we're met by a fleet of vans that transport us to the ferry for the 15-minute boat ride to the diving resort. Again, the approach is spectacular; the long jetty is clearly a spectacular entrance point with bungalows and the main 'long house' clearly visible and there appears to be a bar at the end of the jetty. Oh, things *are* getting better and better.

After checking in to my bungalow, I'm ready for my first dive. I'm buddied with Wendy, one of the senior dive instructors and guides, and she tells me we're taking a water taxi to the cave on House Reef where we'll roll over the side of the boat taxi and drop down to 60 feet. I feel the pleasant rush of 80F sea water as I descend the wall and I let the current take me slowly along it's sponge and coral face as I start to search for little critters to photograph. Soon Wendy is pointing out nudibranchs, flatworms, sea snails and such, and I notice a turtle that cruises past a few feet above us, seemingly unaware of us. The current carries us along at a gentle pace and finally after 72 minutes, we swim over the eelgrass outside the main dive center and emerge once again into hot sun. Better and better.

What is the diving like? There are about forty dive sites and you get to them via the three dive boats, Wakatobi III, IV and V, (in addition to the numerous water taxis) that ferry the divers to the sites three times a day. These long boats carry no more than 12 divers so there is plenty of space for gear and goodies. As you would expect, there is plenty of water on board and the trips to the sites are usually about 30 minutes away but a couple, Blade for example, is an hour's cruise. Most of the dive sites are walls that are covered in soft coral, huge sponges all manner of hard coral. Among all these static delights, is a venerable cornucopia of fish of all shapes and sizes. 'Nemos' of all colors are plentiful each in their specific anemone.

There is plenty of room for all of the divers, gear, cameras and other paraphernalia that divers insist on taking diving. The crew of four help with everything from setting up dive gear, helping divers out of the water, serving refreshments and answering all questions. For a group of 12 on the boat, there are three dive guides so you get plenty of attention underwater as well as above. And the guides have great eyes for spotting all of the great little creatures.



And there are plenty of the little critters around. Wakatobi is known for it's 'muck dives' as well as for it's hospitality and warmth. I was determined to find critters that I had never seen before. These include the famous pygmy seahorses (hippocampus denise) that are about 1/4 inch long and live in fan corals (subergorgia sp) that are identical in color. Despite one of the guides showing me one of the seahorses, it took me a full minute to see it and be able to focus my camera on it. I spent the best part of 20 minutes photographing this little beast and I was utterly fascinated that Erwin, my guide, has managed to find it. I also wanted to see some of the different colored frogfish that live in the area. Again, the guides were able to help me find them. In fact, the guides found me just about everything that I asked for, so thanks guys.

For the deeper divers out there, the walls descend almost to the bowels of the earth and Wakatobi has full trimix facilities although you will have to bring your own manifold to build twin sets unless you happen to have an Armadillo back plate or a similar unit that will support side mounted cylinders. And now Wakatobi is fully stocked as a rebreather center. They have a couple of spare Evolution (11 cu ft) and Inspiration (19 cu ft) sized cylinders for rent as well as a huge stock of 797 grade Sofnolime and several sling bottles available, but please call them beforehand to reserve the cylinders and get current pricing. Again, if you give the guys enough of notice there are caves and caverns that have not yet been fully explored, so, if you fancy some underwater investigation, this could be the place for you to visit.

What about non-diver activities? Well, the snorkeling is excellent as the house reef is shallow (6 to 8 feet) for a long way and there is plenty to see. The resort will arrange a trip into the local village so that you can see the indigenous people and where they live and work. There are masseuses available every day at very reasonable rates and they are very good. The whole of the resort is well laid out with numerous plants and flowers so photography is interesting. Providing there are good clouds, the sunsets are great – and you can enjoy a large Bintang beer for about $4.

Getting to Wakatobi is a serious travel commitment. I flew via Houston, Japan, Guam and finally Bali (Continental Airlines) where the Wakatobi aircraft collected me for the final leg of the journey. The final details of the charter flight to Wakatobi are decided late in the program so that the flights land and correspond with the tides on Tomia Island, so it is wise to have a layover in Bali. There are numerous places in Bali to stay from cheap and cheerful to the luxury resorts. Try and take a few days to explore the 14th century temples and look at the local markets. And if you can find a local restaurant that roasts whole suckling pigs, a traditional local meal, then go for it. If, and when, I came back to Wakatobi, I might fly east via Singapore and have a few days there instead. That way, I think that things will be even better.

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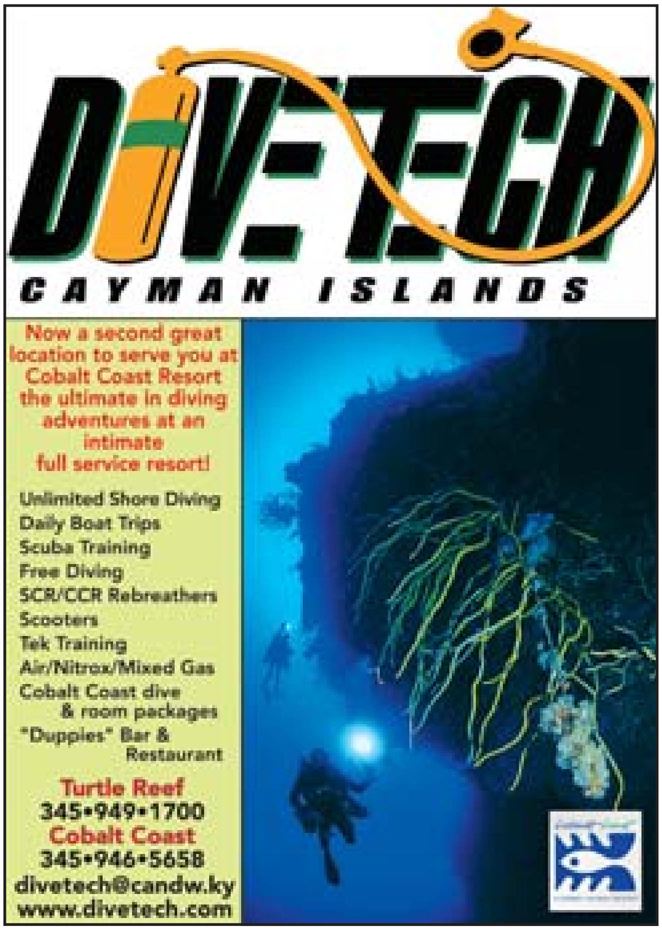
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USS SAUFLEY DD-465

Text by: Barry Lawson, Scott Maclean, and Bert Wilcher

Excerpt from ADM Issue #7

Following her shakedown off New England, Saufley commenced participation in the Guadalcanal campaign in December 1942. During the Japanese withdrawal from Guadalcanal in January and February 1943, she patrolled the waters north and west of the island, sweeping for anti-ship mines and provided coastal bombardment.

In March, Saufley transported troops, towed landing craft to the target islands, and provided shore bombardment in support of troops as they landed on Pavuvu. Saufley was engaged in the assault on the Green Islands, which broke the Japanese Rabaul-Buka supply line and provided the Allies with another strategic airfield near Rabul.

After sailing to Pearl Harbor, Saufley was reassigned to operation "Froager" and provided escorts and shore bombardment for operations in the Saipan-Tinian area. Saufley moved south for the invasion of Guam. Here, the destroyer provided call fire support for the assault troops.

Proceeding to Leyte Gulf, Saufley soon found herself engaged in antisubmarine action. For the next two months, Saufley engaged in escort duties between Leyte Gulf and Ulithi, until the end of hostilities in mid-August.

She participated in many Pacific campaigns and earned 16 battle stars during WWII.

In January 1951, the escort destroyer was reclassified an Experimental Escort Destroyer and was assigned to experimental work under the control of Commander, Operational Development Force in Key West. For the next twelve years she engaged in the development and testing of sonar equipment and antisubmarine warfare weapons.

In July 1962, Saufley was redesignated a general-purpose destroyer and regained her original designation, DD-465. She participated in the filming of the movie "PT 109," and participated in patrols off the Cuban coast during operation Cuban Quarantine.

Saufley was decommissioned on January 29, 1965. Her use as an experimental ship continued, instruments and gauges were placed to register stress from explosions and in February 1968, as a result of these tests, she was sunk off Key West.

Saufley now rests upright in 420 fsw off Key West. After the recent NAUI Technical conference, an attempt to dive the Saufley was planned. A three-diver team, consisting of Barry Lawson, Scott Maclean, and Bert Wilcher planned and executed a successful dive to the Saufley on October 8, 2000.

Key West, Florida   420 fsw

With a length of 376'6" and beam of 39'4," the first challenge became hooking a secure anchorage to the vessel to have a stable dive platform. With this accomplished, the challenge of a dive to this depth with open-circuit dive systems required coordination of bottom gas mixes, dive team logistics, and safety diver timing to ensure a safe outcome.

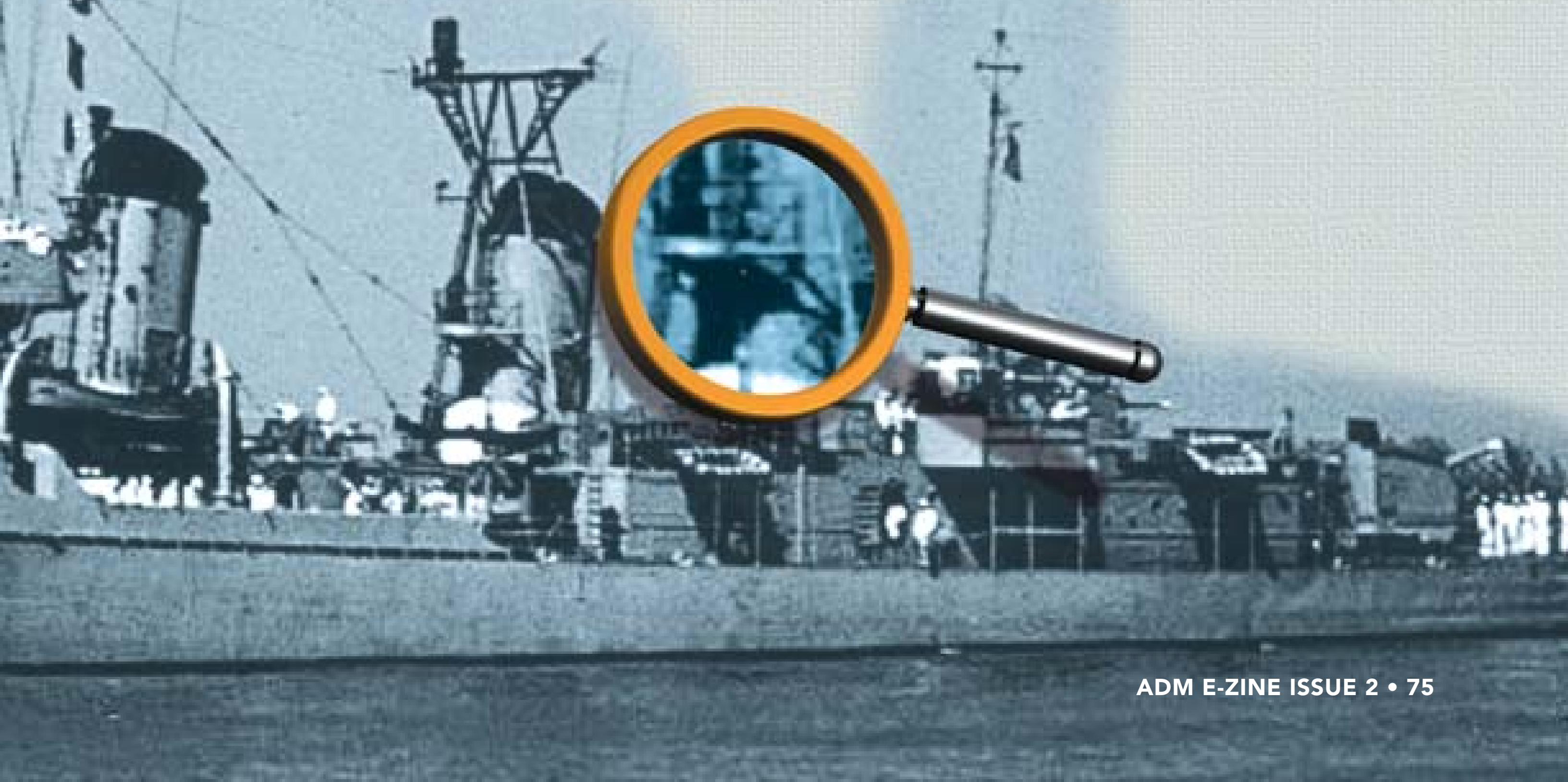
Best mix was determined to be a tri-mix 10/(55-60), EADs of 158-131, with deco gases being EAN32 and 100% O2 from 20 feet. Run times were planned using Abyss and Z-planner for run times of 12 and 14 minutes to ascent. The dive team descended onto the fantail of the ship, checked the anchor, and explored the aft section of the ship, returning to the ascent line at 12 minutes.

Uncoupling of the ascent line from the Soufley was completed and deep tri-mix decompression stops were taken while the ascent line was secured to the surface dive boat. Intermediate decompression was completed on EAN32 and final decompression, from 20 fsw, was completed on 100% oxygen.

The team was assisted by safety divers who continuously monitored the team after starting intermediate, (130 fsw), decompression stops, and during the oxygen.

Additional information on Saufley can be found in Dictionary of American Naval Fighting Ships and Ships of the U.S. Navy, 1940-1945.

Builder:	**Federal Shipbuilding Company**
Laid Down:	**January 27, 1942**
Launched:	**July 19, 1942**
Commissioned:	**August 28, 1942**
Fate:	**Stricken September 1, 1966**

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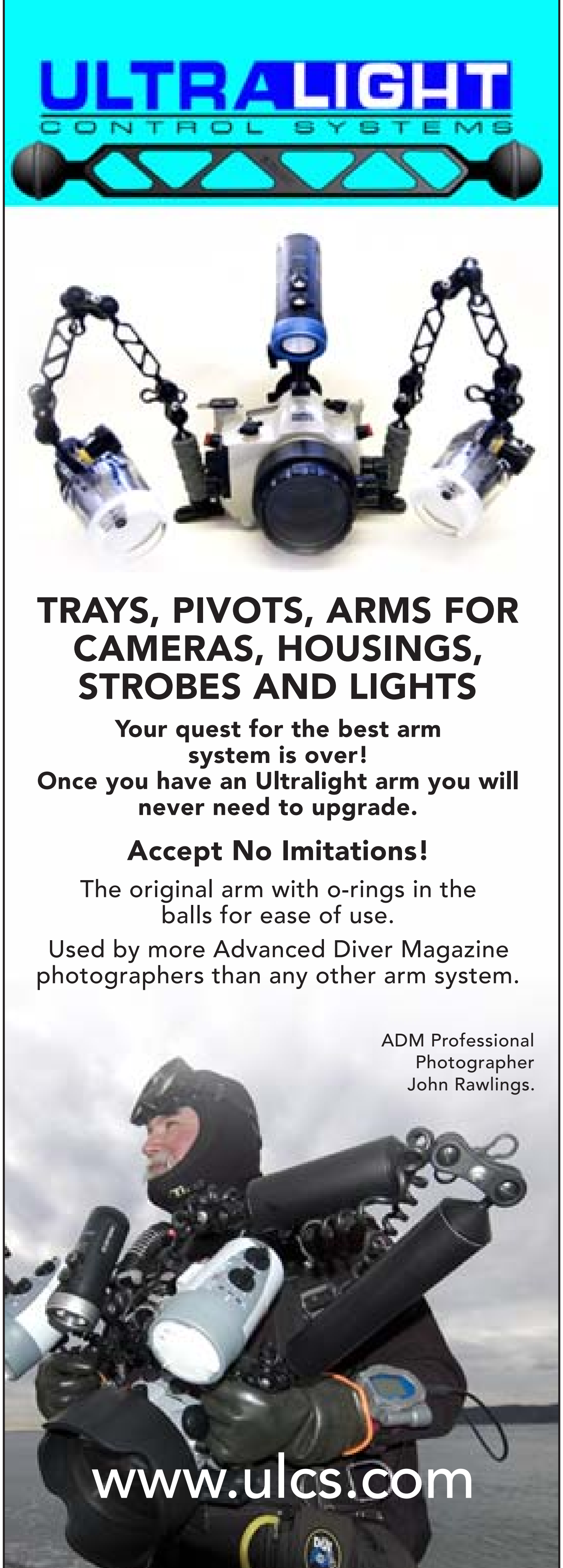
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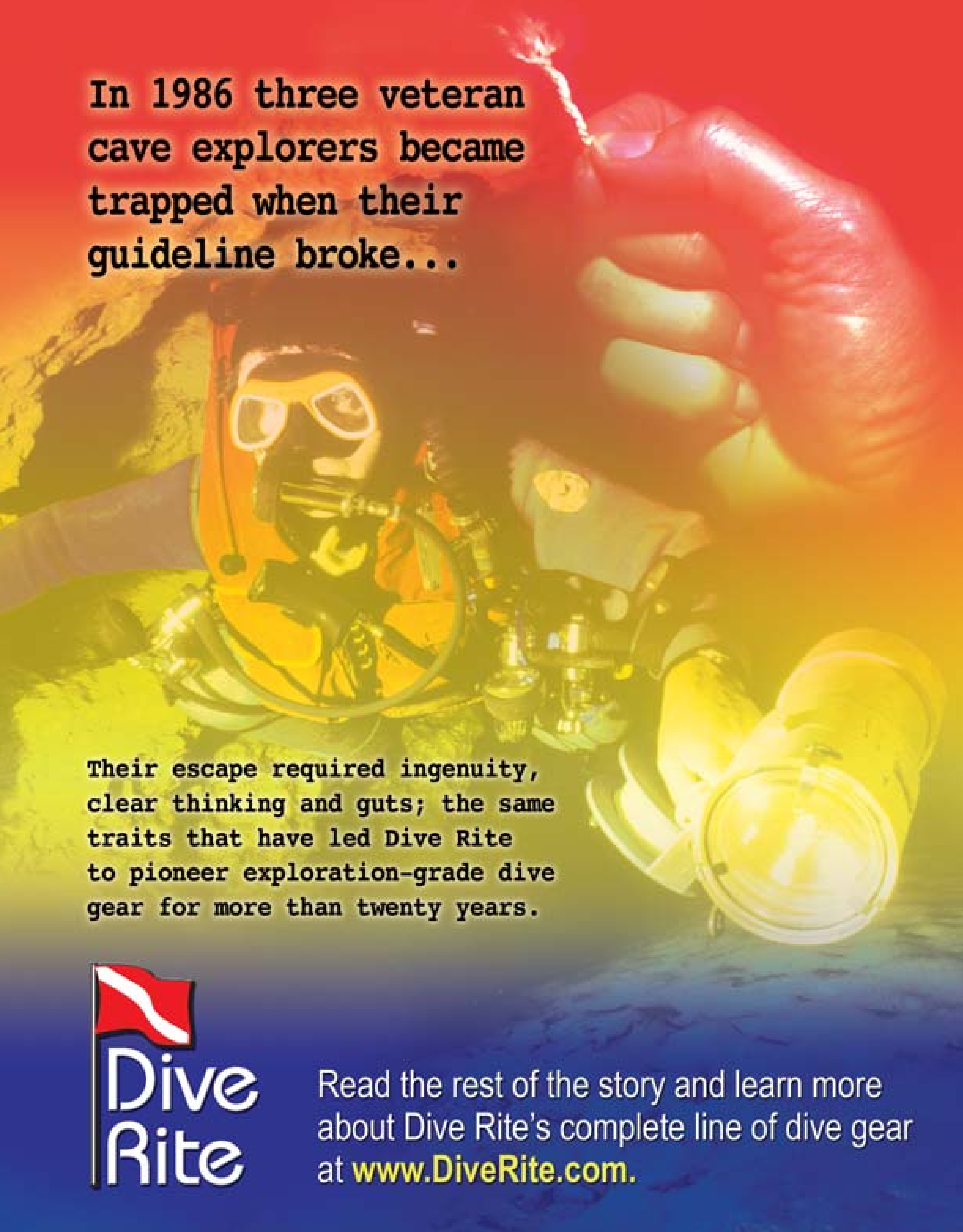
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