ALERT DIVER

THE MAGAZINE OF DIVERS ALERT NETWORK

FALL 2014

A TASTE OF THE TROPICS – THE BAHAMAS AND FLORIDA KEYS

THE UNDERWATER WILD OF CRISTIAN DIMITRIUS

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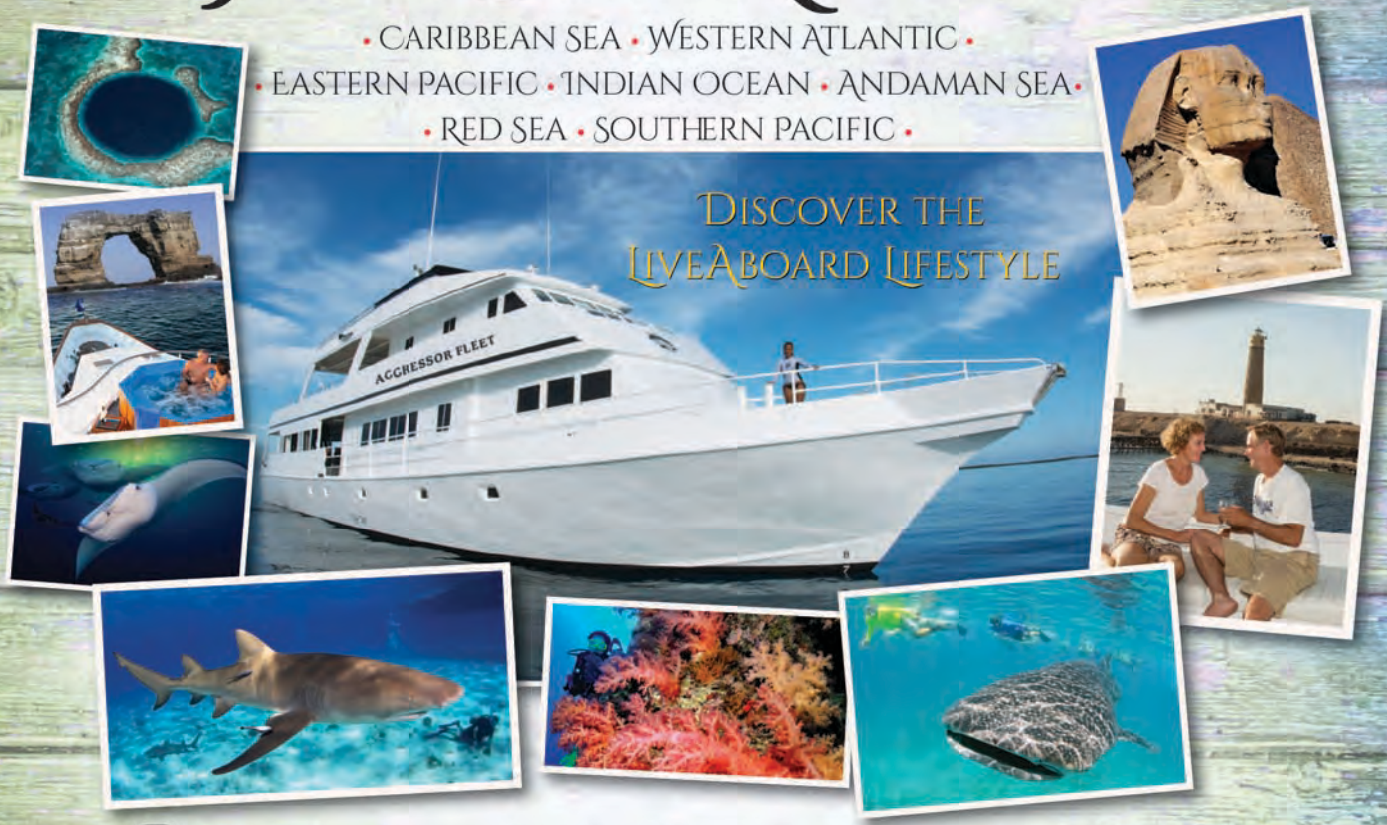

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VISION

Striving to make every dive accident- and injury-free. DAN's vision is to be the most recognized and trusted organization worldwide in the fields of diver safety and emergency services, health, research and education by its members, instructors, supporters and the recreational diving community at large.

DAN YOUR DIVE SAFETY ASSOCIATION

MISSION

DAN helps divers in need of medical emergency assistance and promotes dive safety through research, education, products and services.

Divers Alert Network® (DAN®), a nonprofit organization, exists to provide expert medical information for the benefit of the diving public.

DAN's historical and primary function is to provide timely information and assistance for underwater diving injuries, to work to prevent injuries and to promote dive safety.

Second, DAN promotes and supports underwater dive research and education, particularly as it relates to the improvement of dive safety, medical treatment and first aid.

Third, DAN strives to provide the most accurate, up-to-date and unbiased information on issues of common concern to the diving public, primarily — but not exclusively — for dive safety.

ALERT DIVER'S PHILOSOPHY

Alert Diver® is a forum for ideas and information relative to dive safety, education and practice. Any material relating to dive safety or dive medicine is considered for publication. Ideas, comments and support are encouraged and appreciated.

The views expressed by contributors are not necessarily those advocated by Divers Alert Network. DAN is a neutral public service organization that attempts to interact with all diving-related organizations or persons with equal deference.

Alert Diver is published for the use of the diving public, and it is not a medical journal. The use and dosage of any medication by a diver should be under the supervision of his or her physician.

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CONTENTS

FALL 2014

features

ON THE COVER:
One of San Salvador's friendly Nassau groupers (*Epinephelus itajara*) yawns for the camera. Alex Mustard took the photo using a Nikon D4 set at 1/200th sec. @ f/16, ISO 400, with a Sigma 15mm fisheye lens, Subal housing and Seacam Seaflash 150 strobes.

A massive school of glass minnows fills the swim-through at Coral Canyons, Green Turtle Cay, Bahamas. Photo by Stephen Frink.


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CONTENTS

FALL 2014

departments

A white grunt (*Haemulon plumieri*) yawns widely as a cleaning goby (*Gobiosoma genie*) peers out from beneath its top lip. San Salvador Island, Bahamas. Photo by Alex Mustard.

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Call DAN

BY BILL ZIEFLE

A popular theory states that it takes 10,000 hours of practice to become an expert in a field. Since its inception in 1980, the DAN Emergency Hotline has served the diving community for more than 300,000 consecutive hours and counting. Divers facing a medical emergency know they can call the DAN Emergency Hotline at +1-919-684-9111 any time, day or night. To date, this service has helped thousands of injured divers — members and nonmembers alike. Regardless of where you are in the world, when something goes wrong, call DAN.

If you find yourself in a situation where you need to dial that emergency number, here is what you can expect: The operator who answers your call will record basic information such as your name, location and a call-back number; then your call will be transferred to a DAN medical information specialist, who has the experience and training to handle your concerns with sensitivity and professionalism. Depending on the time of day, there may be a short delay while the operator transfers the call. If the call is disconnected, someone from DAN will return your call promptly.

STEVE EXUM

The medic who takes the call will quickly confirm the information provided by the operator and request additional information about your emergency. It may be necessary to contact one of our attending physicians or access other resources such as DAN TravelAssist® to get you the help you need. It is not uncommon for certain situations to require multiple calls as events unfold. It is therefore extremely important that you try to provide DAN with accurate and multiple points of contact.

Connecting with DAN at the earliest possible opportunity helps ensure you get the best available medical care. Once you are at a local medical facility, DAN can provide critical support to the attending physician and on-site medical personnel. With 34 years of accruing experience and building affiliations with the top dive-medicine physicians in the world, DAN offers a wealth of resources that would otherwise be unavailable to many local doctors.

If medically necessary or if there is a need for additional chamber treatments, DAN may arrange evacuation to a facility that can offer a higher standard of care. Organizing medical transportation or an air ambulance is a complex process; it often takes several hours to secure arrangements and execute transfer, so the earlier DAN can evaluate the situation and initiate the process, the sooner you will have the medical attention you require.

Payment for services in foreign countries can also be an issue. In such cases, DAN can intervene to arrange payment for medical services or provide appropriate payment guarantees so you will receive medically necessary treatments. With DAN dive accident insurance, you should never be required to make payment to a hyperbaric chamber or medical facility. DAN will ensure that 100 percent of eligible expenses are paid, providing secondary insurance coverage up to $500,000. If anyone requests payment in advance of treatment, consider that a red flag and immediately report it to DAN.

> "Connecting with DAN at the earliest possible opportunity helps ensure you get the best available medical care."

DAN knows that when you're facing a medical emergency your loved ones back home will want to hear how you're doing. DAN can help when you don't have the time or ability to provide regular updates; with your consent we can notify family members and give them information about your condition.

DAN's Emergency Hotline is the cornerstone of our service to DAN members and the entire diving community. Whatever the situation, no matter where you are in the world, help is just a phone call away. Call DAN. AD

DAN
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Introducing DAN's Health & Diving Resource Series.

At DAN, we believe a smarter diver is a safer diver. That's why our medical researchers and educators have developed this comprehensive line of books, brochures and guides that provide valuable information on topics critical to diver health and safety as well as common issues encountered by new and experienced divers. DAN's new series offers greater insight into subjects such as ears and equalization, cardiovascular health, decompression sickness, hazardous marine life and more. These essential resources are available to you as tools to help you enhance diver safety in the community. So become a smarter, safer diver. Explore DAN's health and diving resources before you enter the water.

DAN's Health & Diving Resource Series includes:

Reference Booklets
Provides extensive insight into a single topic critical to diver health and safety including cardiovascular health, ear injuries and medical conditions, marine life injuries and decompression sickness.

Reference Brochures
Focuses on a singular topic related to common problems experienced by divers such as the recognition and care of DCI, identifying cardiovascular risks, understanding equalization, preventing stings and more.

Smart Guides
Provides vital, top-level information on popular dive health and safety issues. Themed topics range from *How to Equalize Like a Pro* to *Ways to Run Out of Air and How Not To.*

Public Service Brochures
Educates the public and increases awareness about important safety issues in the dive community. Breathing-gas contamination, boating safety and lionfish awareness are just a few of the issues addressed.

DAN.org/Health


STEPHEN FRINK


STEPHEN FRINK

Visual Responsibility

BY STEPHEN FRINK

I embarked on a long overdue task recently: cleaning out my storage shed. Along with boxes of old paper records stored far beyond Internal Revenue Service obligations to do so, I found some vintage dive magazines. Many were cutting edge for their time and were instrumental in growing the sport of recreational scuba to where it is today. My old *Skin Diver* magazines made me particularly nostalgic because I worked for that publication as a freelance photojournalist for 17 years in the 1980s and '90s. One cover photo from December 1980 spoke volumes about how far we have come in our awareness of marine conservation and the role of the marine photographer in the realm of visual communication.

The cover photograph was a beautiful bikini-clad dive model gently sitting on the edge of an orange elephant ear sponge, wonderfully lit and technically excellent. But sitting on a sponge? Today a responsible magazine would never publish such an image, and if it did its readers would quickly and rightly castigate it. Even though it wasn't my shot, it could have been, given the ethics of the time. If I dug deep enough into my old three-ring binders of slides I'm sure I would find pictures I took of divers in contact with coral or sponges or perhaps holding turtles, puffing pufferfish or riding manta rays — things we now know we should never do again.

Our attitude in those days can be attributed to more than just ignorance or arrogance. We believed the sea was an inexhaustible resource of wonder — self-replenishing and never-ending. In this issue, Jerry Greenberg reminisces about his early days photographing the reefs of Key Largo, Fla. — in particular his work in the January 1962 issue of *National Geographic* on America's first undersea park (see Page 19). In the context of the Coral Restoration Foundation's good work replenishing our coral reefs with transplanted coral, I was eager for Greenberg to weigh in on how things used to be. Some of his most iconic images were taken in immense fields of elkhorn and staghorn coral off South Carysfort Reef at the far north end of what was then John Pennekamp Coral Reef State Park.

Even though I did not move to Key Largo until 1978, I saw these vast panoramas of branching corals, and they probably didn't look too different from what Greenberg saw two decades before. Carysfort was a long trip to the north for many of the local dive boats, and when I did occasionally get up there with my leaky Nikonos II camera and Seacor 21mm lens, I never brought home significant images. But I wasn't worried; I could always go back, or so I thought.

I never imagined that the annoying black-spined sea urchins (*Diadema antillarum*) that poked through the knees of my wetsuit during night dives would suffer mass mortality throughout much of the Caribbean and tropical Atlantic in 1983. And I was not aware that

these animals were grazers that kept the reef substrate clear of algae and available for colonization by coral.

I didn't think about the storms that would damage the reef or the possibility that clumsy and uneducated divers were breaking these fragile corals. Whatever the contributing factors, the coral gardens of South Carysfort were gone before I really noticed what was happening. In other areas of the Key Largo reef tract there is considerable new coral growth (including fresh elkhorn growth on North Carysfort), but the wide-angle vistas I'd envisioned in my mind's eye on that particular reef were never to be.

That was my first and most enduring epiphany about the fragility of the coral reef. It is also part of the reason I was so excited to see beautifully intact elkhorn corals off the Abacos when I was shooting for Bahamas Underwater Photo Week (see Page 64). I'm certainly more appreciative now when I have the privilege of visiting a pristine reef, and I try to make the images count.

With privilege comes responsibility. Back in the day I remember having a conscious debate with myself as I found a particularly inviting subject surrounded by fragile corals. Is my photograph important enough to justify breaking just a little coral to get to the sweet spot for the perfect angle? After all, underwater photography requires proximity, and proximity invites contact. The correct answer is obviously no. No photograph is worth breaking coral or damaging the reef. The coral reef is a shared resource, and no diver has the right to purposely inflict damage. As visual communicators it is our obligation to interact with the coral reef in a benign manner and to photograph subjects in such a way that we send the right message.

On a recent night dive in Indonesia I heard my guide chirping through his regulator and saw him excitedly pointing at a puffed-up pufferfish. My instincts kicked in, and I took the photo, but I shot only one before I caught myself. I had another conscious debate with myself. Had I ever seen a pufferfish in the water column that was inflated without some diver making it so? No. Was it likely the guide did it and then swam it over to me? Yes. Would me excitedly taking numerous pictures of the obviously alarmed pufferfish communicate to him that it was OK to do this for his guests next week? For sure.

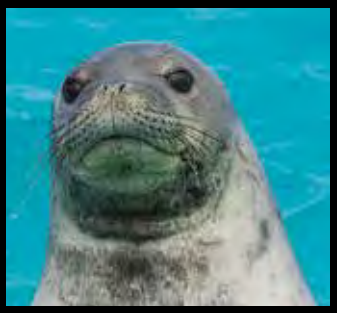
We had a quiet chat on the boat on the way home during which I explained why I couldn't take that shot. Sometimes as visual communicators we have to just say no. The shot is not worth it, and the message is just wrong. AD

WHAT'S NEW ON ALERTDIVER.COM

AUSTIN GALLAGHER

IMMERSION RESEARCH

Biologist Austin Gallagher reports on the current state of shark populations on Page 20. Take the plunge with Gallagher as he dives among oceanic whitetips in his film *Bold*.



DOUG PERRINE

MONK SEALS

Read "Choosing Extinction" on Page 108 to learn about the hazards facing the critically endangered Hawaiian monk seal. Then watch *National Geographic's Monk Seal Mystery: Northwest Hawaiian Islands* to explore the seals' world through crittercams.

STEPHEN FRINK

BEHOLD THE BAHAMAS

In collaboration with the Bahamas Ministry of Tourism, *Alert Diver* hosted the Bahamas Underwater Photo Week in May 2014. Four shooters documented Bahamas diving from 10 different islands. Read their stories on Page 64, and continue exploring the islands in the online bonus gallery

AMOS NACHOUM

A REMOTE EVACUATION

Read big-animal photographer Amos Nachoum's story of his emergency evacuation from Antarctica on Page 42. Then peruse images from his other expeditions to Earth's southern extremes.

ALL THIS AND MUCH MORE AWAIT AT WWW.ALERTDIVER.COM.

Letters

GRAB, CHECK AND GO

I purchased a DAN Grab and Go first-aid kit just before a recent tour of Mongolia. When it arrived, I checked out the kit to see what it contained. Later, I was very glad I'd taken the time to do that.

We were staying at Red Rock Ger Camp in the northern Gobi desert, many miles over very bumpy dirt roads from the nearest town, when the local women's crafts collective visited to show their wares. While riding to our camp, two of the women took a nasty spill from their motorcycle. They arrived bruised, scraped and in some pain. Fortunately, our tour group included both a critical-care nurse and a retired doctor who examined them, cleaned and bandaged their abrasions and handed out painkillers from their own first-aid supplies. One woman had strained her shoulder and it needed support, but all anyone had were bandanas, too small to make a proper sling. Then I remembered the triangular bandage in my DAN kit. I quickly fetched and applied it, to the comfort and satisfaction of the patient and our group's "medics."

Your first-aid kits are a must-have, especially for adventure travel when you're miles from any medical help. Purchasers should check out the contents before packing their kit in their luggage — I'm glad I knew what was in that little red pouch when it was needed!

— Callie Mack, via email

MISGUIDED PROTECTION?

As a DAN member and lifelong waterman, I'm extremely disappointed to see the propaganda article regarding California's new

underwater parks (Summer 2014, Dive Slate, Page 14). I have been hunting in the ocean in California for more than 30 years. The best hunting grounds that I have dived for decades were taken away from me, and it was done in the name of science.

The "science" on which these decisions were based is junk science. Black and white sea bass counts have been increasing dramatically since gillnetting stopped and with the existing protections of the Department of Fish and Game (now renamed Department of Fish and Wildlife with infiltration and pressure from the Humane Society). The lobster fishery is also healthy and had been growing year after year before any area closures.

Spearfishermen account for such a tiny percentage of take that there is no reason to close off any area to us. Taking a position against underwater hunters alienates a large percentage of DAN membership. I've always liked and recommended DAN, so it hurts even more when an organization I considered to be a friend — that I belong to — takes a position against me. I hope you'll even the score by adding an article about hunting California waters and how these new parks have affected divers who hunted those areas for years.

— John Weymouth, via email

Publisher's response:

Dear John,

I reread David Helvarg's article, and for the most part it simply reports established facts. The author's bias in favor of marine protected areas (MPAs) is clearly evident in the last sentence though: "I suspect that in as few as 10 or 15 years from now, the Californians who today so vehemently oppose MPAs will have to shrug and reluctantly acknowledge that something of value really did happen when a world-class state park system moved underwater." That is his opinion, and it's stated as such. Please understand DAN was not politically motivated in our coverage of this topic, nor were we involved in any way in the process to create these MPAs. Our editorial treatment of this issue in *Alert Diver* was intended to speak to new realities of California diving of which our members should be aware. Any opinions expressed in the article should not be construed to represent the views of DAN.

— Stephen Frink, Publisher,
Alert Diver

RESCUING AN UNRESPONSIVE DIVER

I was reading my Summer 2014 *Alert Diver* magazine when I noticed something that confused me. In "Right People in the Right Places" (Skills in Action, Page 56), I saw the following statement: "The other divers partially inflated Al's empty BC and swam him up to the surface at an aggressive speed." This concerned me because I learned in my rescue-diver training to straddle the back of the unresponsive diver's tank and inflate my own BC until the two of us achieved neutral buoyancy so I could more easily control the ascent. Also, if a rescuer happens to drop a diver and

his BC is inflated, he might end up in an uncontrolled ascent, whereas if the rescuer's own BC is inflated it can be vented. I wanted to know if both ways are OK in case I ever face this problem.

— Kelly Lumpkin, Atlanta, Ga.


STEPHEN FRINK

DAN's response:

Dear Kelly,

The description of events included Al "falling like a rag doll" and then striking the bottom head first at 82 feet. These details indicate Al was negatively buoyant. Without some cursory inflation of his BCD, he would have been like lead weight all the way to the surface and, if released, would have sunk to the bottom again. The initial inflation facilitated movement toward neutral buoyancy for the rescue pair, making for easier control and protecting the rescuers from the risk of rapid ascent due to overinflating their own BCDs. Overinflating an injured diver's BCD should certainly be avoided for the very reasons you describe, but the end goal is to get the diver to the surface efficiently — and as safely as possible for everyone involved. A BCD without sufficient air in it will not help achieve that goal.

Regarding the second part of your inquiry, the fact that the ascent rate was described as "an aggressive speed" may be cause for concern. However, keep in mind that an unresponsive diver's chances of survival are much greater at the surface than they would be on the bottom. The rescuer's attention to keeping Al's airway open probably protected him, at least in part, from the expanding gas in his lungs. The rescuers would also need to be conscious of their own breathing, making sure to exhale sufficiently to avoid problems for themselves as a result of the fast ascent. Proper rescue technique dictates a safe ascent rate to protect the rescuers, and this should not be discounted in an emergency. Having additional injured divers divides resources and can compromise care for all once on the surface. AD

— Patty Seery, MHS, DMT; Deputy Director, DAN Education

WRITE US

Tell us what's on your mind by writing us at:

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ONLINE

Send email to *letters@dan.org*.
All letters included in this column are subject to editing for length and content.

DIVE SLATE

MISSION 31
AN AQUANAUT'S JOURNEY

Text and photos by Kip Evans

It had been a long day, and I fell face-first into my bunk, exhausted. As I started to close my eyes, the bunkroom suddenly lit up like an airport landing strip. Sitting straight up, I looked directly toward the source of the light to see a huge tarpon swim by the viewport window. With each pass its silvery body reflected the habitat's bow light back into our bunkroom. This spectacle was amazing, and that window would become our team's theater screen for many more unbelievable shows over the next several weeks.

That night was June 1, 2014 — my first night as a resident of the Aquarius Reef Base underwater laboratory. Starting that day, I was tucked away in my new aquatic home with scientists Andy Shantz, Adam Zenone, expedition leader Fabien Cousteau and our two habitat technicians, Mark "Otter" Hulsbeck and Ryan LaPete. We had just completed two weeks of intensive dive training, and I was looking forward to finally starting my job as one of two aquanaut documentary shooters saturating with Mission 31.

THE AQUARIUS HABITAT

Located some nine miles off the coast of Key Largo, Fla., in the Florida Keys National Marine Sanctuary, Aquarius is a complex underwater structure that sits at a depth of 63 feet. The structure is tethered to a life-support buoy on the surface; a team of highly trained Florida International University (FIU) scientists, including professional divers and engineers, operate the habitat from a command center in Islamorada, Fla. Aquarius is the only remaining underwater laboratory in the world, and it is dedicated to helping scientists study the ocean and its inhabitants for extended periods.

Resident aquanauts can spend days or even weeks underwater using an advanced diving technique called saturation diving. One of the benefits of saturation diving is that an aquanaut from Aquarius can remain at depth outside the habitat for extended periods with a reduced risk of decompression sickness. This is because the diver has already absorbed the maximum amount of nitrogen for that depth. In fact,

Fabien Cousteau emerges from Aquarius Reef Base during a working dive in the course of his 31-day saturation at 63 feet.

Below: **Actor Ian Somerhalder and Conservation International chief scientist Greg Stone, Ph.D., join Fabien Cousteau at Aquarius Reef Base.**

if a diver were to stay at the same depth as the habitat, then he could dive indefinitely because the dive would not — at least in theory — involve any decompression.

Saturation diving requires special training and preparation, so each member of our team had to pass a battery of medical exams, challenging swim tests, checkout dives and hardhat training to qualify as an aquanaut for Mission 31. We also participated in classroom instruction that covered everything from how to use the gazebo — a small external structure containing survival necessities to be used in case of emergency — to how to use the restroom.

MISSION 31

Cousteau created Mission 31 as a tribute to his late grandfather, Jacques-Yves Cousteau, who spent 30 days underwater in the Continental Shelf Station Two underwater habitat in the Red Sea in 1963. Mission 31 derives its name from Fabien Cousteau's goal of having a team of aquanauts live underwater for 31 days — one day longer than his grandfather's team did 51 years ago.

Our time underwater was busy: We had 4:30 a.m. wake-up calls for early-morning science experiments; we hosted VIP visitors from the surface; and we received daily deliveries from U.S. Navy divers, who used water-tight pressure pots to transfer food and other supplies to the habitat.

An entire topside team was dedicated to our personal welfare and safety. Led by Roger Garcia and Tom Potts, FIU employees monitored the mission 24 hours a day, keeping track of our oxygen and carbon-dioxide levels, power usage, food reserves and medical needs.

MEMORABLE EXPERIENCES

During my time as an aquanaut, I became very fond of late-afternoon diving. With unlimited air and up to nine hours of bottom time, I often planned my dives to coincide with twilight, taking advantage of better water clarity to view the transitioning animals coming up from the deep. I must admit, however, that I also relished

the opportunity to dive alone (while tethered to the habitat) after all the visitors had returned to Islamorada.

I spent several late evenings with Cousteau using our Light and Motion lights and filming fish, invertebrates and even corals that exhibited fluorescent properties (see Advanced Diving, Page 44). On one spectacular evening, Shantz, Zenone and I encountered swarming plankton, dozens of reef squid, aggressive barracuda and even a loggerhead turtle all within an arm's reach of the habitat. Some of these evening shoots can be viewed on the Mission 31 YouTube channel.

These night dives were truly remarkable, but so were the late-night shows that occurred while we were snug in our bunks. On several occasions we watched a goliath grouper that we named Sylvia (in honor of aquanaut Sylvia Earle) feeding right outside our window. She would often hang within inches of the glass and dart after small fish with amazing speed.

On one particular evening we all watched in astonishment as Sylvia attacked a pushy barracuda that had been invading her turf. In all my years of diving, I had never documented a grouper attacking a barracuda.

Fabien Cousteau peers out of the main viewing port of Aquarius Reef Base.

OUTCOMES

Employing the tools of the 21st century to take a page out of his grandfather's documentary past, Cousteau used the Internet to educate the public about Mission 31 and the ocean. Engaging students and followers via Skype, Twitter, Facebook, Instagram and traditional media, Cousteau and our team reached hundreds of millions of people across the globe with blogs, videos and even underwater selfies. Along the way our production team produced 31 videos documenting not only life inside Aquarius but also stories that were taking place on shore. Some of my favorite videos were produced with our partners Nokia, Doxa, Backscatter, and Light and Motion.

Mission 31 scientists from FIU and Northeastern University collected enough data to publish at least 10 scientific studies during the 31 days of saturation. Cousteau and our team participated in 70 Skype sessions with schools, universities, camps and the media. Mission 31 was both a personal and professional journey for me, and it will remain one of the greatest adventures of my life.

A French angelfish (*Pomacanthus paru*) swims amid staghorn corals recently planted by the Coral Restoration Foundation.

Coral Restoration Expands Internationally

Text and photos by Tim Grollimund

In December 2010 I jumped onto a boat with a group from the Coral Restoration Foundation (CRF). I had volunteered to photograph their seminar class harvesting corals from the staghorn coral nursery and planting the fledgling corals on Molasses Reef.

In those days CRF President Ken Nedimyer's techniques were changing and progressing rapidly. He had recently shifted from mounting coral cuttings on individual pedestals to hanging them from lines. The coral trees that are the norm in coral nurseries today were being deployed on a test basis at that time.

Every so often something triggers special people to go beyond themselves and unceasingly pursue a path to greatness, even if they can't know the full impact of their efforts at the moment. I believe Nedimyer is one of those people. I felt it the first day I volunteered. Before he is done I am convinced the entire ocean-aware community will know about Nedimyer and the CRF. The work they are doing is that important, and raising awareness of the deteriorating condition of the world's coral reefs is high on the priority lists of ocean conservationists around the globe. The beauty of this organization is that you can get involved as a diver and plant corals to help CRF make a difference.

CRF has nurseries full of coral and big plans. Nedimyer, the staff and several volunteers reiterated that point recently at an Ocean Reef Conservation Association event in Key Largo, Fla., CRF's home waters. They transferred the first cultivated corals from the Ocean Reef nursery to Carysfort Reef, and I had the pleasure of tagging along. I was also fortunate to be onboard when they planted the first cultivated elkhorn corals on Molasses Reef. CRF is making great strides.

The organization's proven techniques are easily exportable to other reef-dependent cultures around the world. There is more to restoration efforts than the nurseries; identifying resilient genetic strains of coral is one of the keys to success. CRF's objective is to cultivate the surviving strains gathered from depleted areas and nurture them. Replanting them on the reef is a critical step in the reef's transition back to a productive ecosystem. Once the coral is planted, grows, breeds and expands, the ecosystem-building relationships begin to manifest. Coral restoration is the linchpin for recreating an ecosystem.

CRF currently has nurseries in Bonaire and Colombia, and six other island nations are in various stages of readiness to join the ranks in the near future. Mike Echevarria, chairman of CRF's board of directors, says the organization is getting new inquiries every week from the international community. Recognizing the demand for coral cultivation, CRF created a new entity for overseas expansion called Coral Restoration Foundation International (CRFI). Coral Restoration Foundation Europe, a London-based charity under the direction of Peter Raines, was formed to support CRFI and its projects. Together they have plans for the Pacific and Asia and have received inquiries from the Middle East as well.

CRF is refining its proven techniques into a turnkey operation for overseas deployment. Echevarria believes they have the potential to be in 25 countries within five years once they put the finishing touches on the turnkey package.

The path to a working nursery goes something like this: Once CRF receives an inquiry, the inquiring organization works with CRF to establish a stakeholder base that includes dive operators, the tourism industry, local or

Denise Nedimyer observes staghorn coral spawn collected from the Coral Restoration Foundation's nursery.

Above: **Staghorn corals are nurtured on a PVC "tree," where they will grow until they can be successfully transported and then transplanted onto the coral reef.**

Reflections on Carysfort Reef

By Jerry Greenberg


STEPHEN FRINK

Jerry Greenberg put Key Largo, Fla., on the underwater map with his January 1962 National Geographic *cover story, "Key Largo Reef: America's First Undersea Park." To understand the significance of the work the Coral Restoration Foundation is doing today, it helps to know the recent history of these reefs, a subject Greenberg knows well. At age 87, he is actively diving these reefs today.*

I started diving Key Largo in 1949. Back then I was spearfishing with friends from Miami, coming down to the Keys to shoot grouper and snapper to sell to local restaurants. All I knew was Molasses Reef at that time because that's about as far as we could go from Mandalay Marina in our little skiff with its tiny outboard motor. It wasn't long before I became interested in photography, and I saw in a Leica publication an article by Peter Stackpole about his underwater photography. I had the same Leica camera and a 28mm lens, and I paid $150 — which was huge money at the time — for a housing to take it underwater.

Most of my early underwater photography was done at the south end of Key Largo, where I photographed walls of porkfish. I still remember when I shot my iconic photo of Carl Gage swimming through the school of spadefish on June 1, 1960. I spent two and a half months on the *National Geographic* assignments working around Molasses Reef, but something was still visually missing from the piece. I needed a sweeping overview of what a coral reef was.

I remembered Carysfort Reef at the north end of Key Largo, which was too far to run my little boat. The good people at the Ocean Reef Club provided me a place to work, which made the trip to the reef much shorter. From there I rediscovered the beauty of South Carysfort, and what a wonder it was.

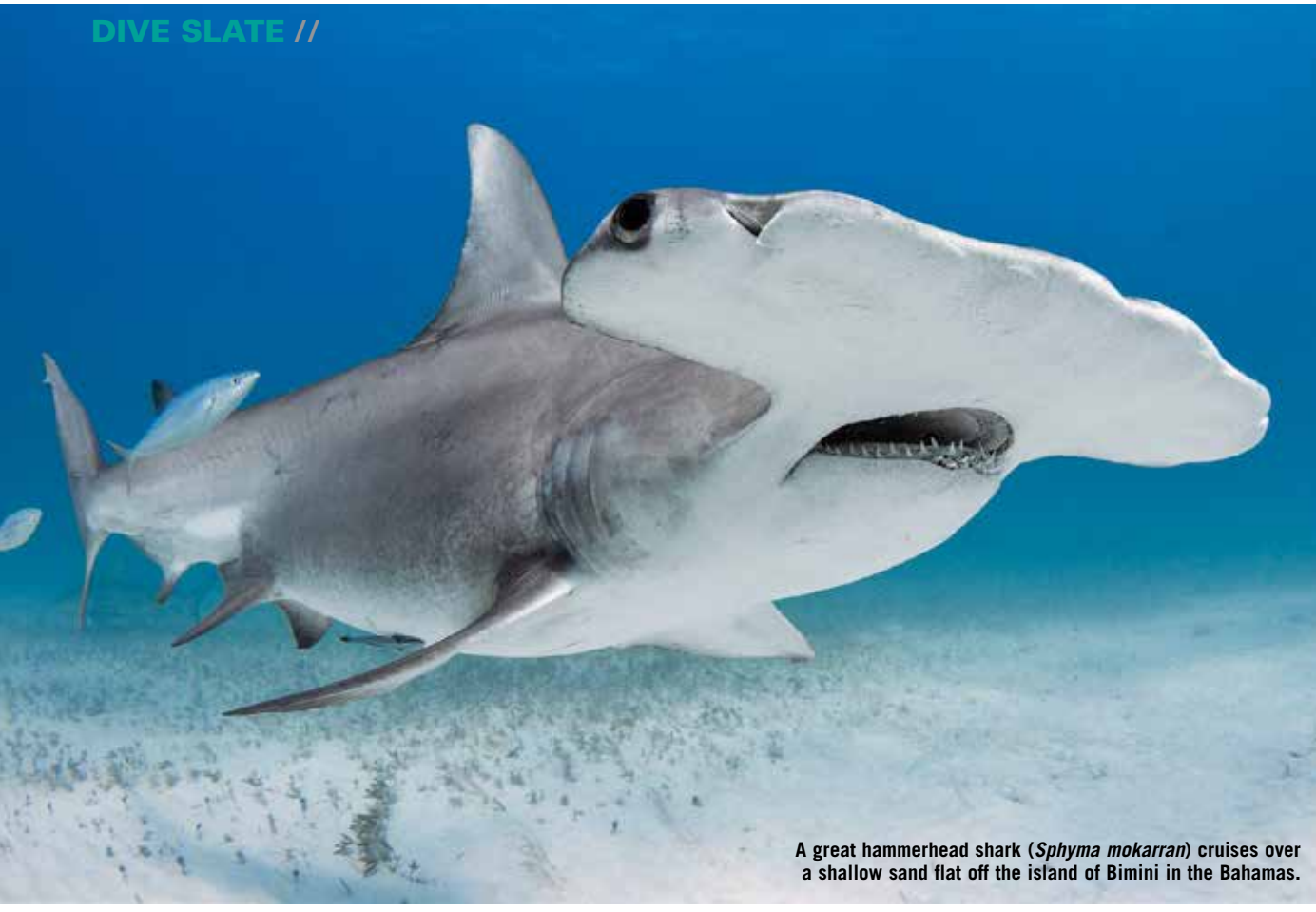
There were vast fields of elkhorn and staghorn coral, big boulder corals and lots of fish. I shot some of my early Anscochrome slides there and also did panorama work with my Rolleimarin cameras with the 2¼-inch by 2¼-inch images I stitched together manually. One of these composites ran across the bottom of two pages in the *National Geographic* article. There was *Acropora palmata* (elkhorn coral) as far as the eye could see, which was quite far indeed that day.

Most of those corals are gone today, victims of storms, water-quality issues and the die-off of the black long-spined sea urchins. But pockets of new coral are coming back, and the work Ken Nedimyer is doing with the CRF to plant coral is astonishing. Will we ever have those vast fields of branching corals again? Probably not in the lifetimes of those reading these words, but progress is being made.

national government agencies and the scientific community. Creating a local nonprofit composed of the stakeholders is the next step, which then leads to planning, permit applications and a host of other logistical details. Echevarria believes this systems approach to restoration will foster optimism and hope in communities and instill stakeholders with a sense of ownership.

The ultimate goal is for CRF to become a clearinghouse for coral science, ecotourism, grant applications for restoration groups and fundraising for nurseries. It is an ambitious project, tailored to individual communities according to stakeholder needs. And it all started with one little polyp landing on Nedimyer's live rock farm about a decade ago.

The events I photographed for CRF changed my outlook forever, and if you have occasion to participate in a coral planting trip, it will change yours, too. Come to the Florida Keys — or very soon, to some other places around the Caribbean — and experience it for yourself. To join the effort, either as a participant or a stakeholder, visit *www.coralrestoration.org*.



A great hammerhead shark (*Sphyma mokarran*) cruises over a shallow sand flat off the island of Bimini in the Bahamas.

Shark: An Icon on the Rise

Text and photos by Austin Gallagher

Over the course of millions of years, sharks have earned their reputations as effective and impressive predators. The first humans to encounter these animals must have been astonished, afraid and fascinated — attitudes that continue to this day. Historically, we have hunted sharks, displayed them as trophies and eaten them; only recently have we learned how vulnerable they are to our presence. Through the growing awareness that sharks actually require our protection, a global conservation movement was born.

Still, perspectives toward sharks remain mixed. While many popular media outlets such as Discovery Channel's sensationalistic Shark Week consistently stoke our fear, convincing us that shark attacks are ever prevalent and always on the rise, sharks are also one of the most popular groups of wild animals on the planet. People love to watch them and will pay serious money to observe them in the water. Some students happily sacrifice several years of their lives, in addition to substantial monetary investment, simply to be able to study them. Play your cards right, and you can even become a shark celebrity, featured on some of the many popular documentaries about these compelling creatures. In 2014, fictional sharks were hurled from within tornadoes — for the second time. If a shark is spotted from a boat, the evening news immediately broadcasts the event. Stock in sharks is higher than it has ever been, but has the newfound ubiquity of the shark in popular culture blurred the truth about the animal's status?

About 25 percent of all shark species are threatened with extinction. The issue, however, is actually much more complex. Many shark species are vulnerable to even low levels of fishing pressure. For example, one species of thresher shark gives birth to only two pups every year, and it takes them nearly 13 years to reach maturity. It is not difficult to imagine why this species would be at particular risk. Similarly, the shark-fin market is responsible for the death of tens of millions of sharks every year. Some species have declined more than 90 percent in recent years and will likely require decades under informed management before they begin to show signs of population recovery.

From a conservation standpoint, however, there is much to celebrate. Modern-day research into sharks truly stands on the shoulders of giants who pioneered the study of these enigmatic species. Countless groups of researchers spend significant time at sea, in conference meeting halls, behind closed doors and on the heated policy frontlines to collect data and craft policies designed to implement protective measures and sustainable strategies for shark management. A great example of their accomplishments can be seen in the recent success of the white shark, which is showing signs of recovery on both the east and west coasts of the United States, according to research published this year.

Today people can track the daily movements of tagged sharks in real time from their smartphones. A variety of corporations — even sunglasses companies — are donating to support shark conservation. Researchers continue to make unbelievable discoveries in places such as the deep sea, where a new species of shark is described every few weeks on average. We still know almost nothing about these species or the status of their populations, and their existence remains overshadowed by the large and sexy "A-list" species.

Great progress has been made in recovering shark populations in many regions and for several species, but don't let the commercials, news stories or movies fool you. The number of sharks along our coasts is not suddenly increasing. Indeed, there have been important regional conservation wins, but the issue is truly global — a point highlighted by the government of Western Australia, which last year used lethal shark-control measures to mitigate a spike in shark attacks that occurred over the past several years. While their concerns may be real, such measures will not remedy the issue.

In stories of negative encounters between sharks and humans, humans tend to be the losers, so it is easy to see why we may perceive an apparent rise in shark encounters as evidence of the animals' increased abundance, but there are no scientific data to prove this correlation. This discrepancy between perception and reality shows that shark conservation is as much a social issue as it is ecological.

While public attitudes and policies related to the status of sharks may change over time, the animal's slow-growing nature and low reproductive output will not. We still eat them, but great strides are being made to curb the demand for shark-related products. Education and awareness are still paramount, and we should continue to stand up for sharks and serve as leaders in our communities. With effective outreach and research combined with efforts to dispel incorrect information, sharks may continue their rise into the stratosphere of popular culture and may one day recover and flourish in oceans around the world once again.

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YOUR DIVE SAFETY ASSOCIATION

MEMBER PROFILE

MARGO PEYTON

HOMETOWN: Provincetown, Mass.
YEARS DIVING: About 25 — I have logged more than 5,000 dives!
FAVORITE DIVING DESTINATION: Anywhere I can teach kids to dive safely
WHY I'M A DAN MEMBER: I respect DAN because of the organization's commitment to education, safe diving and safe dive travel, which also reflects our company's core values.

PHOTOS COURTESY KIDS SEA CAMP

In an age when most people spend much of their leisure time in virtual reality, Margo Peyton has created a way to bring families together for real-time underwater adventures. She began with a simple concept: Families who want to dive together should have a safe yet fun place to experience the marine world. Since 2001 her Kids Sea Camp has awarded more than 5,000 dive certifications, but perhaps Peyton's own measures of her success are even more revealing: More than three-fourths of all Kids Sea Campers are return participants, and the program has a perfect safety record.

AD: You started Kids Sea Camp because you had a hunch that other people would feel like you did: You didn't want to travel without your children, and you wanted them to learn to dive in a kid-centered environment.

Peyton: I wouldn't say it was a hunch; it was more like a dilemma. I was a single mom working in the dive-travel business. I constantly flew to the Caribbean and other dive destinations and had to leave my kids behind, which I didn't want to do. My dad was a fisherman; when I was very little he would put me in tide pools and watch me play. I wanted to watch my own kids learn about the ocean; I wanted to bring them to the Caribbean and teach them to dive in safe, kid-friendly surroundings.

AD: At some point you realized you weren't the only person who wished there was a place for families and kids to dive together.

Peyton: Carolyn Pascal, who has a long history in dive travel and publishing, has been a part of Kids Sea Camp from the beginning. We grew the idea together after we took our kids to Curacao's aquarium, where they experienced the reef from indoor tanks. We wanted them to have a real-life experience. The first Kids Sea Camp was held in Curacao in 2001, and the timing hugely influenced our development.

AD: In what way?

Peyton: After 9/11 families grew closer, and safety became a major issue. People saw that we were moms and that we brought our own kids to places where we felt safe. They realized that Kids Sea Camp programs were safe because we employed kid-friendly operators and instructors. Not many operators can justify the additional liability of teaching kids to dive. We find the ones who are capable and willing to take the extra steps necessary to provide a comfortable learning environment for families. For example, we promote the "DAN Is My Buddy" program, and most of the operators we work with enroll the kids in that program.

AD: Are there programs at Kids Sea Camp for families with different experience levels?

Peyton: Definitely. I think one of the reasons we've been so successful is that we offer a range of activities and educational presentations, including underwater naturalist, photography and video courses as well as wreck diving. Families seem to love learning and improving their diving skills together. We just certified one of our first Supplied Air Snorkeling for Youth (SASY — a program for ages 5-7 from the Professional Association of Diving Instructors, or PADI) students as

Margo and Jennifer Peyton fly the Kids Sea Camp colors during a shore dive off Buddy Dive Resort in Bonaire in 2012.

Opposite, from top: **Margo Peyton enjoys a Fijian celebration during Kids Sea Camp in 2009. Kids dive in the calm waters off Laguna Beach Resort, Utila, during a Kids Sea Camp week in 2014.**

an assistant instructor. Kids often move through training levels with the same group, and they stay in touch with each other throughout the year. It's great to see the kids grow up and their families reunite at different Sea Camps. We also started Family Dive Adventures, where we promote kid-friendly resorts; and my husband, Tom Peyton, and I created Ocean Wishes as a pay-it-forward program for less-fortunate kids.

AD: Most instructor programs focus on teaching adults. What are some of the challenges of teaching kids to dive?

Peyton: I love teaching kids! They are naturals in the water and are never, never boring. They get the concept of neutral buoyancy much more quickly than adults do. They have excellent open and teachable minds. I get the biggest kick out of watching the kids correct their parents, hearing them say stuff such as, "Stop using your hands. No bicycling…."

AD: What else goes into making Kids Sea Camp a great learning experience for families?

Peyton: Educational activities are a huge part of our program. In our seminars we cover the full range of issues from plastics in the ocean to shark finning. A few years ago I introduced photography programs to Kids Sea Camp. The participants love to document their dives, and the kids who are interested in photography show much greater interest in the reef. Also I think our photography programs force kids to work on buoyancy control. After learning about how fragile coral is, no one wants to damage it.

AD: So families bond during dive training as well as educational programs?

Peyton: Absolutely. I feel that families who have participated in Sea Camp share a common thread, which includes love for diving and a sense of wonder and respect for the oceans. I believe that my job, my obligation to the large and impressionable audience I reach each year, is to educate them about the effects humans have on the planet, especially the oceans. We had an experience in the Galapagos a few months ago that really impressed everyone. Way out in those remote islands we cleaned a significant amount of plastic from the beaches. A baby sea lion even presented me with a plastic bread bag! Kids and adults were totally amazed to see plastic fouling those uninhabited islands. Hearing about it on television isn't enough. Showing them in real time how far civilization's impact reaches is one of my goals and my duty.

— Maurine Shimlock

DAN EDUCATION SPOTLIGHT

DAN CALENDAR OF EVENTS

DIVE SHOWS AND EVENTS

Toronto Outdoor Adventure Show
Feb. 20-22: Toronto, Ontario
Many divers also enjoy exploring the great outdoors by hiking, biking, climbing mountains or paddling above the surface. Join fellow outdoor adventure enthusiasts at Canada's ninth annual showcase of gear and adventure travel. Dive into all of your hobbies at once; discover new adventure destinations and the gear you need to get you there.

Our World–Underwater
Feb. 27–March 1: Rosemont, Ill.
Join the DAN team for a day of seminars, safety discussions and workshops at the Midwest's largest dive expo. Make sure to ask about our new and improved travel insurance program, plus don't miss the crowd favorite — the CPR Challenge. Performed at the DAN booth, it's the ideal opportunity to test your CPR skills while you compete for prizes. Bring your DAN membership card and photo ID to receive $5 off daily admission.

Boston Sea Rovers Show
March 6-8: Boston, Mass.
This weekend-long clinic features more than 40 seminars, a film festival, advanced training and specialized workshops from industry experts. At the DAN booth, we will showcase our new dive-accident coverage, travel insurance programs and *Health and Diving* resources. We can also assist you with your membership renewal.

Beneath the Sea
March 27-29: Secaucus, N.Y.
Save the date for your "DAN Dive Safety Day" at Beneath the Sea, America's largest consumer dive and travel show. Prepare for the season with a day of total dive-safety immersion. Leading experts will present a series of interactive and engaging seminars that focus on essential incident prevention and management information to help you dive smarter. Visit the DAN booth to try the CPR Challenge, review our new programs and products, renew your membership or simply say hello. Bring your DAN membership card and photo ID to receive $5 off show admission.

RESEARCH AND MEDICAL EVENTS

Dive Safety Seminars
Dec. 3: Durham, N.C.
The DAN team presents "Does Sex Matter in Diving?" during a special safety seminar evening at DAN headquarters. This session addresses special considerations for female divers and considers whether sex affects diving risk. Topics will include decompression safety, thermal stress, pregnancy, breast cancer, menopause and others.

BOAT SHOWS

Miami International Boat Show
Feb. 12-16: Miami, Fla.
To promote "Safety on Land and at Sea," DAN is extending its safety and insurance programs as well as its products to protect all water enthusiasts. Stop by the DAN booth to check out DAN's new marine safety products for 2015, and find out how DAN can help you wherever your aquatic adventures take you.

FIRST-AID TRAINING AT YOUR FINGERTIPS

DAN first-aid students now have a digital option for obtaining course material. The e-book editions of DAN's first-aid student handbooks are compatible with iOS, Android and Kindle devices and contain all of the materials from the printed editions of the first-aid manuals along with the following additional features to enhance functionality:

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DAN first-aid student e-books are available through DAN Instructors. To begin your incident prevention and management training, find an instructor near you at *DAN.org/Training.*

ONLINE VIDEO SERIES: "DEFINING DIVE SAFETY"

Dive accidents seldom result from a single mistake; instead they typically occur due to a series of events. If the chain of events can be positively disrupted or prevented, the number of accidents can be reduced. Thus it is crucial to recognize the potential problems and the appropriate steps for prevention and intervention.

Using dive-accident and fatality data, DAN identified some common elements that contribute to the majority of mishaps. Divers can enhance their safety by improving these fundamentals.

In "Defining Dive Safety," DAN Medical Information Specialist Marty McCafferty discusses the most common contributing factors in dive accidents and provides critical insight into recognizing and preventing dangerous scenarios. Visit *YouTube.com/DiversAlertNetworkTV* to learn more.

QUICK TIPS FOR TRAVELING WITH DIVE GEAR

Most airlines allow you to pack your regulator, buoyancy control device, masks, fins and snorkels in either carry-on or checked baggage, so many divers opt to bring their gear with them to their travel destinations. But not everything can be packed in your carry-on, and some gear requires special care.

When packing for your next dive tip, consider these tips:

It's good practice to carry on safety and comfort essentials such as your regulator, dive computer, mask and swimsuit in case your baggage is delayed. This way you will never have to miss your first scheduled dives. If possible, you should also carry on any expensive or sensitive equipment such as cameras, housings or strobes.

For safety reasons, dive knives and spearguns must be properly stored in checked baggage. Remember to sheath and secure them to prevent injury to anyone inspecting or handling your baggage.

It may be helpful to include a note in your checked baggage explaining what your dive gear is. Although many security personnel are familiar with dive gear, a note could help facilitate the inspection process for those who are not.

Most divers opt to rent tanks and weights at their dive destination to minimize the weight they carry as well as the additional hassle. Compressed-gas cylinders are permitted in checked baggage only if the regulator valve has been completely disconnected from the cylinder and the cylinder is no longer sealed. The cylinder must be available for visual inspection by security personnel. If you plan to travel with compressed air, contact the manufacturer to identify a qualified technician.

Finally, make sure your gear is covered when you travel with DAN Travel Insurance. Visit *DAN.org/Travel* to learn more.

BARBARA DOERNBACH

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A Touch of Ripley

TEXT AND PHOTOS BY NED AND ANNA DELOACH

Three South Africans, a Frenchman, a Norwegian and a Turk bail out of a boat backward at night. Although it may sound like the beginning of a bad barroom joke, it's actually the beginning of an amazing real-life adventure.

The divers, guests at a resort in Lembeh Strait, Indonesia, decided at the last minute to organize a night dive to search for a legendary sea monster said to live in the depths of Teluk Kembahu Bay. I wasn't about to miss out on the escapade. Once underwater, I fell into formation behind the others, following our Indonesian guide down a sand slope. At 40 feet the guide stopped at the edge of a rubble patch and swept his beam across the bottom. As if on cue, a giant segmented worm — far larger and more fearsome than expected — sprang out of the sand with the speed of a cobra. The team backpedaled in unison.

Every eye locks onto the creature's claim to fame and the source of its common name: a twin set of retractable jaws, snapped wide to the side like switchblades retooled with curved tips and serrated edges — perfect for maximum carnage. Agitated by the flood of lights, the worm disappears back into the sand as suddenly as it had appeared.

After collecting our wits, we begin switching off our lights as instructed in the boat briefing until only the glow of the guide's beam, filtered through his fingers, illuminates the sand. The worm surges up again, this time stretching an arm's length above the bottom before plunging back into the sand like a piston, where it sits with the tip of its head exposed and its angry jaws flared. No one moves. Finally, our guide motions us closer, and we creep forward, one at a time, and stare down at the jaws designed for violent death.

By fate, giant tropical worms such as this one, now known universally as Bobbit worms, came to the public's attention shortly after the 1993 story broke about Lorena Bobbitt taking revenge on her philandering husband in a most memorable way. The name remains

a fixture 20 years later, forever vilifying the worm.

Although they're known worldwide, much about these secretive worms remains a mystery. For starters, even though more than 350 species have been scientifically described in the genus *Eunice*, a great deal of the early work needs revision. Even for the few *Eunice* experts around, it is virtually impossible to identify one from a photograph, and it can even be challenging with the specimen in hand. Genus members, all armed with their notorious mouthparts, range from small animals only inches long to titans such as the one we saw in Lembeh. A few collected specimens measure 10 feet in length, and one Australian colossus is reputed to have reached 20 feet. Perhaps unsurprisingly, the worms' natural history also remains a mystery.

After the other divers lose interest and wander away, I remain kneeling beside the beast, transfixed. I'm particularly intrigued by how the jaws collapse back onto themselves to disappear inside the worm's fleshy head. No less bewitching is the sheen of rainbow iridescence rippling along its back. In the midst of my reverie, the worm offers a rare gift — a reward for my chronic curiosity — releasing a stream of smoky spawn into the night.

I have an even more memorable Bobbit worm encounter on a subsequent trip to Dominica, a lush volcanic island in the eastern Caribbean. During a safety stop at the top of an offshore pinnacle, my dive guide, Imran, points toward a hole in the reef. Glancing down I see the unmistakable form of a large reef-dwelling Bobbit crawling through the shadows.

In one of those "What was I thinking?" moments, I slip my steel wand beneath its body and lift. The worm comes out without the least bit of resistance. Imran retreats, his eyes bulging. Amazed, I keep lifting until the creature dangles in a great U from my stick. Astonishingly, the famous jaws remain retracted. I slip my upturned hands beneath the belly and watch as it crawls over my palms like a pet corn snake. Measured against my height, the body appears to be at least 6 feet long. I drape the worm across the bottom and snap a portrait before inserting the head inside the hole, where it calmly disappears.

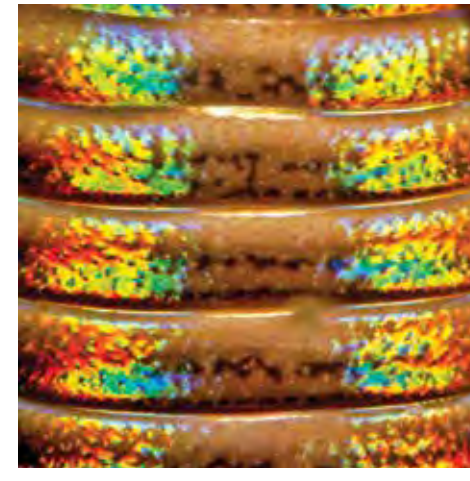
Back aboard the boat, Imran is dancing in disbelief: "That's crazy, man. You're lucky to have a face."

"Yeah," I answer, still attempting to sort through what just happened myself. "I guess I am lucky."

Word travels fast on Dominica, and the next morning at least a half dozen disbelievers meet me at the dock. Although few locals on the island dive, everyone has been raised with horror stories about the monster worms inhabiting their waters. In a weird sort of way, you could think of the *Eunice* worms as island mascots. After retelling my tale for a third time, I retrieve my computer from my room and display the portrait.

"No, mon. Look at dat. It's obvious de worm is some kind of sick," one skeptic claims. The others gathered around the screen nod in agreement.

"What else can I say?" I reply. "You can believe it or not." AD



From top: **This Bobbit worm in Dominica spreads across the sea floor for a portrait; the iridescent skin of a Bobbit worm; a Bobbit worm spawning.**

Opposite: **A Bobbit worm springs from the sand in Lembeh.**

DAN NOTE

To avoid an increased risk of decompression sickness, DAN® recommends that divers avoid strenuous exercise for 24 hours after making a dive. During your annual physical exam or following any changes in your health status, consult your physician to ensure you have medical clearance to dive.

Water: Element of Life and Fitness

TEXT BY KELLI CUPPETT / PHOTOS BY STEPHEN FRINK

Human life begins in liquid, with amniotic fluid protecting and surrounding the prenatal body. The human body is made up of four major components: water, fat, minerals and proteins; water accounts for 60-70 percent of the body's mass. So it seems natural that we are drawn to water for consumption, exercise, recreation and relaxation.

The physical principles of immersion in water also provide benefits to the body. When the body is submerged, hydrostatic pressure can decrease swelling, aid in blood circulation and support and massage the body. The weightlessness you feel in the water also means that the water is reducing the compression of your joints. And, assuming the water temperature is not too cold, your heart rate decreases after submersion, resulting in a relaxed state.

Water also provides a great environment for rigorous exercise. It is 12 times more resistant than air, and exercising in water provides bidirectional resistance that is difficult to obtain on land without specialized equipment.

Scuba divers must work the water efficiently — swimming, streamlining and managing air consumption by moving smoothly. As with any sport, maintaining a healthy body and good physical state are key to maximizing your experience. Water aerobics provides a diverse exercise program, and its bidirectional resistance targets opposing muscle groups throughout the entire body.

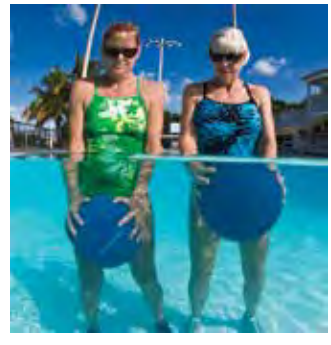
A typical one-hour water aerobics class consists of five minutes of warm-up exercises using short lever movements (i.e., jogging, marching, side-stepping, paddle-wheeling forearms, plunging arms, etc.), followed by five minutes of stretching, five minutes of cardiovascular warm-ups, 25-30 minutes of cardio, 10 minutes of muscular conditioning and five minutes of final stretching. The water's resistance, coupled with the force behind each movement, increases strength and endurance while burning 400-500 kilocalories per hour.

Try the following five shallow-water exercises to condition the core. The water depth should be between the chest and the belly button while your feet are flat on the pool floor. These exercises require the use of an approximately 8-inch playground ball. They can be performed using repetitions (16-32 repetitions each) or time (one minute each) or as interval training (vigorous exercise for 30-60 seconds) between each ball exercise. If you choose to use these exercises in interval training, the duration of each ball exercise portion should be about three times as long as each cardio portion.

Before completing each exercise, follow these steps to align your body:

- Stand on the pool floor with your feet hip distance apart or wider, being careful not to hyperextend your knees. Draw your navel to the spine, and hold the contraction throughout the exercises to keep your core engaged.
- Place your hands on top of the ball, and press the ball down toward the pool floor. Keep the ball close to your hips and the tops of your thighs.
- Stabilize your shoulders by rolling them back and down and retracting the shoulder blades (squeeze the shoulder blades together).

TRICEP PRESS



1. Keeping the elbows tight beside the body, inhale as you bend your elbows to a 90-degree angle, resisting the upward force of the ball. Your palms should be on top of the ball, toward the pool floor.
2. Exhale as you extend your elbows, pressing the ball back toward the hips and tops of the thighs.

OBLIQUE TWIST (Short Lever or Long Lever)

1. Keeping the elbows tight beside the body, bend your elbows to a 90-degree angle, resisting the upward force of the ball. Your palms should be on top of the ball, toward the pool floor.
2. Square your hips forward, and plant your feet on the pool floor. Inhale twist from the belly-button area to the left (around 10 o'clock), exhale and hold. Inhale twist from the belly-button area to the right (around 2 o'clock), exhale and hold.

Tip: To make this a long-lever twist, extend the arms, keeping the ball submerged, and twist.

LATISSIMUS DORSI

1. Straighten your arms, and press the ball to the tops of your thighs.
2. Inhale as you lift your arms straight out in front of you, only high enough that you can keep the ball under water.
3. Exhale as you press down on the ball to return it to the tops of your thighs.

ADDUCTORS SQUEEZE

1. Place the ball between your legs just above the knees.
2. Stand tall, and squeeze the ball with the inner thigh muscles (adductors). This is a quick action.

RECTUS ABDOMINAL CRUNCH

1. With extended arms, allow the ball to come about 6-12 inches in front of your body.
2. Exhale as you draw the base of the rib cage to the top of the hip bones for a crunch. Inhale as you extend to stand, releasing the crunch. Resist the pressure of the ball throughout the movement.

It is important to participate in exercise programs that are diverse and designed to focus on muscle movement, muscular strength, endurance and functional movements. Before beginning any exercise program or changing your physical activity patterns, you should always consult with your physician. AD

THE ST. LAWRENCE RIVER

TEXT BY JENNIFER HAYES
PHOTOS BY DAVID DOUBILET AND JENNIFER HAYES

David and I live in the Thousand Islands region of the St. Lawrence River — not by accident or because I grew up near here but rather by design and desire. The St. Lawrence Seaway, a boulevard for international shipping, is literally our backyard. The low rumble of ships and soul-soothing songs of loons waft through our house and office.

We recently had an incredible opportunity to explore the length of the St. Lawrence, from our dock near Lake Ontario to the distant shores of Newfoundland and Labrador, for a *National Geographic* magazine article published in May 2014. The proposed development of a significant petroleum discovery known as "Old Harry" in the Gulf of St. Lawrence provided the incentive to explore and share what is at risk in the surrounding waters. With the help of our colleagues Michel Gilbert and Danielle Alary, we began planning our expedition.

Our dock is only minutes away from shipwrecks, storybook castles and sturgeon. In late May, when the river temperature touches 50°F, lake sturgeon gather to spawn on nearby gravel beds. A 3- to 5-knot current roars across their spawning areas, aerating their precious carpet of eggs. Diving here with this ancient, threatened species is like swimming against a fire hose. These magnificent fish can live 100 years and are programmed for slow reproduction: Females first spawn at 25 years and males at 14-16 years. Against a backdrop of diminishing habitat and unsustainable harvest for caviar, this is leading to crises in sturgeon populations worldwide.

The river widens into one of the world's deepest, richest estuaries as it approaches the Laurentian Trench at Tadoussac, Quebec. The upwelling of 38°F, nutrient-filled water supports the 13 species of whale that inhabit the St. Lawrence system, many of them found within

A few-days-old harp seal pup, called a white coat, uses a piece of ice to block the relentless winds that sweep across the sea ice in the Gulf of St Lawrence.

From top: **Boldt Castle, shown here in the fall, sits in the heart of the Thousands Islands, St. Lawrence River. A lion's mane jellyfish moves gently through the rich shallows of Bonne Bay Fjord in Newfoundland. Jennifer Hayes swims with a decades-old female lake sturgeon on her way to the spawning grounds.**

the Saguenay–St. Lawrence Marine Park boundaries. We worked with Groupe de recherche et d'éducation sur les mammifères marins [Group for Research and Education on Marine Mammals] (GREMM) scientists to make images of beluga whales. The St. Lawrence belugas are a beloved and well-studied population in the midst of a desperate downturn due to an inexplicable increase in infant mortality. One spunky beluga approached us out of the green gloom. He puckered his blubbery lips and blew a bubble, cautiously advanced and ever so slowly opened his pink mouth wide and then wider, trying to taste test the Seacam housing.

Famed Quebec divers Paul Boissinot and Georges Mamelonet met us in Percé, Quebec, to guide us to Bonaventure Island in the gulf near Percé. Bonaventure supports one of the largest northern gannet colonies in the world, and great herds of gray seals rest here during their migrations. We were photographing 12-pound

HOW TO DIVE IT

THOUSAND ISLANDS REGION

GETTING THERE: The Thousand Islands region is 90 miles north of the Syracuse, N.Y., airport and a six-hour drive from Boston or New York.

CONDITIONS: Summer weather means warm days (mid-80s°F) and cooler nights. Water temperatures brush 70°F in the freshwater corridor, and most divers use drysuits or 7mm wetsuits. Current can be significant, requiring intermediate to advanced diving skills. Late summer and early fall offer the best visibility.

ON THE SURFACE: Topside diversions include castles, wooden speedboat rides and helicopter or fixed-wing aircraft charters. Or drop by our house for a coffee; we are a great diversion.

ST. LAWRENCE ESTUARY

GETTING THERE: Les Escoumins, an international favorite near the Saguenay–St. Lawrence Marine Park, is a four-and-a-half-hour drive east from Quebec City. They make diving easy. For advanced wreck and technical divers, the *Empress of Ireland* can be reached by ferry to the south shore at Rimouski.

CONDITIONS: Summer weather means warm days, cool nights and cold water. Drysuit experience is required. This is rewarding diving but seriously cold water.

ON THE SURFACE: Whale watching is a must. Hiking and fixed-wing air charters are available.

GASPÉ PENINSULA, GULF OF ST. LAWRENCE

GETTING THERE: Fly into the Michel-Pouliot Gaspé Airport, or make the nine-hour drive east from Quebec City.

CONDITIONS: Moderate currents require intermediate to advanced diving skills. Cool temperatures prevail here. Water temperatures are typically in the 60s°F, so divers generally wear drysuits.

ON THE SURFACE: The gannet colony on Bonaventure Island is an absolute must do. Quebec cuisine is a close second.

ISLES-DE-LA-MADELEINE, GULF OF ST. LAWRENCE

GETTING THERE: Fly into Îles-de-la-Madeleine airport.

CONDITIONS: In the winter the island is covered in ice, which means survival suits topside and waterproof suits for diving.

lobster brutes patrolling the bottom when I was surprised by a squeeze on my behind. I thought the pinch was David's signal to surface, but I turned around to find a gray seal that then playfully pulled at my fins and tried to swallow my dome. These beautiful seals have senses of humor and behave like puppies. Sadly they are the subjects of a controversial cull that's been proposed to remove 70 percent of their number from the gulf in an attempt to resuscitate cod stocks.

We crossed the gulf to the west coast of Newfoundland to meet up with Rick Stanley and Robert Hooper, Ph.D., to explore the deep, cold and clear fjords of Bonne Bay. The plummeting rock walls of the fjord are covered in startlingly dense carpets of stalked anemones. The gentler slopes are home to Atlantic wolffish, which peered out at us from their dens. Their grumpy, gray and somewhat comical expressions reminded David of some of his relatives from Montreal. We surfaced from every dive into a living painting of sunlit coves filled with golden algae and flounders that wafted like leaves. Lion's mane jellyfish of every shape, size and color pulsed past a striking Canadian canvas of evergreens and ancient rock, a perfect stage for David's signature half-and-half imagery.

Winter transforms the gulf into a surreal world of relentless wind and shifting sea ice. It is the kingdom of the harp seal. For us this is the heart of the St. Lawrence, and we have become hypnotized by its raw beauty. Harp seals are born on the ice in late February, nursed for 12-15 days and then abandoned by their mothers to learn how to be harp seals. We met diver Mario Cyr in Îles-de-la-Madeleine and took a fishing boat and pushed into the thinning sea ice, which supported 10,000 harp seals. We descended into the seals' icy world, where frantic, paranoid mothers come and go from the ice shelf, and the wary pups learn to swim. Testosterone-fueled males swirl beneath the ice pack eagerly awaiting an opportunity to mate. There is a tense pulse of life in this cold and challenging world. We spent days in the ice, the pups' cries echoing through the steel hull, sounding like those of human babies. The diving was exhilarating and exhausting. We experienced life-changing encounters that will stay with us.

As we left the seals we were met with a storm that pummeled the weak sea ice, turning it into a blender and killing most of the pups in the gulf for the second year in a row. Warming in the gulf has led to poor and unstable ice that disintegrates beneath the pups.

This dynamic and evolving winter world of the Gulf of St. Lawrence is a current that runs through our lives. We migrate back each year when the frozen sea silence is broken only by the wind and the cries of the harp seal. AD

RED SEA AGGRESSOR, EGYPT

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THE CURIOUS LIFE BENEATH PIERS AND DOCKS

TEXT AND PHOTOS BY ETHAN DANIELS

Photogenic coral reefs and majestic kelp forests deservedly garner much of the dive industry's interest: They are beautiful, and they significantly contribute to marine diversity. Unfortunately, linked habitats such as sand and rubble slopes, seagrass beds, mangroves, rusting shipwrecks, piers and docks are habitually overlooked because they are perceived to lack traditional aesthetic value. As a result, many people do not fully appreciate these habitats' ecological importance.

Piers and docks in particular act as artificial reefs, harboring an abundance of shallow-water fish. While not intentionally designed to attract marine life, these partially underwater structures often serve as oases for both common and extraordinary organisms in locations that may otherwise amount to aquatic deserts. Even though the diversity of life under piers may seem to be relatively sparse when compared with healthy Pacific coral reefs, the sheer variety of animals, plants and microorganisms drawn to these man-made formations can be vast and the associated food web exceedingly complex.

Throughout the islands of the western Pacific, thousands of piers and docks have been built in a variety of marine environments. Those put in place along deep channels are swept by nutrient-rich waters, which deposit prolific filter-feeding marine growth on their vertical structures. Coralline algae, sponges, hydroids, tunicates and brilliant *Dendronephthya* soft corals develop in ever-changing menageries and bouquets that proffer limitless micro-habitats for additional invertebrates and small, planktivorous fishes.

Other piers and docks are built in protected, current-free bays where large mazes of forested islands, limestone islets, thick mangroves and narrow channels serve as nurseries, reproductive sites and feeding grounds for thousands of marine species. Although the region may include plenty of thriving underwater habitats — such as fringing reefs, flooded forests, marine lakes and submerged seagrass meadows — piers and docks offer unique characteristics such as dark recesses sheltered from direct sunlight and stationary vertical substrates that act as steadfast territories for both sessile invertebrates and hungry fish.

Drifting down among the dim pilings under just about any Pacific pier that has been in the sea for more than a few weeks, divers will quickly see that marine life can reach robust levels here. Sunlight sparkles along the edges of the terrestrial platforms above and peeks through wooden slats, creating striking light beams that waver across the sand and rubble bottom. Despite the diversity of the western Pacific region in terms of colorful, diurnal reef species, most pier-dwellers prefer muted, gloomy confines where camouflage is vital to survival. Deep shadows cast by pilings, dock floats and wooden pier floors provide hiding spots for intricately veiled critters of all shapes, sizes and behaviors.

On the bottom, ignoring bubble-blowing divers, there often live at least a few well-fed scorpionfish, spiny devilfish or stonefish whose grumpy-looking countenances blend into the mounds of living rock and debris. These classic ambush assassins have delineated invisible territories, much like trolls hiding under bridges in sinister fairy tales. Venomous, lie-in-wait predators barely have to move to feed on large numbers of unsuspecting cardinalfish, damsels, blennies or gobies that hover on or just above the nutrient-filled silt. Underneath some docks it is possible to find the same stonefish in the exact same spot for weeks at a time. Why move a muscle if food swims right in front of your mouth?

Not far away from the ambush predators, pairs of banded pipefish may poke their slender snouts out from rocky crevices to feast on zooplankton, while a juvenile crocodilefish, perfectly mimicking a drowned

Clockwise from the top: **Mimicking a decomposing mangrove leaf, a juvenile cuttlefish hovers just above the bottom. Every pier or dock is different according to its location, size, depth, etc. Slipping through tall pilings, a school of young longfin spadefish seeks protection from predators under a pier. Reef stonefish are true masters of disguise, and they seem to habitually make their homes in the shadows of docks or piers.**

piece of bark, might crawl stealthily across bottom debris. Piers throughout the western Pacific are also magnets for juvenile cuttlefish that regularly drift through the scenery, alternately feeding and hiding. You may see a cuttlefish imitate a mangrove leaf, an algae-covered rock or any number of underwater objects, using its nervous system to control its millions of specialized cells to manipulate its color and texture as it searches for crustaceans or fish.

Divers on their first exploration of these man-made structures may not immediately recognize the annual cycles of succession that continually change the makeup of these mini-ecosystems. However, diving a dock many times can reveal a proliferation of some previously unnoted species due to environmental disturbance, lunar periodicity or an influx of new larvae. While the species living under the structure change over time due to immigration, competition and local extinction, the overall number of species generally stays the same if the area is left undisturbed. These dynamic ecosystems recall the theory of equilibrium in island biogeography.

By tearing away their gazes momentarily from the life on the critter-laden bottom and looking upward, divers can discover an entirely different view. The complex embroidery of attached organisms on the vertical pilings or clinging to the bottom of floats often include a menagerie of barnacles, colorful but toxic sponges, tube-dwelling polychaetes, coralline algae, hydroids and delicate tunicates, in addition to a host of vertebrates.

A silver river of hundreds of scad or other baitfish may slip sinuously among the forest of pier pilings. Visual predators such as the bluefin or giant trevally, which usually circle piers from a distance, watching

Caught in the open, schooling scad are easy targets for marauding trevally and small sharks. These silvery prey-fish often seek refuge under docks or piers, which attracts larger predators.

and waiting, might be momentarily confused with so many identical fish packed into a living, moving wall. Late in the afternoon the predators become more active, and their anxious prey pack even closer together. In contrast to the quickly moving prey fish, motionless adolescent longfin spadefish frequently hover above the wide-eyed scad, watching the parade and perhaps wondering what all the hurry is about.

Each locale offers slightly different environmental factors — varying depths, light intensities, currents, plankton availability, nutrient levels, water chemistry, etc. — that affect which marine life colonizes a structure. When new pilings are put in place, they act as open territory, fit for colonization by hundreds of sessile organisms. In a matter of days, marine life begins to claim territory upon the thick wood or metal supports. Barnacles, hydroids, bryozoans, crinoids, mussels and innumerable barely visible creatures settle onto the pilings, where certain cues signal for them to metamorphose into thriving, mature communities. The quick succession of life shows how prolific larvae are in the overall tropical marine environment. Evolutionarily, it pays obvious dividends for a species' planktonic larvae to be able to settle and metamorphose immediately upon sensing the right environmental factors.

In some areas where coral reefs are not profuse, docks and piers can potentially increase fishery resources, either by drawing in dispersed populations of fish or by creating a more suitable habitat for the escalation of fish populations. Many organisms that typically live in cavern environments are also found in the dark cavities of piers and docks.

Considerable variation may be expected in different portions of one set of docking facilities and certainly between docks placed in ecologically different situations. No two docks are ever alike in terms of their aggregated marine life. Most illuminated spaces will tend to be monopolized by photosynthetic organisms, and partly or completely shaded areas are apt to have assemblages of more unusual animals. Many of the organisms living under floats or on pilings are those normally found at deeper parts of the intertidal or subtidal zones. On a pier or dock, they can live close to the surface without danger of exposure to intense sunlight.

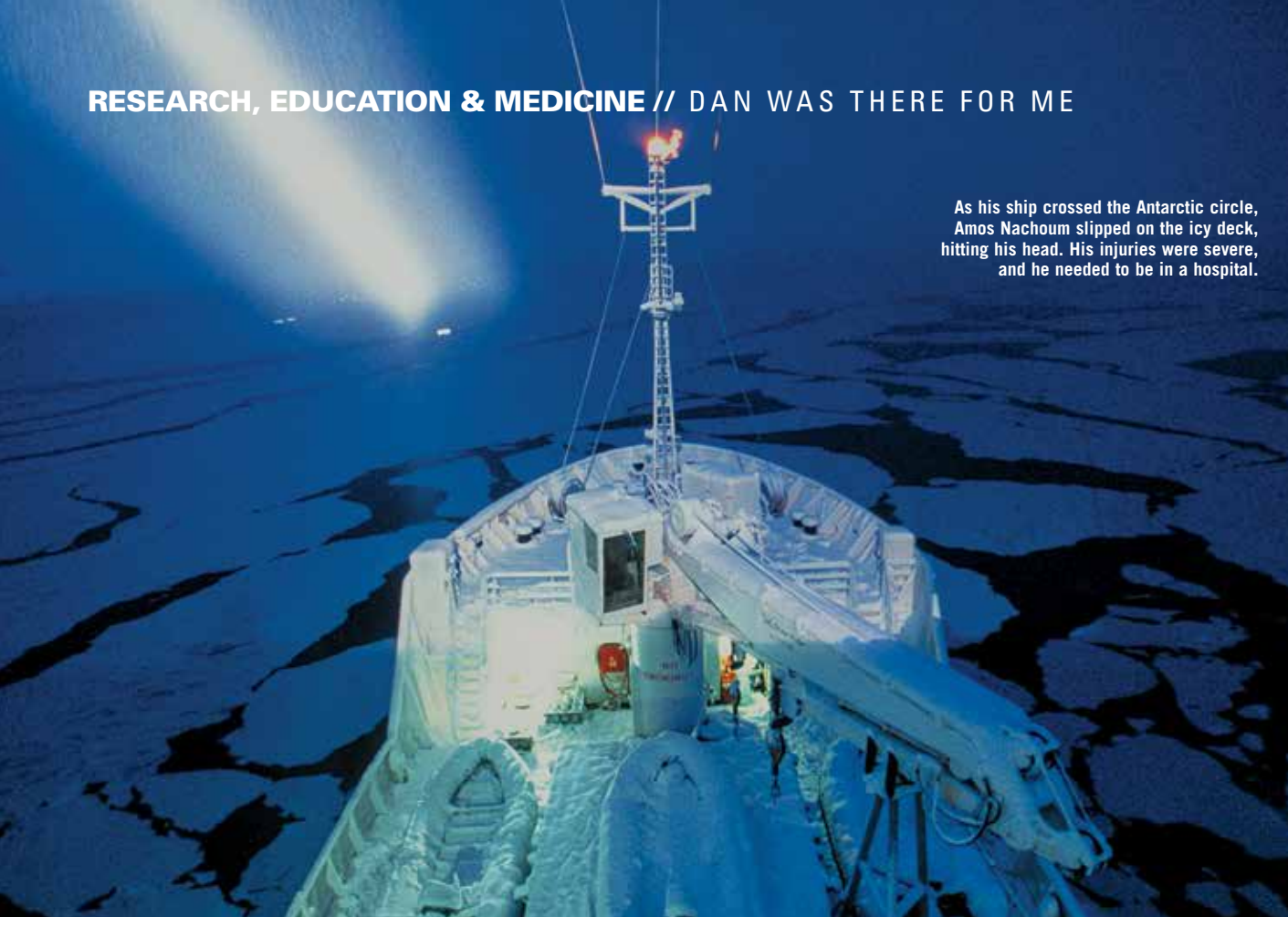
Just about any structure under which divers (and their gear) can slither will present strange, bottom-dwelling critters *and* unique environmental scenery vastly different from that of coral reefs. While the Pacific offers any number of exhilarating dives over bottomless drop-offs, along deep pinnacles and through swift channels where large fishes roam, piers and docks are consistently rich in bizarre, photogenic inhabitants. For photographers these man-made marine habitats are almost always productive for both macro and wide-angle photography. Pier pilings, dock moorings and surrounding habitats are loaded with the odd creatures for which divers have a special affinity — from tiny harlequin shrimp to lumpy frogfish to leaflike waspfish. While many divers focus on a pier's smaller critters, larger predators such as resident giant moray eels or tassled wobbegongs, who appreciate the culinary abundance at these locations, will also frequently patrol the waters around these man-made structures.

Each marine ecosystem, each underwater habitat, each niche with its associated wealth of generalist or specialist inhabitants is part of the all-encompassing biosphere. No trophic level or species exists in isolation. Even piers and docks, which bear various collections of odd and intriguing creatures and their own distinctive food webs, are intricately tied to the open ocean. These structures of wood, concrete, nails, ropes and tires are merely part of a dynamic puzzle whose pieces extend from DNA molecules to entire ecosystems and whose effects radiate through the world's oceans. AD

RESEARCH, EDUCATION & MEDICINE

JEFFREY DE GUZMAN

An emperor shrimp hitches a ride on a nudibranch at 165 feet in Secret Bay, Anilao, Philippines.



As his ship crossed the Antarctic circle, Amos Nachoum slipped on the icy deck, hitting his head. His injuries were severe, and he needed to be in a hospital.

DAN to the Rescue: Out of Antarctica

TEXT AND PHOTOS BY AMOS NACHOUM

There we were, hanging over the bow of the boat, some five levels above the sea. You could not miss us there, all 50 guests wearing their rescue-red overcoats and overlooking the Antarctica mainland as we crossed the milestone of the polar circle. The sea was slick and calm, the sky overcast, and there were many icebergs around.

I was standing there with my tripod, my case full of Canon digital-camera bodies and an assortment of lenses, expecting something to happen. The light and view shifted as the vessel started turning around, so I prepared my gear: I propped my tripod on my shoulder, and with my Pelican case in my dominant right hand I reached for the staircase with my left.

Unfortunately, the rail was covered in ice. It was no surprise considering where we were, but as soon as I grabbed onto it with my left hand I realized how precarious it was. Without a good grip, I shifted the equipment in my hand, lifted my leg to step down and immediately realized I was in trouble. To save myself I let go of the camera case with all of my precious gear, but even that was not enough to prevent my fall. Soon I was rolling down the stairway on a moving ship in Antarctica.

My instincts kicked in. I tucked my head to my chest, one hand over my face and the other over my head, subconsciously hoping to minimize injury. I was falling uncontrollably down over the metal steps. The first time I hit the ladder it was painful; after the second time I did not recall anything more. I was out. Unconscious.

When I woke up I was lying on the iron-cold passageway with a familiar face by my side. It was Goran, the co-leader of the expedition. He was smiling, but his blue eyes were saying something else — he was obviously concerned. He was talking to me, but I could not hear or understand him. I tried to stand up, but it was only when Goran put his hand on me to hold me back that I felt the warmth spreading down my face against that cold passageway. My head was bleeding, and from the growing pool of blood I realized how badly I was hurt.

A few minutes later the ship's doctor arrived with a stretcher and moved me to the ship's clinic. After the

painful cleanup of the two deep cuts in my head, the doctor began stitching me up, and I gratefully fell asleep.

I felt better the next morning after a good night's sleep and was hoping to get out of bed. I was eager to plan my next few days on board before I could get back to diving, but I soon learned that the vessel had changed direction and was moving full speed north in preparation for my evacuation. I resisted at first, asking to keep the program going for the rest of the 50 guests, but the potential damage from my injuries was too great. I had a probable concussion, and I'd lost more than a pint of blood from my head wounds, so I had to be evacuated to a hospital in Chile as soon as possible.

"Do you have DAN insurance?" was the first question I was asked when I was well enough to talk. When I pulled that familiar red and white membership card from my briefcase I felt as though I'd produced the "Get Out of Jail Free" card from the Monopoly board game.

Getting out of Antarctica quickly was very tricky. For the next two days the boat steamed full speed ahead, north from the polar circle to King George Island, where the Chilean base has the only airstrip on the Antarctic Peninsula that can regularly and reliably serve South America. Flying in and out of Antarctica is considered "touch and go." A plane can take off from Puntarenas in Chile or from the base only if the weather at the final destination is clear for visual landing, as there is no instrument or light landing on Antarctica. At the midpoint of the flight, the pilot performs a second weather check to confirm if conditions are clear for landing. If the weather has deteriorated, the pilot will turn back, which happens about 80 percent of the time, because weather in Antarctica changes every few hours.

By early morning I learned that DAN had mobilized a plane to fetch me, providing the weather remained clear over King George Island. As the plane reached the point of no return, I was ready to leave. I said goodbye to all of my expedition guests as I was lowered off the vessel, 52 hours after the accident occurred. One of my guests, Mark Fernandez, kindly volunteered to escort me to King George Island and stayed by my side.

As soon as I touched land and the Zodiac inflatable boat returned to the ship, they lifted anchor to continue their diving adventure. My adventure at the moment was more about survival.

The two officers at the nondescript wooden hut at the Chilean base spoke only Spanish. The place was semiheated, with worn furniture and a few small black-and-white prints — one of the polar explorer Sir Ernest Shackleton and the other of the Chilean vessel that arrived in 1916 for the rescue of Shackleton's team from Elephant Island. The photos reminded me of the remoteness of my location and the direness of my circumstances.

Stepping outside the hut, I saw the weather change yet again. I could hear the airplane above the dense clouds, but I could not see it. It then occurred to me that the pilot could not see the runway any better than I could see the airplane. Yet, with no other options available, the pilot plunged through the cloud bank and landed safely.

Once again I was asked to show my DAN insurance card, and I was admitted to the plane. The pilot came to the door with a long face and said something in Spanish. I couldn't understand his words, but the meaning was clear: There was a problem. Visibility over the runway had reduced to less than one mile.

Expecting to be stuck on the ground for another day, I was astonished when the clouds broke with enough time for the pilot to get us all aboard and lift off. It happened in the nick of time; the clouds over King George shut down the airport only 30 minutes later.

After takeoff the flight was uneventful. I ended up in a hospital in Puntarenas, Chile, under excellent care and constant supervision.

During the next few days the charter service that operated my evacuation checked in with me. They said that the cost for my evacuation was $30,000 — and this was in 2004 dollars. It might cost twice that much today. Once more I was reminded of the value of my DAN membership and insurance, not only for the education and peripheral benefits provided but also for the very real insurance benefits and evacuation assistance when I was in need.

There is a reason I ask my guests on our *BigAnimals.com* expeditions to have DAN insurance. In the remote areas of the world to which we travel to experience the photo opportunities we enjoy, we need someone watching our backs, and that is what DAN does. AD

Seeing the Reef in a New Light

Fluorescence night diving

BY LYNN MINER

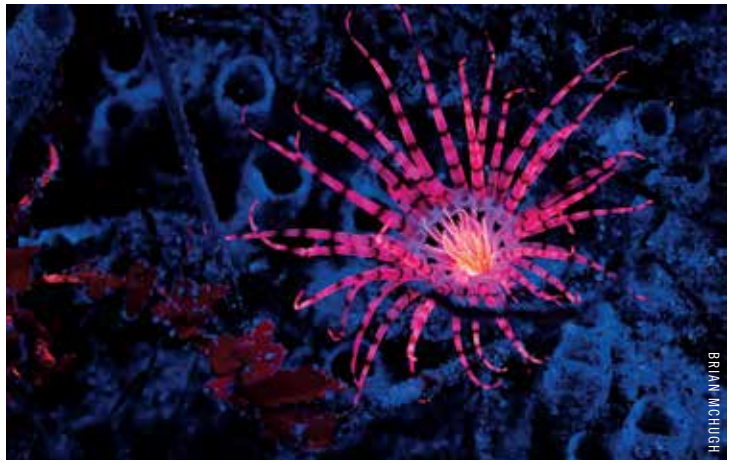
Divers, who are inquisitive by nature, are always looking for new ways to experience the wonders of the underwater world. One increasingly popular diving technique, called fluorescence (fluo) night diving, gives divers the ability to observe marine creatures in brilliant, glowing colors invisible to the naked eye.

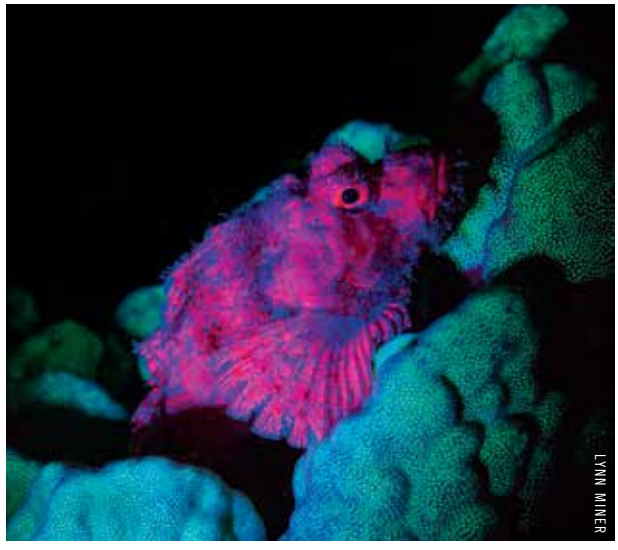
Fluo diving relies on the property of some marine life to emit longer wavelengths of visible light when illuminated with shorter-wavelength blue light. The term "emission" is very important to understanding the physics of fluorescence. The emission of light differs from the reflection of light that happens when, for example, you take your white light torch on a night dive. In traditional night diving, white light is reflected off of the reef or organism and bounced back to your eyes. Emission light, however, is light that the organism creates and emits back to you. The process is similar to bioluminescence in that the organism creates its own light; however, in bioluminescence the light, which is generated by chemical reaction, requires no excitation light.

To view biofluorescence, fluo divers equip themselves with blue-light torches and barrier filters for their masks (and cameras, if they are doing photography). The barrier filter's function is to block the blue light that is reflected back to the observer from the organisms on which the light is shining. All that would be visible without the barrier filter is a very bright blue light, but the filter is designed to cut off all or most of the wavelengths in the blue part of the spectrum. The intensity of the emission light from the organism is very dim — so dim, in fact, that it is completely overwhelmed by the blue light; but if you block the blue, all you will see are the emission colors.

Different species of marine life display fluorescence differently. This moray eel is revealed predominantly in green emission colors.

STEVE LOCK





Clockwise from upper left: **An anemone emits fluorescent light, unlike the surrounding sponges and corals. Without fluo dive gear it would be impossible to observe the colors of this blenny. It is not well understood why scorpionfish and others have evolved to fluoresce. To learn more or to purchase fluo dive gear, visit *FireDiveGear.com*.**

The wavelength of light used in most fluo torches is a narrow band of blue, somewhere between 440-480 nanometers (depending on the manufacturer). Fluo diving differs from ultraviolet (black-light) diving because UV light is in the sub-400nm range. Some companies produce UV torches for underwater use because invisible UV excitation light has the advantage of requiring no additional filters, but researchers have also discovered that blue light is more efficient in stimulating green fluorescent protein (GFP) and its mutations, which emit colors other than green.

Blue light is so effective because (as we all know from our beginner open-water course) it is the only light available at depths beyond about 30 feet, which means that this is the light in which organisms such as coral have evolved over the eons. Most UV light from the sun bounces off the surface of the water, and the light that penetrates makes it only a few inches, rendering UV light an inefficient light source for fluo diving.

Not all marine organisms exhibit the fluo effect, but for those that do the visual demonstration can be dramatic. Some examples of fluorescing species include anemones, a variety of shelled animals, some types of fish, coral polyps and both soft and hard coral structures. The terms "hard" and "soft" coral can be a bit misleading. For example, brain coral is often mistaken as hard coral, but it is considered to be in the long polyp stony (LPS) family of soft coral. The small polyp stony (SPS) family of coral is similarly misrecognized as hard coral even though it is actually soft. These misidentifications are due to the fact that, in both cases, the living coral is made up of tiny soft creatures that live and die building up large stony structures over the course of decades. Interestingly, these two species are the coral subjects that emit the most fluo effects. Examples of soft coral that rarely fluoresce are generally in the Alcyonacea order; it is important to note, however, that in all groups there are exceptions to the rule — just like with people.

The basic point is that there is great variance in the types of coral that fluoresce, and we have not yet determined all of the rules of this phenomenon. This is one of the allures of fluo diving: You can make your own discoveries as a citizen scientist.

Many people think that fluo diving is done only for views of the spectacular colors or for the purposes of underwater photography. It certainly meets those expectations and can indeed be a life-changing experience, but it is also much more than that. Fluo diving has become an indispensable tool for coral-health research efforts and coral-propagation census analysis. If you come upon a polyp or drifting coral larvae with white light, you will see little or nothing; with the


LYNN MINER

proper fluo diving gear, however, the individual, almost-microscopic organisms will shine in the sand like sparkles in the snow on a moonlit night. Not only is this amazing to witness, but it also provides scientifically valuable data.

Coral reefs are considered the rainforests of the ocean. In normal waters, corals develop a symbiosis with single-celled algae called zooxanthellae, which use photosynthesis to provide food and energy to the coral. When water temperatures rise, the zooxanthellae are ejected, removing the vital nutrients the coral needs to survive and causing "bleaching" of the coral. The coral bleaching that accompanies rising temperatures makes the coral vulnerable to additional stresses that can ultimately destroy the entire reef. Apart from coral bleaching, ocean acidification reacts with the coral's calcium-carbonate skeleton, causing it to break down and dissolve. These effects can be witnessed under white-light conditions, but they are even more dramatic when using fluorescent technologies.

Increasing numbers of marine institutes and universities are using fluo equipment to assess the effects of rising ocean temperatures and acidification on coral in addition to other more general coral studies. Fluo diving has even led to discoveries of previously unknown species that were too small to see with white light but shine like beacons in the dark when illuminated with blue light.

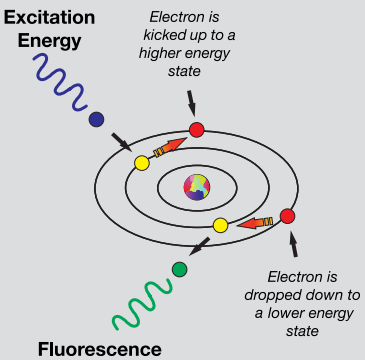
It is not well understood why some corals and other sea creatures evolved to fluoresce, but what is known is that some marine organisms — including corals, tunicates, barnacles, sponges, anemones, jellyfish, clams, nudibranchs, cephalopods, shrimp, crabs, worms and fish — produce GFP and mutations of GFP that react when illuminated with a blue light. The vast variety of species that demonstrate this effect suggests that fluorescence is not simply an accidental byproduct of some other evolutionary function but likely serves some currently unknown purpose.

Theories abound as to why these species evolved to fluoresce. One thought is that fluorescence serves as a form of sunblock that can protect corals and other species in shallow water from UV energy; other theories posit fluorescence as a means of intraspecies communication. The evolutionary biology of fluorescence constitutes a thriving area of study in many marine institutes and universities.

Still, fluo diving is not only for scientists. If you would like to try fluo diving, the Professional Association of Diving Instructors (PADI) has a Fluorescence Night Diver distinctive specialty course that I wrote, which several dozen certified instructors around the world teach. The course covers the science of fluo diving in much greater detail and specifically emphasizes the safety implications unique to fluo diving.

If you decide to fluo dive, remember that almost no light remains when you put on your blue barrier filter; the emission light you see is dim and cannot light up the entire reef, and the filter eliminates your only other light source. Therefore, you must exercise excellent buoyancy control and remain constantly aware of your surroundings. If a coral head doesn't fluoresce, you can crash into it, so you should always approach and depart a site using your backup white-light torch and have it handy when you enter an area with little fluo activity. Alternatively, you can always remove your mask filter and see fine — in blue. AD

THE PHYSICS OF FLUORESCENCE



The schematic representation of the fluorescence effect demonstrates the mechanism when blue light strikes the protein GFP, which absorbs the blue light's energy. The absorption of the light's energy causes the electrons of the protein's constituent atoms to make a quantum jump from one valence electron shell to a higher shell. The change of energy state then instantly "decays" back to its quiescent resting state. When the decay occurs, the electron gives up, or emits, a photon of light, but at a lower energy and longer wavelength.

In summary, when you illuminate the protein with blue light, it emits back in other colors of the spectrum, including green, yellow, orange and red. The color emitted is determined by how many jumps the electron makes.

A Culture of Dive Safety

BY PETAR DENOBLE


RICK MELVIN

Establishing a culture of dive safety is central to the mission of Divers Alert Network. Such a culture requires collective effort, and DAN intends to promote a discussion with the recreational diving community at large to advance safety and improve the diving experience.

The mantra of individual responsibility seems to ignore the very real social context of diving, a sport that is rarely practiced alone. In addition to one's fellow divers, a dive incident may involve training agencies, dive operators, dive resorts, travel agencies, dive shops, medical and scientific organizations, equipment manufacturers and/or the media. Most incidents are attributed to human error, and calls to raise individual awareness are the remedies most often suggested by those concerned with safety.

While individual errors are a perennial issue in dive safety, it is also important to consider the role of social context in diving accidents and to promote appropriate social interventions, which may be more effective than interventions focusing exclusively on individual divers. To promote dive safety, we need to review the current safety culture (or lack thereof) in recreational diving as well as the role of individual divers and other constituents of the diving community.

We ask you to participate in this effort and provide your view of what constitutes a culture of dive safety. DAN will take this conversation to dive shows, meetings and social media, but we intend to initiate the dialogue in this column. To do so we invited three distinguished, independent dive leaders to provide their insights.

What does "recreational diving culture" mean to you?

Jill Heinerth: Sport diving is a community made up of many different subcultures. These small groups of divers are knitted together by their shops, clubs, charter operators or perhaps agency affiliations. Some of these tribes are known for their technical expertise, their great trips or safe operations. Others are tagged for aggression, cockiness or exclusivity. If you've been diving long enough, you'll find that people drift in and out, switch sides and change their behaviors. Sometimes change is brought on by the wisdom of experience, sometimes through the example of great leadership and other times influenced by the shocking impact of witnessing an incident or tragedy.

John Lippmann: The diving culture can create unlikely friendships between individuals who lead totally different lives and would otherwise have little opportunity or interest in interacting. Such friendships can become strong through the trust and varying levels of reliance that can develop between dive buddies. However, as with many of such groups, cliques can develop. These are sometimes necessary for group focus, but they can also be divisive.

Alessandro Marroni: I strongly believe recreational diving culture means awareness, education, common sense and respect for the underwater realm as well as for the fellow divers. Unfortunately, achieving these ends requires characteristics that are ingrained in divers through their cultures and experiences on the one hand and on the other hand acquired through study, attention, and the learned ability to evaluate and prevent risk. The first thing to be aware of is that diving takes place in the water, in which we humans would not survive unless we adopted special measures and acted not only with passion and curiosity but also with competence and prudence.

What are characteristics of a safety-aware diver?

Marroni: Safe divers have the same passion to understand the safety limitations of diving as they do for underwater photography, fish-watching or the simple

enjoyment of exploration. They also remain aware of other divers, including their needs and the possible risks they represent. Much too often poorly arranged buddy teams or diving groups can lead to catastrophic events that could easily have been prevented by more careful selection and predive checks.

Lippmann: A "safety-aware" (or more appropriately termed "safety-prepared") diver would generally possess a variety of traits. These include a strong sense of self-preservation and self-responsibility, keenness to learn about pertinent risks and an awareness of his or her own physical, mental and medical health. Such divers seek relevant information about the site and potential associated hazards and are also prepared to abort a dive if necessary without being swayed by peer group pressure to take unacceptable risks.

Heinerth: In my opinion, a safety-aware diver is one who is fully engaged in his or her participation in diving. A safety-aware diver is one who looks at a given dive and asks: "Am I fully capable of self-rescue in this scenario, and am I fully capable and willing to execute a buddy rescue if needed?" A safe diver would enter the water only if each answer was an unequivocal "yes."

What is the role of training agencies in shaping and disseminating a culture of safety?

Lippmann: Under their certification umbrella, they have the greatest influence on dive professionals. It is important that the agencies make their instructors and divemasters champions of dive safety, monitor their work and provide appropriate support in implementing the culture of safety. Those instructors who significantly or repeatedly breach reasonable safety standards need to be sanctioned appropriately.

The PADI "Responsible Diver" Campaign and the campaign to educate divers to ascend slowly and do safety stops are great examples of the important role that agencies can play in educating divers about key safety issues.

Heinerth: Training agencies have the opportunity to set the ground rules right from the beginning and guide divers to recognize that the general safety rules have been developed from practical experiences. One instructor who slips through the cracks without following standards can affect hundreds of future divers, who can also move on to affect another generation of divers. Maintaining high standards is critical to nurturing a consistent climate of safe diving practices.

Marroni: The commercial need to ensure expansion for the recreational diving industry has at times promoted misconceptions that activities in and under the water present little or no risk. I believe training agencies may be pivotal in producing changes by introducing the hazard identification and risk assessment (HIRA) components into their training programs to increase both the safety and the appeal of the sport.


STEPHEN FRINK

How can dive operators contribute to the culture of dive safety?

Heinerth: These days operators are under increased competition to offer the best adrenaline-laced experiences. But I learned early that enthusiasm is infectious. If you love what you are doing, then your clients will love their experiences with you. There is wonder and satisfaction just being underwater. It's great if you get blessed with a view of stunning manta ray, but it can be just as exciting to see a jawfish with a mouthful of eggs. Dive satisfaction doesn't require great depths or unnecessary risks.

Marroni: Many dive operators are not aware of the risks involved or their responsibilities toward their clients. They may not pay enough attention to their clients' skills or fitness levels, environmental and technical safety, dive boat safety, tank refill stations, etc.

Lippmann: Dive operators have the obligation to ensure that their equipment is well-maintained, that their staff members are well informed, competent and vigilant, and that divers are well matched for the sites they dive. If we don't receive a sufficiently safe level of service from the dive operators we pay to dive, we should have little hesitation to look elsewhere.

STEPHEN FRINK

How can the culture of dive safety be promoted?

Lippmann: Incident reporting and analysis provide strong tools on which to base relevant accident-prevention protocols. DAN has a key role to play here, and the diving community is better served if it helps DAN collect information on diving incidents and accidents so they can help guide training strategies and diving practices. Unfortunately, in some places there is a tendency to withhold important information about accidents for fear of legal or commercial repercussions. It would be great if this would change.

Heinerth: As a young diver in Tobermory, Canada, I took a class from a great role model named Dale McKnight. Our class worked hard for days, practiced skills and made plans to go on the deepest dive (and first decompression dive) of our lives. We were on the boat heading to the site when Dale told us that we had done such a great job that he would reward us with an extra 10 feet of depth and five more minutes of bottom time. My colleagues hooted and hollered in excitement, while I felt a deepening anxiety. With my head bowed, I quietly muttered that I did not feel ready and would sit on the boat. I was disappointed and embarrassed. Dale tried unsuccessfully to reel me back into the dive.

After a few minutes, Dale admonished the other divers for permitting him to shift a safe, organized

plan into a "trust-me" dive. At first I did not understand what was happening, but I soon recognized that he was patting me on the back. I had passed his test. He taught me an important lesson: A true survivor needs to know when to be willing to turn back and call it a day.

Marroni: We can promote a culture of dive safety by transmitting love for the underwater realm while at the same time clearly explaining that the marvels of the sea do not come cheap but rather require certain basic but strict rules that help us avoid being overwhelmed by the force of natural elements.

We should spread similar messages in every course, before every dive and through every article or documentary related to diving. It is important to avoid indulging the superficial messages about the ease of diving or the misinformed, overly catastrophic "scoops" following dive injuries or fatalities. DAN has been striving to do so over the past 30 years, and I think that the results prove the efficacy of this approach. AD

MEET THE EXPERTS

Jill Heinerth, a pioneering underwater explorer and filmmaker, has dived deeper into caves than any woman in history. To recognize a lifetime devoted to water advocacy, she was awarded the Wyland Icon and Sea Hero of the Year awards. In recognition of lifetime achievement, the Royal Canadian Geographical Society presented Heinerth with the inaugural Medal for Exploration. Her photography and writing have been featured in prominent publications around the world.

John Lippmann is the founder of DAN Asia-Pacific (DAN AP), which he established in 1994 to improve the safety of scuba diving within the Asia-Pacific. He was chairman, executive director and director of training for DAN AP for 20 years, the editor of *Alert Diver Asia-Pacific* for 13 years and is currently chairman and director of research at DAN AP. An internationally recognized dive-safety expert, he has written many books and articles about dive safety. In 2007 Lippmann received an Order of Australia award for services to scuba-diving safety, resuscitation and first aid.

Alessandro Marroni, M.D., is the founder and president of DAN Europe and chairman of International DAN. He is also vice president of the European Committee for Hyperbaric Medicine (ECHM) and a lecturer and professor of hyperbaric medicine at the Universities of Belgrade, Padova, Palermo and Pisa. Marroni is the author of more than 250 scientific papers and publications on underwater and hyperbaric medicine and has been a scuba instructor since 1966.

Boat Collision and Propeller Safety

BY BRITTANY TROUT

STEPHEN FRINK

Scuba divers often find themselves sharing the water with boats, as divers use boats to travel to dive sites and sometimes dive in areas with heavy boat traffic. Collision injuries from vessels and propeller strikes are hazardous for divers in such areas.

The U.S. Coast Guard Boating Safety Resource Center reports that from 2005 to 2013 boat-propeller strikes caused 636 injuries and 38 deaths of people engaged in water activities (boating, water skiing, swimming, snorkeling, diving, tubing, etc.); 442 of these injuries and 29 of these deaths were caused by a person being struck by a vessel. Preventing accidents while diving in areas with boat traffic requires that divers be aware of vessels at all times both below the surface and topside.

Depending on the location and vessel type, licensure or certification through boat-safety education courses may be required. Boating laws vary internationally and by state in the U.S.; therefore, it is important that both boat operators and divers remain aware of the regulations in effect for a specific location.

SIGNALING TOOLS

Dive flags. Flying a dive flag is an effective and in some places required means of alerting boats that divers are in the water. Similar to boat-operation laws, dive-flag regulations vary by location and vessel type in the U.S. and internationally. The two types of flags most commonly recognized in relation to diving are the alpha flag and the diver-down flag.

The internationally recognized alpha flag is flown when the mobility of any vessel is restricted, indicating that other vessels should yield the right of way. This flag is often flown along with the diver-down flag when divers are in the water, because dive boats must maintain a close vicinity to the divers and cannot quickly move. The diver-down flag explicitly signals that a diver is in the water, and it should always be flown from a vessel that has divers in the water. The alpha flag indicates that divers are in the area; however, it also has other uses. It is best practice to fly the diver-down flag along with the alpha flag to avoid miscommunication.

A diver-down flag is recommended to alert vessels during shore diving. The distance divers are required to stay within the dive flag depends on the dive location. A floating buoy tethered to a dive reel can be used to signal where divers are located in the water. A reel towing a floating dive flag should never be attached directly to the diver. Carrying the reel helps prevent the diver from being dragged in case the flag is caught by a passing boat.

Whether the dive flag is flown on a boat or a buoy marker, the flag should be in good condition to ensure visibility. Replace the flag when the safety integrity is compromised by faded color or rips. The size of the required dive flag may also vary by location. Always make sure the flag is visible from all directions.

Surface markers. Safety tools such as surface marker buoy (SMBs), whistles and other audible signals, dive lights and signaling mirrors can be used to communicate your location to boaters after you ascend from a dive. An SMB may be used in addition to a dive flag for alerting boaters that divers are in the water. Before the dive, review how to deploy the SMB to be prepared for using it on ascent.

When using signaling devices at the surface, divers should never assume they are visible to boat operators.


STEPHEN FRINK

Although laws vary by jurisdiction, divers should stay within 300 feet of a diver-down flag in open water and within 100 feet in rivers, inlets or navigation channels. When surfacing, stay as close to the flag as possible.

Glare from the sun, waves, passengers, weather conditions and other factors can make noticing a diver in the water difficult.

BE ATTENTIVE UNDERWATER

In addition to using signaling devices and paying attention to boat traffic topside, divers must be aware of passing boats when they are underwater. Looking and listening for boats overhead is a good practice, but keep in mind that poor visibility and sound localization when underwater can interfere. In most cases, a diver should be able to hear a boat from underwater, but it may be difficult to localize the direction from which the sound is coming because sound travels approximately four times faster in water than in air. Wearing a hood may alter hearing thresholds even more.

A safety stop for three minutes at 15 feet (5 meters) allows a diver to decrease nitrogen uptake and is also an opportunity to scan for boat traffic before ascending to the surface. Divers should be careful not to rely on quick reaction time in the event that they must move away from a passing boat while underwater. A boat can rapidly close on an unknowing diver without always granting enough time to move a safe distance away. For these reasons it is not advisable for divers to rely on observing for boats under the surface without a surface signaling device.

HAVE AN ACTION PLAN

A plan for treatment and evacuation of a diver struck by a boat or propeller should be in place before arrival at the dive site. To treat a laceration wound, stem the loss of blood by applying pressure bandages, and get the injured person to medical services as quickly as possible. Know who to call and what role others play in responding to a medical emergency.

RESEARCH AND PREVENTION

DAN Europe currently has a propeller-injury campaign to educate boat operators and divers how to safely share dive sites; visit *www.daneurope.org/web/guest/safety-campaigns1*. The website provides a collection of incidents and witness accounts as well as posters and educational materials so that divers can learn to prevent future incidents.

In North America, DAN utilizes an online incident-reporting system to collect information on dive accidents and injuries, including propeller and other boat-collision incidents; visit *DAN.org/divingincidents.* The information on reported cases is used for case summaries and to create prevention materials. AD


STEPHEN FRINK

Blue Lagoon Rescue

BY BRADLEY MORRISON

I began diving in 1975, became an instructor in 2000 and became a DAN instructor in 2002. As an independent instructor for more than a decade, I thought I had experienced almost everything that could happen in or near the water. How wrong I was.

The Blue Lagoon in Huntsville, Texas, is a dive-training mecca 70 miles north of Houston. It is an old alkali quarry, so it does not support life, but it has great visibility for a Texas mud hole. Because the quarry has platforms and a few other structures in it, it is perfect for training open-water (OW) divers. The maximum depth at the quarry is 25 feet. There is a full-service dive shop, cabins, shelters and air available for divers; this is in the middle of the East Texas Piney Woods, so there isn't much else for miles around.

On one beautiful day, with sunshine and half a breeze, I had four students in the water completing an OW training course. Two other students were on the shore waiting to do their advanced open-water (AOW) navigation run along with my son Bradley, who was a rescue-diver candidate. The final OW student had just reached the surface after completing his controlled emergency swimming ascent when I suddenly became short of breath. Thinking quickly, I called for Bradley to come help me. Believing that I was either simply drilling him or just feeling lazy, he leisurely swam out to tow the "tired diver" to the shore that was at least 100 yards away. When he arrived on scene and performed his assessment, however, he realized that this was no drill.

I was worried that I had a collapsed lung, but I was still coherent and able to speak. I yelled for my other son, Christopher, to get the oxygen out of the vehicle. "How appropriate," I thought to myself, "to finally meet my end while teaching a class in 25 feet of water."

Bradley towed me to shore and made an egress. Even though he had watched me teach the DAN Emergency Oxygen course several times before, he hadn't yet completed it himself, so he had to use his memory to figure out how to put together the equipment on his own. Luckily, he must have been paying attention. Bradley and Christopher soon administered oxygen per the briefing plan.

After 15 minutes of trying to catch my breath without success, emergency medical services (EMS) were finally called. Upon arrival, they ruled out the collapsed-lung theory and discovered that I was in atrial fibrillation of an unknown cause. I was immediately transported and hospitalized overnight and have since made a full recovery and have been cleared to dive. I never lost consciousness or awareness of what was happening.

All four of my OW students are now certified, and the two AOW students have completed their certification and have started rescue-diver training. Bradley, nearing the completion of his rescue-diver training, thinks he should get a free pass for saving my life, but that's not going to happen.

This incident occurred in 2012, so the ages and certifications have changed since then. Bradley is now 17, a college-bound student and rescue-diver candidate. Christopher, 13, is a high-school student and an AOW candidate. I couldn't be prouder of them.

I later asked Bradley and Christopher what they were thinking during the event. Bradley said he went on "automatic." He did everything I had taught him and more. See, sometimes they do pay attention. Christopher said he just followed Bradley's orders and tried to remember what he'd learned from watching some of the classes I had taught. For my part, I think I'll keep them around — rent-free. AD

THE MEDIC'S PERSPECTIVE

It is always a pleasure to hear when medical emergencies result in a positive outcome. The response from the diver's sons speaks volumes to the importance of early and continuing education in dive safety and emergency preparedness. The incident also reminds us that there can be and are instances when dive leaders experience problems and require assistance. Dive professionals are not immune to circumstance or error, and being trained and confident enough to provide aid when necessary should be part of every diver's aspirations.

In many ways this diver was lucky. First, he had a team of responsive and organized student divers around him — a testament both to his skill as an instructor and to his sons' attentiveness and confidence. He was also lucky that he did not have a collapsed lung. It is not uncommon for some heart problems such as atrial fibrillation to manifest as shortness of breath, and the fact that Bradley was able to yell for his son is inconsistent with a collapsed lung. Providing surface oxygen was absolutely appropriate in this case as it is in most first-aid situations associated with diving.

As this account illustrates, very different issues can present in similar manners, and it is a very human trait to self-diagnose when we experience a sudden health condition. When in distress, it is fully understandable that we want to determine the problem and immediately try to make it better, but it is far too easy to make the wrong diagnosis. This is why prompt evaluation by medical professionals is imperative. Once EMS arrived, they very quickly identified the health issue and were able to treat him appropriately.

There is still no substitute for proper training, practice and having the confidence to implement care when needed. The diver and his sons are to be commended for their response to a frightening and serious situation.

Having an episode of atrial fibrillation should keep the diver on alert. Atrial fibrillation is often recurrent and becomes more frequent with aging. Fitness to dive is evaluated on an individual basis and should be reconsidered regularly.

Deep Vein Thrombosis and Diving

DAN medics and researchers answer your questions about dive medicine.

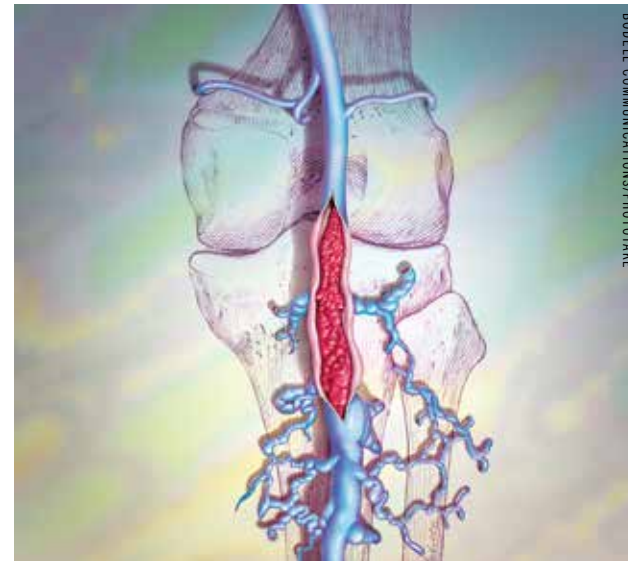
Q: I've heard that deep vein thrombosis (DVT) is a concern for travelers on long flights. What are the risk factors for getting DVT, and will I still be able to dive if I do?

A: DVT is a condition in which a blood clot forms in one or more of the deep veins, usually in the legs. When blood clots break free and travel with the blood, DVT can cause life-threatening conditions such as stroke or pulmonary embolism. DVT is not related to diving, but divers often travel and are thus exposed to the risk of DVT.

Although DVT while traveling is rare (the prevalence for travelers on flights of more than eight hours is between 0.3 and 0.5 percent), risk factors include older age (with increasing risk after age 40), obesity, estrogen use, recent or current pregnancy, thrombophilia, prior personal or family histories of DVT, active cancer, serious illness, recent surgery, limited mobility, central venous catheterization and significantly above- or below-average height.

If you will be on a long flight and believe you might be at increased risk for DVT, you can reduce the likelihood of developing the condition by wearing compression socks and talking with your primary-care physician regarding the possible benefits of anti-inflammatory medications. It is also good practice to periodically stand up and walk around, exercise the feet and calves while you are seated and stay well-hydrated.

If you develop DVT, you should not dive during the acute phase of the condition or while you are taking anticoagulants. You may return to diving after DVT, but you should not do so before consulting a physician trained in dive medicine. It is less likely that you will be able to return to diving after pulmonary embolism, but you may be able to do so in consultation with a physician. Returning to diving after a stroke should also be evaluated on an individual basis.



BODELL COMMUNICATIONS/PHOTOTAKE

For more information about DVT, see DAN's "The Dive Lab" blog at *DAN.org/TheDiveLab/DVT*.

— Petar Denoble, M.D., D.Sc.

Q: I recently went on a dive trip in which the staff insisted that we should all drink five to six liters (about 1.5 gallons) of water on dive days. Is this really a good idea?

A: This practice is not universal and not recommended. It is a natural human tendency to rationalize that if a small amount of something is good then a larger amount must be better, but that rationale seldom holds true. Consuming that much water could actually lead to serious medical problems.

One potential complication is "water intoxication," a phenomenon in which excessive consumption of water leads to a decreased amount of sodium and other electrolytes outside of the body's cells. The reduced sodium concentration outside the cells means the sodium levels within cells are relatively higher. Water will enter the cells to try to equilibrate the sodium levels, which causes them to swell. This in turn can cause skeletal and abdominal muscle cramping. Furthermore, swelling in the brain cells can result in confusion, personality changes, coordination problems and a lack of situational awareness. Severe, untreated cases of water intoxication can lead to coma and death.

Another potential complication for divers is an increase in the fluid volume of the blood. When we are submerged in water there is a shift in blood volume from the peripheral vessels to the central circulation. This is expected and normal. Typically when this blood shift occurs the heart's


STEPHEN FRINK

contractile force increases accordingly to compensate, but an abnormally high blood volume can overwhelm cardiac function in some individuals. This leads to immersion pulmonary edema (IPE), which can develop on the surface, during a dive or immediately after surfacing. Essentially the body's own fluids accumulate in the lungs, causing acute shortness of breath and potential loss of consciousness. Depending on the severity of symptoms, the person may require anything from supportive care to aggressive intervention by medical professionals.

The potential complications of excessive hydration outweigh any perceived benefit. Adequate hydration is important, but there are no data that demonstrate that divers need to significantly increase their fluid intake. Be skeptical of bold proclamations, and do not hesitate to ask for sources of such recommendations.

— Marty McCafferty, EMT-P, DMT

Q: I will be testing equipment in a series of two 60-minute dives to 10 feet (3 meters) at an altitude of 5,400 feet (1,646 m). The following day I will ascend to a maximum altitude of 11,570 feet (3,527 m) for a skiing trip. Is it safe to drive to a high altitude after my dives?

A: You get credit for thinking in advance about the issue of ascent to altitude after diving. While easily forgotten in dive planning, it can be a significant problem depending on the dive(s) and altitudes.

Generally speaking, it is best to avoid altitude exposure, either through ground travel or flying, soon after diving. The current DAN guidelines for flying after diving recommend a minimum preflight surface interval of 12 hours after a single dive within no-decompression limits, 18 hours after multiple dive days or multiple sequential days of diving, and "substantially longer" than 18 hours after decompression dives.[1] The exposure altitude covered by these guidelines is between 2,000 and 8,000 feet (610 and 2,438 m). Altitude changes of less than 2,000 feet are ignored in the belief that the pressure change fits within the normal variability of meteorological pressure. The majority of available data do not address travel to altitudes greater than 8,000 feet, but it certainly represents a greater degree of decompression stress.

The dive exposures you describe, however, are modest enough that it is useful to refer to the U.S. Navy altitude tables.[2] They were constructed mathematically to consider specific dive profiles in the calculation of altitude exposure limits. The *U.S. Standard Atmosphere*[3] describes the ambient pressure at 5,400 feet altitude as 12.05 psi. The "equivalent depth" (which is necessary


MARKO DIMITRIJEVIC

when using standard tables that are based on sea-level diving) is computed by multiplying the actual dive depth by the atmospheric pressure at the exposure altitude, then dividing by the normal sea-level pressure assumed for the tables. The equivalent depth is thus 10 feet x 12.05 psi/ 14.7 psi = 8.3 feet. The equivalent depth for a 15-foot actual dive depth is 12.3 feet and for a 20-foot actual dive depth is 16.4 feet. Given the rules of rounding up with dive tables, there is effectively no change in the depths used for the computation of repetitive groups. (Note: This would not hold true for deeper dives.)

The U.S. Navy Revision 6 Table 9-7 places a diver completing a dive to 10 feet for between 102 and 158 minutes in repetitive group C. Diving to 15 feet (5 m) for between 121 and 163 minutes would put the diver in repetitive group E. Diving to 20 feet (6 m) for between 106 and 133 minutes would put the diver in repetitive group F. The altitude change from the lowest to highest point of travel you reported is just less than 6,200 feet (1,890 m). Table 9-6 does not restrict a 7,000-foot (2,134 m) climb in altitude for repetitive groups A-D. The minimum surface interval to precede travel is one hour and 37 minutes for repetitive group E, four hours and four minutes for F and six hours and 10 minutes for G.

Assuming the dives are conducted as planned and the travel takes place the next day (likely more than six hours later), there should be minimal risk of decompression sickness resulting from the diving. There are two points worth noting for those being exposed to altitude after diving. First, the 10-foot depth involved in your case is highly unusual. More typical diving exposures would warrant longer surface intervals before travel. The second point is that while the U.S. Navy tables give seemingly precise schedules, they do not consider the myriad factors that can alter the risk of decompression sickness. It is important to maintain the mindset of prevention by building in additional safety factors wherever feasible. AD

— Neal Pollock, Ph.D.

ASK US!

The DAN Medical Information Line is here to answer all your dive-related medical questions. You can reach the medical staff during regular business hours (Monday through Friday, 9 a.m. to 5 p.m. ET) by calling **+1-919-684-2948, ext. 222.** You can also submit an email at *www.DAN.org/contact.*

REFERENCES

1. Sheffield PJ, Vann RD, eds. *Flying After Recreational Diving Workshop Proceedings*. Durham, N.C.: Divers Alert Network, 2004.

2. *U.S. Navy Diving Manual*, Vol. 2, Rev. 6. NAVSEA 0910-LP-106-0957. U.S. Naval Sea Systems Command: Washington, D.C., 2008: Chapter 9.

3. *U.S. Standard Atmosphere, 1976*. National Oceanic and Atmospheric Administration, National Aeronautics and Space Administration, and United States Air Force. NOAA-S/T 76-1562. U.S. Government Printing Office: Washington, D.C., 1976; 227 pp.

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Entangled in Kelp

BY BRITTANY TROUT

THE DIVERS

On his first-ever night dive, Sam, an uncertified and inexperienced diver with fewer than 15 lifetime dives, descended to catch lobsters with two other uncertified divers (Dave and Tim). The three descended, while a fourth diver (Ron) planned to freedive and assist with hauling in the anticipated lobster catch. A fifth diver (Eric) remained on the boat. *(Note: All names are fictitious.)*

THE INCIDENT

Dave's tank slipped out of his BCD strap five minutes into the dive. He alerted Tim of the issue and signaled that he was going to surface to adjust his gear. Dave and Tim went to the surface, while Sam, unaware of their decision, continued with the dive. When Dave and Tim returned to the boat, they realized Sam had not followed them and were unsure of his location. They conducted a brief surface search and concluded he must still be at depth. While freediving, Ron saw Sam entangled in kelp at approximately 25 feet. Sam was still wearing his mask, and his regulator was in his mouth. He was conscious and fighting to free himself from the thick kelp.

Sam began to panic, causing him to flail and become even more entangled. After several unsuccessful attempts to free Sam from the thick kelp, Ron returned to the surface and alerted the others that Sam was entangled and needed help. Eric responded with scuba gear from the boat. Unfortunately, by the time Eric got there, Sam was no longer wearing his mask, his regulator was not in his mouth, and he was not breathing. Eric cut Sam free and brought him to the surface. Another boat that had heard the distressed calls for help was there to pull Sam out of water. CPR was started immediately, and Sam was transported to a local hospital, where he was pronounced dead.

Entrapment and entanglement are the triggers in approximately 20 percent of fatal dive accidents. All divers should be prepared to manage these hazards.

ALLISON SALLMON

FATALITY ANALYSIS

Understanding the root causes and the series of events leading to a dive fatality is important for the prevention of future incidents. Investigators recovered the dive gear, which they tested and found to be working properly. The tank contained more than 2,000 psi on recovery, indicating that Sam did not run out of air; however, his regulator was found out of his mouth when he was recovered.

The trigger in this case was kelp entanglement, which made this dive an emergency and began the chain of events that led to the fatality. Sam's panic served as the disabling agent, causing him to engage in irrational behavior that did not help to resolve the entanglement and led him to drop his regulator. Losing his regulator caused him to suffer asphyxia and drown.

DISCUSSION

The decedent, Sam, was not a certified diver. He had some previous dive experience, but he lacked proper training and had never conducted a night dive before the fatal dive. Dave and Tim also lacked formal training and certification even though they had more experience. Formal scuba training through certifying agencies equips divers with knowledge along with the skills necessary for safe diving. Training prepares a diver to respond calmly and confidently to emergency situations. Diving that involves unique risks — in this case, night diving, lobster hunting and kelp-forest diving — requires additional training, preparedness and appropriate equipment. Acquiring certifications for such environments is recommended.

Diving in kelp requires streamlined equipment to reduce the risk of entanglement and a cutting tool to resolve possible entanglement. Sam was not carrying a cutting tool, and it is unknown whether his equipment was streamlined. In addition to being responsible for one's own safety by obtaining the appropriate training for specifically risky environments, it is also wise to dive with a divemaster and/or rescue diver trained to react in emergency rescue situations.

Buddy diving means diving in pairs, not in an odd-numbered group. Pair diving is the best practice to prevent buddy separation. In a group of three or more, miscommunication among dive buddies is more likely even for trained divers, because it can be unclear who has been in communication with which buddy. In this incident Dave and Tim communicated the ascent to one another, but Sam remained unaware of the situation. This may have contributed to Sam's panic because he could not locate others to help free him from the kelp.

A medical emergency or equipment failure did not trigger this incident. It was caused by a foreseeable factor for which the divers were not prepared. Although a lack of formal training may have contributed to this fatal incident, there are other valuable lessons in this tragedy that certified divers should not overlook. AD

REFERENCE

Denoble PJ, Caruso JL, Dear GdL, Pieper CF, Vann RD. Common causes of open-circuit recreational diving fatalities. *Undersea Hyperb Med.* 2008; 35(6):393-406.

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**Purchasing an AED in California requires medical director approval.*

Oxygen Unit with Soft-Sided Case

DAN's lightweight, soft-sided oxygen unit is designed for easy transport to the scene of an emergency. This bag securely holds a Jumbo D cylinder that delivers 45-60 minutes of oxygen. **Product code: 601-1030; Price: $600**

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Weighing 14 lbs., DAN's Rescue Pak is a compact oxygen unit that features a smaller M9 oxygen cylinder that delivers 14-20 minutes of oxygen. Ideal for locations that are close to emergency response. **Product code: 601-4000; Price: $475**

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DAN's seamless aluminum oxygen cylinders are 40% lighter than steel and come in Jumbo D or M9 cylinder sizes. White-shoulder cylinders are available for Canada. Cylinders are shipped empty. **Product code: 601-1030; Price: $100 Jumbo D; $82 M9**

Rescue Pak Extended Care

The Rescue Pak Extended Care oxygen unit offers the same features as the Rescue Pak but comes with a larger, Jumbo D cylinder that delivers 45-60 minutes of oxygen, perfect for locations far from emergency assistance. **Product code: 601-1000; Price: $650**

A WEEK UNDERWATER IN THE BAHAMAS

I have been visiting the Bahamas as a dive photojournalist since the early 1980s, sometimes several times each year. While each trip has been productive, sometimes amazingly so, each has had the challenge of being just a vignette of a greater whole. There are 700 islands and 2,000 smaller cays in the Bahamas, with major centers of population and commerce on New Providence (Nassau) and Grand Bahama (Freeport). Among the Out Islands (sometimes known as the "Family Islands"), 27 are populated. This is a vast oceanic wilderness spread over 100,000 square miles. No one person could cover it editorially or experientially in a single visit, but with a little help from my friends we gave it a try.

We recruited four world-class marine photographers and tasked them each with visiting two or three islands and photographing and reporting on their adventures for Bahamas Underwater Photo Week. We all traveled simultaneously in the last week of May 2014. The Bahamas Ministry of Tourism arranged for filmmaker Cristian Dimitrius (see Shooter, Page 92) to document our adventures. The photo team included Eric Cheng, Alex Mustard, Berkley White and me. Wetpixel.com staff Adam Hanlon and Abi Smigel Mullens reported the event via social media. See their coverage at *wetpixel.com/articles/coverage-bahamas-underwater-photo-week* and *www.facebook.com/events/700675866656754/?fref=ts/*.

We present to you, distilled from several terabytes of collectively produced digital data, **Bahamas Underwater Photo Week 2014**.

Stephen Frink

Grand Bahama, Bimini and the Abacos

TEXT AND PHOTOS BY STEPHEN FRINK

GRAND BAHAMA

It is appropriate that my week began with a visit to my friends at UNEXSO (the Underwater Explorers Society) in Freeport, Grand Bahama, for they were the progenitors of so many things that define Bahamas diving today. Celebrating their 50-year anniversary in 2015, UNEXSO was instrumental in developing shark diving, and they also have a robust cave-diving program. When few destinations were sinking shipwrecks, UNEXSO acquired and sank ***Theo's Wreck*** as a dive attraction in 1982; the 228-foot freighter now rests on her port side near the edge of the continental shelf in 105 feet of water.

While the deep-dive tank that once hosted Walter Cronkite, Arthur Godfrey and Kim Novak is long gone, and the boats that once transported Lloyd Bridges (with his sons Beau and Jeff) have been upgraded long ago, that early spirit of adventure and innovation still lives on at UNEXSO today.

My first dive of this trip with UNEXSO was to **Ben's Cavern**, named for long-time UNEXSO dive instructor Ben Rose — who, according to local lore, needed water for his overheating radiator and hiked into the bush, discovering the cavern leading to the immense freshwater cave system that now bears his name. Reservations are required at Ben's Cavern to prevent overcrowding, and it can be dived only with skilled cave-qualified instructors to keep divers from penetrating the cave system beyond what their skills allow. We dived only the cavern portion, with the light from the entrance always visible; yet even just a few fin strokes beneath the pool in only 20 feet of water we encountered a beautifully decorated system that hints at the subterranean glory that makes the blue holes and caves of the Bahamas must-do sites for cave enthusiasts.

UNEXSO is perhaps best known for their **Shark Junction** shark encounter. With longtime friend and dive professional Cristina Zenato handling the feeding, we dived to a 30-foot sand patch where over the past two decades the sharks have been conditioned to expect bait carefully presented by a chainmail-clad shark wrangler. Cristina has clearly established an intimate awareness of individual sharks, some of which are more friendly and engaging than others. One shark would swim to her lap repeatedly, like a puppy hoping to be scratched on its

An Atlantic bottlenose dolphin swims along a shallow reef off Freeport, Grand Bahama.

Above, from left: Cristina Zenato puts a reef shark into tonic immobility during a UNEXSO shark dive; Brendal Stevens explores the wreck of the *San Jacinto* near Green Turtle Cay; a queen angelfish at Long Island.

Opposite: Ben's Cavern, near Freeport, Grand Bahama, is notable for its lavish decoration.

Michael Sherratt views an elkhorn forest off Man-O-War Cay.

Divers explore the shallow wreck of the *Sapona* off Bimini.

head. (Watch the viral video of this encounter at *tinyurl.com/zenato-frink*.) Cristina can bring these sharks to a state of tonic immobility by stroking them along their electroreceptors, the ampullae of lorenzini, to the point where she can support them gently, cupping their snouts as they lie perfectly still in her hand.

At the **Dolphin Experience** visitors can interact with bottlenose dolphins in a controlled environment within a large canal and basin or as scuba divers in the open ocean. For the open-ocean encounter, divers are transported to the reef from one of UNEXSO's dive boats as a smaller skiff runs alongside, with the dolphins following their trainer out to the reef. They typically go to a shallow reef in 30-45 feet of water, a site punctuated by scattered high-profile clumps of coral and gorgonia. While the dolphins are attentive to their trainer with classical conditioning reinforcing their behaviors, the dolphins are swimming freely in the open ocean, and the proximity the divers enjoy is impressive.

While Freeport offers plenty of activities above and below the surface for any dive holiday, Grand Bahama Island offers even more. An hour's drive can take shark-diving enthusiasts to **West End**, home of **Tiger Beach**. Here, along an area of shallow reef and rubble bottom, large tiger and lemon sharks have been conditioned to reliably appear by years of shark feeds. These are wild sharks in the open ocean; divers should exercise care. It may not be a dive for everyone, but it is a very popular encounter. The site is exposed to the prevailing winds in winter, so most prefer to visit Tiger Beach in the summer and early fall.

West End also offers one of the best shallow shipwrecks in the Bahamas, the **Sugar Wreck**. In only 20 feet of water, the Sugar Wreck holds massive schools of grunt and other reef tropical and comes alive at night with marauding stingrays and loggerheads that sleep beneath her nooks and crannies. Nearby is **White Sand Ridge**, long known for its resident school of spotted dolphins.

Traveling east from Freeport, we arrive at McLean's Town, the gateway to **Deep Water Cay**. Well known from the late 1950s by bonefish anglers, new owners acquired the club at Deep Water Cay in 2009 and decided that the same bountiful marine life that endear the destination to fishermen would likewise appeal to divers. The fishing is mostly flats fishing — catch and release for bonefish, tarpon and permit, or offshore for wahoo, tuna or mahi mahi.

Deep Water Cay defines casual elegance. While my whirlwind visit did not allow thorough exploration of their nearby reefs, I enjoyed two shallow reefs at **Lisa's Point** and **Dean's Reef**, but the highlight was drifting along the tidal flow in only 10 feet of water at **Thrift Harbor** and seeing schools of eagle ray, sargassum clusters growing from the seafloor, dozens of angelfish and even a few nurse sharks.

BIMINI

Situated just 53 miles due east of Miami, Bimini has long been a destination of choice for yachtsmen and anglers. Hemingway lived there from 1935 to 1937 and wrote *To Have and Have Not* between days out trolling the Gulf Stream aboard his yacht, *Pilar*. Dive legend Neal Watson brought recreational diving to Bimini in 1975; his son, Neal Watson Jr., now conducts dive operations there.

Bimini is popular for shark enthusiasts because of the seasonal appearance of great hammerheads and bull sharks just offshore as well as the Bimini Sharklab's research work. Beyond sharks, the diving is diverse and quite excellent. Highlights include the shallow-water exploration of the **SS *Sapona,*** the coral caverns and swim-through at **Victory Reef** in 35-85 feet of impossibly clear water, and the Caribbean reef, lemons and blacktip sharks consistently in residence at **Bull Run**.

A boat ride north to the expansive sand flats where spotted dolphins (*Stenella frontalis*) freely roam is a must.

Brendal Stevens feeds stingrays at Green Turtle Cay

Large schools of grunt populate the wreckage of the *San Jacinto*.

This is definitely a snorkel adventure, for scuba is too slow and ponderous for these capricious and fleet marine mammals. When they choose to engage a snorkeler, it is on their own terms and usually with significant enthusiasm. They tend to lose patience with those who aren't willing to swim, dive and play with them, but for those able to be an amusing diversion for a while, close encounters are quite probable.

THE ABACOS

In the Abacos I was fortunate to visit two destinations that provided surprisingly significant differences both topside and underwater despite their relative proximity: Green Turtle Cay and Man-O-War Cay.

The new airport at Marsh Harbour is the first stop for the water-taxi rides that take you to either of these dive destinations. I was familiar with **Green Turtle Cay**, having dived there several times previously and enjoying my time with Bahamas dive icon Brendal Stevens, who with his wife runs a popular dive operation that offers packaged accommodations with a variety of small hotels and guest homes.

Brendal and I started out on the Civil War wreck ***San Jacinto***, a gunboat that struck a reef while chasing a blockade runner in January 1865. I photographed the huge boilers of the steamship and the massive propeller, barely perceptible amid the flattened wreckage of the stern. As shipwrecks tend to do, this one held big schools of grunt and a few photogenic green morays, all in just 25 feet of water.

Our next stop was **Coral Caverns**, a site dotted with swim-throughs and cathedral light piercing through from above. Caribbean reef sharks have clearly been fed here, enough so that they promptly appear at the sound of an anchor drop. But this day the attractions were the friendly Nassau grouper that clearly knew Brendal as friend and protector and the massive concentrations of silversides clogging the reef canyons.

While motoring to the next site I looked over the side and was amazed at the elkhorn coral garden visible just below in water of 100-foot visibility. I have seen elkhorn come and regrettably go on more islands than I could name; to see it here so healthy and pristine was absolutely inspirational. When the sharks and grouper from Coral Canyons followed us to the elkhorn forest, it made for a meaningful photo opportunity.

The next day was a good one for critters at opposite ends of the evolutionary spectrum. In the morning we went to a secluded beach where Brendal has made a habit of feeding friendly stingrays. In an encounter reminiscent of other stingray feeds I've seen on Bimini and Grand Turk (as well as Stingray City and Sandbar on Grand Cayman), the rays swim along the shallow beach, eager to hoover up whatever bit of fish or conch might be offered. In the afternoon I shot over/unders of, oddly enough, pigs in the shallows of No Name Cay.

I enjoyed the hospitality of Michael Sherratt of DiveTime Abaco while on **Man-O-War Cay**, a tiny island of only about 300 residents. The island has a strong boat-building legacy and tends to be quiet. No liquor is served on the island; you can have a drink in your guesthouse, but you can't buy it on the island. The island is only 2 miles long and very narrow, so the roads are better suited for golf carts than cars. The wide-open spaces are underwater, and that's where we headed early the next day.

The reefs of Abaco are relatively shallow, with most dives to less than 60 feet. Our first dive was at **Mini Wall** within the Fowl Cays National Park. The abundance and easy familiarity that Michael had with the Nassau grouper here made it obvious this was a marine preserve, with no hook and line or spearfishing allowed. The reef canyons held plenty of yellowtail, a species becoming more rare due to overfishing in other places.

At **Tunnels**, also known as Tombstone Reef, there is a fabulous stand of elkhorn in the shallows, but most divers are likely captivated by the play of light shafts that pierce the swim-throughs 25 feet below. We also visited **French Grunt Reef** and **Fish Bowl**, each presenting a different variety of lovely hard corals and seafans as well as friendly tropical fish.

Maritime-history enthusiasts must visit the wreck of the **USS *Adirondack*** off the northeast point of the island. This Union ship ran aground in August 1862 while preventing blockade running by the Confederacy. The scattered remains lie in 10 to 30 feet of water, but the most prominent artifacts are two immense cannons, each 12 feet long and weighing 10,000 pounds.

Clockwise from left: **Caribbean reef sharks (*Carcharhinus perezi*) join a diver at the *Ray of Hope* shipwreck near Nassau, Bahamas. Shark wrangler Charlotte Faulkner is surrounded by Caribbean reef sharks near Nassau. A large black grouper (*Mycteroperca bonaci*) hangs out in the *Ray of Hope* shipwreck.**

New Providence and Eleuthera

TEXT AND PHOTOS BY ERIC CHENG

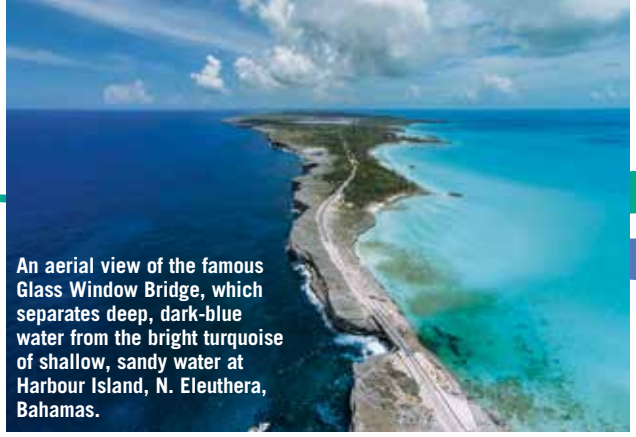
NEW PROVIDENCE

I have been visiting the Bahamas since 2002 and have made 14 separate dive excursions to explore her waters. For this *Alert Diver* assignment, I spent time in both New Providence (staying in Nassau) and Eleuthera, a long wisp of an island to the east.

Five James Bond movies have included underwater scenes shot in New Providence, where the capital and largest city, Nassau, is located. In addition to the obvious beauty of its beaches and resorts, the water in the Bahamas is clear and impossibly blue, so vibrant it almost defies reproduction on film. In the film *Into the Blue,* starring Jessica Alba and Paul Walker, the color and clarity of the water would have won an Oscar if there had been a "water quality" category. There are easily accessible shipwrecks, shallow reefs and the vertical wall of the Tongue of the Ocean. The most enticing of all for adrenaline junkies are the sharks. The Bahamas are one of the best places on the planet to view and interact with multiple species of large sharks.

Shipwrecks dominate the diving off the southwest end of New Providence. In four days we dived the ***Ray of Hope***, ***Big Crab***, ***Sea Viking, Port Nelson***, the **Bond wrecks (*Tears of Allah* and *Vulcan Bomber*)** and ***Willaurie***. The wrecks were purposely sunk as dive attractions, and most are upright. They are perfect for wide-angle shots that feature the entire wreck; if you are lucky, you might get a shark or two in the frame. The *Willaurie* stands out for its fully coral-encrusted scaffolding, which is full of reef life and friendly fish. If you are into macro photography and fish portraits, a visit to the *Willaurie* is not to be missed.

New Providence is best known for the sheer masses of Caribbean reef sharks and interactive encounters. My dives were hosted by Stuart Cove's Dive Bahamas, the largest dive operator in New Providence. Dozens of Caribbean reef sharks investigating the bait crate on the sandy bottom at times completely obscured views of my dive guide and shark wrangler, Charlotte Faulkner. She was able to demonstrate a strange shark reflex called "tonic immobility," during which sharks become temporarily paralyzed when the area around their



An aerial view of the famous Glass Window Bridge, which separates deep, dark-blue water from the bright turquoise of shallow, sandy water at Harbour Island, N. Eleuthera, Bahamas.

The silhouette of a hawksbill turtle (*Eretmochelys imbricata*) forms in front of a sun ball at Eleuthera, Bahamas.

snouts is stimulated. During this state, some so-called shark whisperers can even balance a shark, tail up, on the palm of their hand. There are only a handful of places in the world where divers can get close to sharks without the use of an attractant, and shark diving brings many tourists to the Bahamas. Shark fishing is banned in Bahamian waters, a nationwide shark sanctuary.

One day Stuart Cove picked me up in a fast, 45-foot rigid inflatable boat (RIB), and we cruised quickly out of Nassau harbor past three giant cruise ships that had docked for the day. We motored 10 miles east of New Providence to the **Lost Blue Hole**. Beginning at about 40 feet below the surface, it is 100 feet in diameter and drops down to more than 200 feet deep. I'm told sharks and rays frequently swim inside the hole, but the star of my dive this day was an unperturbed turtle that was eating sponges on the hole's walls.

An aerial perspective is really required to get a true sense of the unusual geology of a blue hole; for this I was equipped with a DJI Phantom 2 Vision+, a small quadcopter that carries an integrated, gimbal-stabilized camera that shoots 14-megapixel stills and 1080p HD video. It beams back live video to a smartphone, which you use to control the camera during flight. Sending the Vision+ in the air a few hundred feet showed the true nature of the blue hole — a lone indigo spot in the huge blue-green expanse of the ocean.

ELEUTHERA

My second stop was **North Eleuthera**, a long, thin barrier island exposed to the open Atlantic Ocean on its eastern shore. Eleuthera is about 110 miles long, and at its thinnest point is barely wider than the span of the road. Home to about 10,000 residents, Eleuthera is one of the Bahamas' main agricultural centers and is known for pineapple farming. I boarded a water taxi for my final destination, **Harbour Island**, home to the famous Pink Sands Beach, among the most beautiful beaches in the world.

The diving off North Eleuthera was wild. **Tarpon Hole** is home to about a dozen large, shiny tarpon, cruising the area like a gang in their 'hood. Strong surge at the Blow Hole crashed against rocks, creating turbulent clouds of air down into the water column. I have seen surge action create similar phenomena at Malpelo and Roca Partida in the Revillagigedo Islands. They are reminders of the unstoppable power of the ocean and are beautiful to witness and photograph.

That late afternoon, Boyd, a co-owner of Valentines Dive Center, drove me to the southern point of Harbour Island with Nora, his 6-year-old daughter. Nora screamed in delight as our golf cart raced up and down the small bumps that constitute the most extreme altitude changes on the island. I wondered what Nora would think of the steep hills we have in San Francisco, my hometown. The south end of the island is virtually untouched and features some old cannons buried in the brush and sand. The raw tropical beauty and vast beaches make this a popular wedding and honeymoon destination.

The next morning I made a couple of dives at **Current Cut**, a narrow channel with raging currents estimated to be 6-10 knots. The dive plan was straightforward: Jump in, descend, ride the current through the passage, and surface. The estimated dive time was 10 minutes (the shortest dive plan I've ever encountered), and the distance traversed was 2 miles. We saw numerous eagle rays (none would let me get close), and all the narrow cuts at the bottom of the channel were full of jacks, angelfish and other fish hiding from the current. Current Cut is a thrilling dive, best done on an incoming tide for optimal water clarity. Dive operators will drop divers in the water a few times since the dive is so short. I did three more dives that day, including dives at **Hammerhead Point** (no hammerheads for me that day, though)**, Split Head Reef** and the ***Arimora* wreck**.

At its narrowest point, Eleuthera is scarcely 100 yards wide. At that point is a bridge called the Glass Window Bridge, striking a dramatic contrast between the dark blue water of the Atlantic Ocean and the bright turquoise shallows to the west. My trips to the Bahamas in the past have been liveaboard-based shark expeditions, so having the chance to explore two distinct regions was a real treat, both topside and underwater.

San Salvador and Long Island

TEXT AND PHOTOS BY ALEX MUSTARD

SAN SALVADOR

I emerge from the silent world to a commotion. The Riding Rock dive boat reverberates with joyful shouts, squeals and laughter — and I can't say I am surprised. I've just surfaced from an hour underwater, and my cheeks ache from smiling. Few things are as special as a wild animal choosing to hang out with you, and we've just had two friendly Nassau groupers, known as Tom and Jerry, taking the reef tour right in the middle of our group. I fall for the big brown eyes and rubbery lips that give the groupers a cartoonish charisma. Their favorite trick is to sneak up on your blindside and suddenly appear inches from your mask. Captain Bruce tells us they like a little tickle under the chin. As a photographer, having groupers posing inches from my lens is about as good as it gets. The captain tells us friendly groupers have been on San Salvador as long as he's been diving.

San Salvador is famous for being Christopher Columbus' first landing in the new world — or as the locals put it, "Columbus was our first tourist!" San Sal is small, just 12 miles long and 6 miles wide with little more than 1,000 residents. It has one of the best runways in the country and is easy to reach either by island-hopper or direct international arrivals from the U.S. and Europe.

"San Sal's tourist draw has always been diving," explains Jay Johnson, the manager of the island's office of the Ministry of Tourism. "Other islands are most famous for fishing, beaches, shopping, casinos — and we have great fishing, nature and beaches here, but what we're really about is diving. San Sal was one of the world's first diving destinations. **Riding Rock Inn** put San Sal on the diving map in 1973. Now two of the most popular places to stay are Riding Rock and the large **Club Med Resort**, called **Columbus Isle**." Our visit is split between the two resorts.

The red sun melts into the flat ocean, and it's time for a night dive. I enjoyed the fun of group diving in the day, but at night I prefer my solitude, hunting macro subjects away from the distraction of flashing beams. I am thrilled to find bountiful subjects: lots of shrimp, handsome triplefins, a beautiful nudibranch and more lettuce-leaf slugs than I could count. San Sal is known for wide-angle subject matter, with superb visibility and a dramatic dropoff just off the beach that rims the island. But I am mightily impressed with the abundance of tiny charms.

The next day I dedicate my dive at **Pinnacle Reef** to macro photography and turn up tiny treasures including an arrow blenny, roughhead blennies, whitefoot shrimp and a decorator crab with orange legs poking out of the gray sponge covering its body. The big stuff is exciting the rest of the divers on the boat. During my stay I see plentiful grouper on all the sites, schooling jacks, snappers and grunts. Most of the schools are clustered around cleaning stations, and the grunts seem to almost unhinge their mouths when yawning to attract cleaning gobies. San Sal's larger attractions include rays, turtles and sharks. Others see hammerheads on our dives, but I guess my head was too stuck in the reef looking for sea slugs. Jay says that you can see groups of scalloped hammerheads in February and March, but you will encounter individuals year round.

San Sal is a family-friendly destination. The dives are mostly easy, although there is the option of depth for those who want it. I saw reef sharks on almost every dive, but unlike the Bahamas' biggest islands, they don't run shark feeds on San Sal because they have found their guests prefer it this way.

The big animals are certainly a draw, with a healthy population of reef sharks and frequent sightings of hammerheads. But my indelible memories were of the groupers — not just underwater, but how mutual curiosity with a wild creature energized a group of teenagers in a way that a computer game or chat room never can. Nassau may be the capital of the Bahamas, but when it comes to Nassau groupers, the Out Island San Sal must be the grouper capital.

LONG ISLAND AND CONCEPTION ISLAND

Our next destination has an even stronger Out Island vibe. Long Island has a super laidback, away-from-it-all atmosphere. The island gets its name because it is just 4 miles across but 80 miles long, with a population of 4,000. We're staying in the north at **Stella Maris Resort Club** and diving with their water sports crew, both of which are very hospitable and relaxed. From here you are able to dive Long Island's local reefs, visit a wreck, make a shark dive or take a day trip to

Left: **A tiny roughhead blenny watches the world go past its hole. San Salvador's coral reefs are rich in macro life.**

Below: **Sharon Battison enjoys a close encounter with one of the many friendly and large Nassau groupers that make their home on the reefs.**

Oppsite: **Adam Hanlon hovers above a gathering of blue-striped grunts on the lush reefs of San Salvador.**

Conception Wall, one of the most famous in the Bahamas. A drive south on Long Island reveals **Dean's Blue Hole**, much loved by freedivers as it is the world's deepest known blue hole at 663 feet.

Our first dive is at the 103-foot ***Comberbach*** wreck, which sits upright in close to 100 feet of water; it is impressive, with good growth on it. The propeller is almost unrecognizable for all the encrustation. What really blows me away is the amazing water, which is exceptionally clear and an almost luminescent blue. Omar Daley, our instructor and skipper, has been diving Long Island for more than 20 years. He says that he has seen huge spawning schools of Nassau grouper at the wreck — "50 feet wide and 80 feet tall around the winter full moons. We even get whale sharks hanging around to feed on the eggs."

We sample a shark dive, which attracts a handful of regular Caribbean reefs and blacktips. It is quite a contrast to the high-voltage shark dives I have done elsewhere in the Bahamas, but it would certainly make a good introduction to shark diving because it is only 30 feet deep and the few sharks generally keep a healthy distance. As historical perspective, Stella Maris was the first dive operation in the Bahamas to offer a shark-interaction dive at **Shark Reef**.

Adam Hanlon inspects the rich marine growth, including colorful sponges, on the wreck of the *Comberbach*, off Stella Maris, Long Island.

My favorite dive is at **Split Rock**, which is a pretty, shallow reef, with a high diversity of life. I spent time with an attractive school of horse-eye jacks and then watched a queen angelfish chomping through a sponge. Omar also loves this spot: "It's great for fish life, particularly with the friendly jacks that just follow you around. It feels like an aquarium with so many varieties of fish. It is bright and shallow, a perfect starter for people's trips."

The next day we make the 16-mile crossing to Conception Island. The calmer summer months are best for visiting the 2-mile-long Conception Wall, which reaches up to 55 feet from the ocean depths. We make two drift dives on the wall, which is rich with sponges — barrels, elephant ear and dark volcano sponges and lots of deepwater gorgonia. Groupers and lobsters are common, and the whole place has a healthy, untouched feeling. Omar says summer is the best time for mantas, and divers sometimes see hammerheads or tiger sharks in the deep distance.

The top of the wall is quite deep; we're diving on air rather than nitrox, so we are soon cruising above it, in the blue with the scenery clearly visible below us. Suddenly we hear clicks and whistles, then moments later a bottlenose dolphin blasts into view, makes a few circuits of the group to check out everyone individually, and then he's off. He was only in view for a minute or two, but the memory of an encounter with this wild dolphin will live much longer.

All our dives are from the large and comfortable ***Solmar 2*** dive boat. In addition to ample space, there is plentiful time. The dives sites are between an hour and two and a half hours away, which means full day trips. On both days, we pull in close to shore between the dives and find ourselves alongside deserted beaches of powder-white sand and inviting, glass-calm turquoise waters. They are places so beautiful that when I'm back home in England under leaden-gray skies I can't quite believe such places really exist.

This seems ideally suited to the guests here, who love the feeling of being on "island time" and aren't necessarily trying to fill their logbook as fast as possible. They appreciate having the beautiful ocean to themselves, with no other divers or boats in sight. The reefs feel untouched, and we see sharks on every dive. It really is like diving back in time.

Deep in the center of Andros Island, Cousteau's Blue Hole is an otherworldly freshwater adventure.

Andros and the Exumas

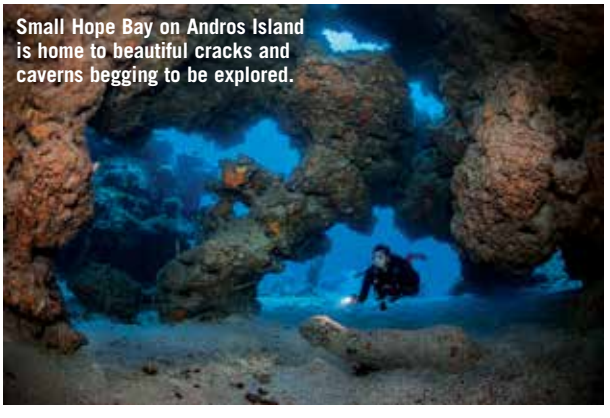
TEXT AND PHOTOS BY BERKLEY WHITE

ANDROS

It seems impossible that the largest island of an archipelago could be the best-kept secret. Andros Island is only 200 miles from Florida and is lined by one of the largest barrier reefs in the world, but it's an island that time passed by. Big jets pass overhead, and cruise ships skirt its shores, delivering honeymooners and highrollers to the large hotels, mega-yachts and casinos of Nassau. My 15-minute flight from Nassau was a time machine to another world. As I crawled out of the tiny plane, the large smiles and firm handshakes confirmed this was my kind of place.

Andros is home to one of the oldest dive facilities in the world, which served as a base for Jacques Cousteau and was also where pioneering underwater photographer David Doubilet cut his teeth as a divemaster, guiding tourists 175 feet deep week after week.

In my short three-day visit I got only a small taste of the 2,300-square-mile island that is sliced and diced by waterways and pocked with hundreds of blue holes. The most accessible blue hole is a giant one near **Small Hope Bay**. Here your dive begins in a narrow slot canyon on top of the reef, drifts deeper and finally emerges into an otherworldly crater the size of a small



Small Hope Bay on Andros Island is home to beautiful cracks and caverns begging to be explored.

stadium. The dramatic lighting and size make you feel like a true cave explorer, but the magic is you get that rush without ever going deeper than 100 feet.

As further variation on the blue hole we drove into the bush to make a brief dive into historic **Cousteau's Blue Hole**. We hit this iconic inner-island hole on a green water cycle but were treated to fragile algae formations that seemed to ooze from the walls while we were suspended over an endless black hole to the center of the earth.

This feeling of being a cave adventurer can easily be continued on most of the outer-reef dives, where endless cuts and caverns in the shallow reef dump you into the rich blue of the outer wall face. The shallow reef begins in as little as 10 feet of water, and with more than 60 dive sites available from Small Hope Bay, I left

Below, from top: **An old drug-running plane is now a ray aggregation reef in the Exumas. The Bahamian Defense Force cutter *Austin Smith* can be a haunting sight when lit up at night.**

feeling like I'd barely immersed myself in the many options. Whether shallow dives to coral gardens along the Andros Barrier Reef, vertical walls along the Tongue of the Ocean or spectacular silverside-clogged caverns like **Dianna's Dungeons**, my time was impossibly brief for the extraordinary opportunities presented.

EXUMA ISLANDS

I repacked my cameras and dive gear for the 15-minute flight back to Nassau to rendezvous with the dive liveaboard *Carib Dancer,* bound for the Exumas. The Exuma chain is a sinuous bridge of sand and stubbly rock bisecting the Bahamas for more than 130 miles. I had previously explored the southern part of the chain and was looking forward to new sites in our northern itinerary. While the southern islands feature popular dive sites (and even swimming pigs), I had heard tales of great walls and sites holding large numbers of fish in the north.

Diving by liveaboard is the best way to see the diversity of a large island chain such as the Exumas, and I was lucky to join a friendly group of skilled divers led by a fantastic crew. Unlike land-based diving, liveaboard ships can work a greater range of dive sites and typically offer more dives in a day. For me nothing is more peaceful than to be at sea for a few days and wake up to an anchor drop at a great dive site. While the weather ultimately limited our cruising range, I was able to see

The Exuma Cays Land and Sea Park was established in 1958, one of 25 national parks and protected areas managed by the Bahamas National Trust. Marine life has flourished in this no-take zone, and creatures such as this gray angelfish are easy to approach and photograph.

sites that further opened my mind to the diversity of the Bahamas.

The northern Exumas feature plunging walls and narrow canyons, crags often teaming with bait fish and hunting jacks. We kept our eyes to the blue and were treated to a few close passes by eagle rays and a gigantic school of spadefish so immense I could only fit a third of the school into one frame. My favorite dives were spent exploring shipwrecks like the ***Austin Smith*** and even a few downed airplanes. While each wreck had an interesting history, it was the abundance of marine life that I found most inspiring. These scuttled wrecks are not just visually compelling but also have created a harbor for fish, eels and Caribbean reef sharks.

Like many divers, I grew up thumbing through dive magazines and catalogs featuring underwater images from the Bahamas. Ultimately, it was the emergence of the Bahamas as a world-class shark-diving destination that has kept me coming back for the past 15 years. On this assignment I was privileged to meet generations of locals who want to preserve these legendary reefs, and I was able to witness first hand reefs that mirror the stories I've heard and even reflect the classic images I've seen. Low-impact diving tourism is one of the micro business models that we can help grow with our tourism dollars, and it provides locals with a cash-in-hand reason to keep fish on the reef. I will be bringing my friends to the Bahamas with me next year! AD

AMERICA'S REEF

THE NEXT GENERATION

TEXT BY NED AND ANNA DELOACH
PHOTOS BY NED AND ANNA DELOACH AND QUINN RIESCH

"As soon as we cross Jewfish Creek things change," I say half to myself and half to Quinn, my 13-year-old grandson, who has his nose pressed against the car window. He is staring west, drinking in a mangrove-lined waterway leading into Florida Bay as we near the top of the bridge crossing Jewfish Creek — the first and one of the tallest of 42 bridges spanning the 127-mile stretch of U.S. 1 known as the Overseas Highway. The historic ocean-going roadway we are about to explore connects 37 islands of the Florida Keys before finally running out of islands to connect at Key West.

"Your grandfather is right about that. The Keys have a way of mellowing you out," Anna (Nana) affirms from the back seat, her face also pasted against the glass.

"Hold onto your hat," she adds as our hatchback tops the crest and coasts down the slope toward Key Largo. "This is going to be fun."

Less than four hours later the three of us are zipping over the sea on our way to **Molasses Reef**. Anna and I have been diving more than 60 years and have made thousands of dives, many in the Florida Keys, often at Molasses. This will be Quinn's first everything, and he's excited. He should be.

Molasses Reef is a 45-minute boat ride from our resort on the bayside (western side) of the long, narrow island known as Key Largo. Our vessel, with a dozen or so divers aboard, slows to enter a house-lined canal excavated straight through the island's limestone rock years ago when you could do such things. Leaving the channel, we race across a lagoon before slowing once again for a winding ride through a mangrove forest. Then we're on open sea heading for the outer reef — a coral fortress paralleling the long arch of 1,700 low-lying limestone islands known as the Florida Keys, which are the remains of an ancient reef.

The reef line where we're headed is the longest and largest coral reef in the continental United States — a wilderness surviving on the northern fringe of where reef-building corals can grow. Nonetheless, the reef is immense. If the structure weren't interrupted here and there toward the south it would be the fourth-largest barrier reef on Earth. We're fortunate to have such a treasure on our doorstep. Like Yosemite, the Grand Canyon and the Appalachian Trail, it's our heritage, it's a part of who we are. I can't think of a better place for Quinn to make his first ocean dives than on America's reef.

Anna and I are on a mission close to our hearts: We are introducing our grandson Quinn to diving. He and two cousins were certified four months earlier. The kids' instruction was excellent, but the checkout dives were conducted in a Florida spring basin, quite different from making a giant stride off a boat into the open sea. Anna and I agreed that his first reef dives should be made with an instructor. So soon after July 4, the three of us set off on a two-week road trip to the Florida Keys — a classic tropical destination renowned for topnotch dive operations, fishy waters and fun.

THE *BENWOOD* AND THE LIST

Quinn's time with an instructor works its magic. Two days after arriving he is relaxed, assured and ready for adventure; and an adventure is exactly what he gets on the ***Benwood***. This World War II-era wreck, twisted into a tangled mass from a half-century beneath the waves, has become a magnet for sea life. When we arrive, the wreckage swirls with fish feeding on a big

STEPHEN FRINK

This aerial photo shows the spur-and-groove coral formations at Molasses Reef.

Below, from left: Bluestriped grunts are packed under a reef ledge off Tavernier. Yellowtail snapper feed on a million-minnow meal on the bow of the *Benwood*. Fringing reefs provide habitat for various fishes, including porkfish.

ball of silversides attempting to hide inside the bow. Predators are everywhere, fat, happy and toying with the million-minnow meal at their leisure. At least two dozen black groupers lurk in the shadows, ambushing the minnows from below while bar jacks and yellowtails strike from above. The frenzy has everything agitated; even green morays are swimming in the open. When I finally climb back aboard, Anna and Quinn are still talking about their adventure.

"Tell Papa what you saw, Quinn."

"A manta," he chirps with a grin as big as the *Benwood*.

"Where?" I ask, a bit uncertain he actually made such a rare sighting.

"Off the bow, not far from where you were photographing the minnows," Quinn replies. "I pointed it out to my instructor and the lady with us. They saw it, too."

"Can you believe it?" Anna adds as she switches tanks. "That's some impressive fish to add to your list."

To help Quinn become acquainted with the wildlife, we suggested that he write down the names of fish species he sees during the trip. Counting the manta, he added six new names to the list on the *Benwood* including the green morays, tarpon and, of course, the gang of well-fed black grouper. We've also scheduled several shore visits during our stay to learn about other facets of the underwater world and to become familiar what is being done to protect marine creatures and the environment.

AN UNDERWATER HOTEL

That afternoon we pull into a parking area next to a mangrove lagoon, the home of the **Jules' Undersea Lodge**, for a tour of the world's only underwater hotel. The submerged habitat, which can sleep six aquanauts, started its operational life in the early 1970s perched on a 60-foot sand shelf off Puerto Rico, where it served as one of the earliest underwater research labs. Quinn and I slip on scuba tanks and navigate a circuitous route across the lagoon. Waylaid by a contingent of shallow-water fish, we arrive late, but we add five more species to the list.

For decades I've heard about the exploits of aquanauts living beneath the sea, occasionally for months at a time. Even with all my reading I had no sense of the intrigue involved until I popped up through the moon pool inside the habitat's wet room. This and the three attached rooms, kept from flooding by a constant flow of compressed air, are stark but well appointed. A pair of round 42-inch windows dominates the space with a warm yellow-green glow and views of passing fish.

SEVEN MILES OF BRIDGE

The following morning we leave Key Largo early for a 77-mile drive to Big Pine Key — the home of **Looe Key Reef** and a gem of a place to dive. Our two-hour drive carries us over much of the Overseas Highway — a destination in its own right. At the start, along the upper Keys, the sea is nowhere to be seen, but as we continue southwest the bridges separating the Atlantic from Florida Bay become longer and longer until soon we're surrounded by water. Bridge after bridge crosses a balmy blue world punctuated with boats and islands. By the time we reach the famous Seven-Mile Bridge on the south end of Marathon, it is easy to believe that the Earth's surface really is seven-tenths water.

The Seven-Mile Bridge runs parallel to an old railroad trestle — a remnant of the first land connection between the mainland and Key West. The ocean-going extension of the Florida East Coast Railway, dubbed "Flagler's Folly" at the expense of tycoon Henry Flagler, who single-handedly financed the ill-fated enterprise, laid its first track in 1905. Completed in 1912, trains ran the line for 22 unprofitable years before receiving a knockout blow from the Labor Day Hurricane of 1935. With no appetite

From far left: **Key deer feed at Big Pine Key. A resident goliath grouper of Looe Key reef parades past with an entourage of bar jacks. Quinn swims over one of the two giant radar dishes on the *Vandenberg*.**

REAL AMERICA'S REEF

to rebuild, what remained of the railway was sold to the state. Following a bit of creative thinking, a two-lane asphalt road was built on top the existing trestles 15 feet above the old tracks, making it possible for automobiles to drive all the way to Key West for the first time.

We arrive at Big Pine Key, the gateway to the lower Keys and just 22 miles from Key West, at 7 a.m., too early to check in at the dive shop, so we go hunting for deer — Key deer to be exact, the islands' miniature version of whitetails, not much larger than Irish setters. We follow Anna's GPS to a suburban crossroads where they are reported to hang out. And sure enough we spot three does and a fawn nibbling grass by the road. Quinn lowers his window and takes a photo.

The high-profile spur-and-groove reef inside Looe Key National Marine Sanctuary has long been one of my favorite dives. Even though fishing is allowed, wire traps, spearfishing and fish collecting have been banned for three decades, allowing the marine life to grow large and plentiful. Almost before the bubbles clear Quinn becomes part of a parrotfish school passing under the boat. A diver-friendly angelfish nips the bubbles about his head as he kneels on the sand. Around a bend he sees a reef shark in the distance. He swims after it to get a better look — a good sign. Even more surprising, a 5-foot, 450-pound Goliath grouper makes a slow pass — a beneficiary of 1990 legislation protecting the species. An encounter with such a large fish would have been unheard of four decades ago when I first dived the Keys.

KEY WEST AND THE *VANDENBERG*

We arrive in Key West mid-morning and stop at the new Florida Keys Eco-Discovery Center. The state-of-the-art educational center offers an opportunity to learn about the area's wildlife, habitats and conservation efforts — a message we want Quinn to hear. We begin by learning about the Florida Keys National Marine Sanctuary (FKNMS), which is one of 14 underwater parks managed by the National Oceanic and Atmospheric Administration (NOAA). The FKNMS, established in 1992, covers nearly 4,000 square miles from south of Miami to the Dry Tortugas (an additional 70 miles by sea from Key West). Two previously established preserves, the Key Largo National Marine Sanctuary and the Looe Key National Marine Sanctuary, were enveloped by the larger and more empowered FKNMS.

These days diving Key West almost has to include a visit to the **USS *Vandenberg***, a 523-foot missile-tracking vessel that now towers 10 stories off a 140-foot hardpan bottom seven miles south of Key West. Since its deployment in 2009 as an artificial reef, the massive ship has attracted divers and fish by the tens of thousands. With his new advanced certification and by diving with an instructor, Quinn is allowed to explore the vessel's superstructure that rises to within 50 feet of the surface. Our only worry is current, which occasionally sweeps the *Vandenberg* with significant force.

Quinn's luck keeps running. On the morning we arrive at the site along with a boatload of volunteer fish surveyors from the Reef Environmental Education Foundation (REEF), barely a ripple stirs around the mooring line, and visibility hovers near 80 feet. The *Vandenberg* seems to go on forever, even after a 20-minute trek from radar dishes to stacks, kingpost and masts with crow's nests attached, we are only able to take in half of the sights. As a bonus, an immense 30- by 40-foot American flag was attached to the forward antenna mount on July 4. It usually blows with the currents, but now in the calm it cascades down in billowing folds of red, white and blue.

Observing the fishwatchers in action made the idea of fish identification even more appealing. The surveyors made up of staff, interns and volunteers are monitoring the *Vandenberg* as part of a multiple-year fish-

From left: A juggler provides evening entertainment on Mallory Square in Key West. Key West's famous night life cranks up on Duval Street.

population census. REEF volunteers also study invasive lionfish and spawning aggregations. Quinn soaks it all in.

No trip to Key West would be complete without sampling a bit of nightlife, although some of it is a bit over the top for our grandson. When he grows up we'll suggest he come on Halloween and whoop it up at Fantasy Fest, a party like none other. For now, following an early dinner we roam Mallory Square and Duval Street where Key West and Margaritaville coalesce into one of the world's favorite perennial party towns. But after a long day on the water and with two dives scheduled for the morning, we leave early and head back to the hotel for a rest.

A MARATHON ADVENTURE

Following the morning dives we pack and drive 50 miles back up the highway to Marathon. On leaving Key West, Quinn's species list stands at 75, thanks in great part to the fish surveyors. By the time he hits the water at the **Pillar Patch** off Marathon, he has nothing but fish on his mind. With the help of a fish-savvy guide, he adds 20 more species during the next four dives, which puts him enticingly close to his trip target of 100.

In the afternoon we are back underwater, but this time inside a huge aquarium at **Florida Keys Aquarium Encounters**, Marathon's new marine life adventure park. This is quite an operation, offering feeding encounters with rays and snorkeling trails, but the high point for us is Quinn and Anna in the main display tank feeding fish from plastic dispensers. With the first squirt, the pair disappears behind a cloud of eagle rays, lookdowns, snapper, hogfish and parrotfish. It's a hoot!

Back on the reef the next morning, Quinn needs five fish to reach his goal, so Anna and I take him out on the flats and show him how to sneak up on sand dwellers. It isn't long before Anna points out what becomes number 100 — a ghost-white sliver of a fish hovering above its burrow. She scribbles "Seminole goby" on her slate with a big 100 to the side. But milestones don't end here. While showing Quinn the eyes of a conch, I notice a small fish flitting inside the shell's pink spiral. It is my turn to celebrate: It's a conchfish, a species I've personally been hunting for 40 years.

Following a nap, we slip on flip-flops and shorts and head for **The Turtle Hospital,** a vintage mom-and-pop motel turned into a hospital and rescue operation. The facility's main attractions are housed in big, blue basins beside the bay where visitors meet recuperating patients and hear their stories. The turtles paddling around the clear pools have all sorts of ailments — some were hit by boats, others were recovering from tumor surgery or were found entangled in nets. One tiny leatherback, with its yolk sac still attached, was recently rescued from a bayside marina where it washed ashore. It will be nourished until stable and then taken 30 miles offshore and released in a float of *Sargassum*. The visit leaves us feeling good about turtles and people.

Our next stop is Tavernier, a small community just south of Key Largo. The reefs are closer to shore here, and the ledges overflow with grunts and snappers. Quinn is on his game, relaxed, excited and enjoying life in general. To top off a great day on the water, a manatee the size of a cow munches algae off the dive platform as we unload gear at the dock.

A TOUCH OF HISTORY

The **History of Diving Museum** in Islamorada should be a place of pilgrimage for everyone who loves diving. It certainly hits the mark with Quinn, who tries out 20-pound dive boots, mans an old-fashioned air pump until he pops a balloon, pokes his head inside a half dozen helmets, attempts to lift a silver bar taken off a Spanish galleon and, during the process, learns a lot about the sport he is just beginning.

Quinn and Anna feed fish in the tank at Marathon's Florida Keys Aquarium Encounters.

From left: A rescued baby loggerhead is in the care of The Turtle Hospital in Marathon. A graysby grabs a creole wrasse on Mike's Wreck off Key Largo.

R E AMERICA'S E F

From left: Denise Nedimeyer shows Quinn how to propagate staghorn coral at the Coral Restoration Foundation's nursery off Tavernier. Old dive helmets are on display at the History of Diving Museum in Islamorada.

REEF

AMERICA'S

Blue angelfish

The modern history of exploring beneath the sea began in 1691 with British astronomer and polymath Edmond Halley inventing the first diving helmet. For the next 250 years his idea of the free-flow helmet dominated undersea technology. This part of the diving story is told by the magnificent helmet collection of the museum's founders, Joe and Sally Bauer. The helmets displayed on the international wall are objects of art as much as technology. But helmets are only the beginning. Every turn takes us on another adventure, from treasure hunting to commercial diving and on to the rise of scuba and underwater photography. As one might expect from such a charming place, even Captain Nemo and his fantasy of living beneath the sea have a place of honor. Our planned two-hour stay slips into four hours, and we're still not ready to leave.

A GIFT TO THE SEA

Ever since Quinn heard about planting coral he was smitten by the idea. A gardener in his own right and a mission man at heart, the possibility of transplanting coral was right up his alley, so Anna and I set up a day on the water with friends Ken and Denise Nedimyer, founders of the **Coral Restoration Foundation** (CRF).

Ten years ago the thought of hand-building coral reefs sounded as preposterous as Captain Nemo's voyages beneath the sea. That was before Ken, a live rock farmer for the aquarium trade, began cultivating staghorn, a fast-growing coral that once covered reef crests throughout the Caribbean. For several reasons the once prolific species died off across the western Atlantic over the last decades; Ken and others watched in dismay as staghorn gardens up and down the Keys crumbled into rubble.

A few years ago, the larvae of staghorn coral settled en masse on Ken's live rock nursery. By law no one can legally sell coral, so at first Ken simply kept an eye on the orphans and watched them grow and grow. Out of curiosity he began clipping segments and attaching them to cinder blocks. Lo and behold, the cuttings grew like weeds. He continued to innovate until coral dominated his nursery. What to do?

The FKNMS was aware of Ken's initial success and felt they had nothing to lose, so they issued a permit allowing him to transplant his homegrown corals on the outer reef. His reefs flourished and the permit was extended and expanded. Then Ken and Denise began to think big. But like most big ideas, this one required time, money and manpower. Manpower is where Quinn comes in. Volunteer divers have helped maintain the nursery, transplanted patches of corals up and down the Keys and recently built new nurseries in Colombia and Bonaire. Today, Ken, Denise and the CRF dream of nothing less than reseeding the entire Caribbean Basin (see Page 17).

"Will it work?" I ask Ken as his open-hull workboat skims toward the nursery grounds. "We're like Lad Akins and REEF, who are combating the lionfish invasion," he replies. "Skeptics love to remind us that we're wasting our time. They say, 'You'll never get rid of lionfish; you'll never rebuild reefs, the job is just too big.'"

He cranks up his voice a notch to be heard over the engine. "I'm certain of one thing: Whatever the outcome, our efforts beat the heck out of doing nothing."

Navigating the nursery is like swimming through a china shop. As far as one can see, thousands of coral fragments dangle like wind chimes from PVC trees held aloft by floats. Quinn moves through the maze like a fish and hovers like a cloud while scraping algae off the plastic scaffoldings. When he is finished, he kneels next to Denise, watching her demonstrate how to break and string pieces so they will hang free in the currents.

After attaching the fragments, Ken and Quinn detach four mature 12-inch clusters from a branch, put them in plastic breadbaskets and head up to the boat for a run to **Snapper Ledge**, where the work and fun continues. It takes the entire second dive for the pair to putty pieces onto two square meters of reef rock. Near where they work a healthy 2-foot-high ridge of previously planted staghorn snakes its way along the ledge. To my eyes, Ken's corals are the best thing this section of the reef has going for itself. However, just to the north and across a long rubble patch is the dive site most know as Snapper Ledge, impossibly jammed with clouds of blue-striped grunt, French grunt and goatfish. For whatever reason, this low-profile ledge holds far more fish than similar reef structures in the nearby region and is in consideration for the greater protection afforded by the designation as a marine protected area. That's part of the genius of the FKNMS; there are designated zones with very specific tiers of protection that hope to satisfy the various stakeholders, whether they be hook-and-line anglers, spearfishermen or just observers and underwater photographers like us.

Out of his gear and brimming with confidence, Quinn takes the helm and steers us back to shore. Between all the day's work he added two final fish to his list — numbers 125 and 126.

Before our eyes Quinn has become a diver, but the second part of equation is equally gratifying: He recognizes that the strange new world he just fell in love with needs his help. The sea is our gift to Quinn, and Quinn is our gift to the sea. AD

Voluntourism

A Good Dive, a Good Deed

BY MELISSA GASKILL

Cocos Island National Park, a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site, sits a day-and-a-half boat ride off the Pacific coast of Costa Rica. In the waters that surround the island, hundreds of scalloped hammerhead sharks wait their turns at cleaning stations around the reefs. Groups of whitetip reef sharks glide through the water alongside individual blacktip, silky and Galapagos sharks, while the occasional massive whale shark plows to the surface. Meanwhile, dozens of marbled and eagle rays — along with pods of bottlenose dolphins, enormous schools of jacks and endemic fish found nowhere else on the planet — join the shark fest.

"It's the most incredible underwater place I've ever been," says Todd Steiner, executive director of the California-based Sea Turtle Restoration Project. "It's a superhighway of giant animals — like the plains of Africa, only underwater."

Steiner explains that, for hammerheads, being cleaned is akin to receiving a massage. Human observation does not appear to affect the behavior at all: "The hammerheads are calm and just slowly cruising, and they'll look right at you." Even human behavior can change in the Cocos: "In most places, when you see a shark you call everybody over to look, but here you see so many sharks and rays that you stop noticing them," Steiner says. "The schools of fish go 60 feet up and down and as far as you can see — tens of thousands or even hundreds of thousands. For me, it's like seeing what the oceans must have been like hundreds of years ago."

Because Cocos Island is both remote and protected, it can be difficult to visit, and only the most serious marine wildlife enthusiasts make it there. When divers travel to Cocos, they're often visiting for something more than simply viewing the spectacular marine life — many of them are volunteering to participate in research aimed to protect the organisms that live in those waters.

Most Cocos Island research seeks to determine whether the underwater park is large enough to protect the endangered species there. Preliminary data suggest that most of the animals are residents rather than just transiting through. Even though they spend the majority of their time within the no-take zone, however, they also occasionally wander out of it. A larger area would provide more protection. "It's great for sharks and sea turtles to be protected at Cocos," Steiner explains, "but as soon as they leave, they fall victim to longline fishing. We see sharks and sea turtles with hooks in them all of the time." And these are only the ones who make it back to the island's protected waters.

Because the animals regularly move outside of the protected areas, a related research question regards how species at Cocos are connected to those in the surrounding Eastern Tropical Pacific islands. Steiner's work indicates, for example, that hammerheads tagged at Cocos routinely swim to the Galapagos and to another island off the coast of Colombia. Tissue samples from the animals also provide genetic information that helps determine the relationships between different organisms. This genetic research demonstrates that green sea turtles migrate to Cocos from the Galapagos, mainland Ecuador, Mexico, Costa Rica and the Western Pacific. "Even though Cocos is a foraging area for animals from around the world," Steiner says, "and green sea turtles spend their teenage years here because it has good food resources to help them grow to sexual maturity, the question remains whether the marine reserve is big enough."

In the case that the reserve is not big enough to protect all of the species that find either temporary or permanent homes in the protected area, Steiner also wants to document the need for designated pathways that will allow marine life to safely move between marine protected areas. Data showing the connection between Cocos and the Galapagos, for example, bolsters the argument in favor of a protected swimway between these ocean hotspots.

Brad Nahill, director and cofounder of SEEtheWILD, one of the nonprofit organizations that connects

Sea turtles and hammerhead sharks enjoy protection within Cocos Island National Park but are vulnerable to longline fishing when they swim outside protected waters. Volunteer divers capture, weigh and tag marine life to determine migratory patterns and assess fishing risk.

NONIE SILVER

travelers with volunteer and wildlife conservation programs, including the one at Cocos Island, points out that protecting wildlife is a big job and the people who are doing it need help, especially in underwater habitats. Divers possess unique skills that allow them to contribute in a number of ways, including cleaning up debris (especially old fishing gear), clearing invasive species and collecting information about coral reefs and other organisms. The extra help is especially vital in countries where governments invest too few resources in protecting the marine habitats on which locals often depend for their livelihoods. For researchers, volunteer divers represent much-needed practical and financial support.

ANDY SALIMON

At Cocos Island, expedition leaders teach volunteer divers how to capture, weigh, measure and tag sea turtles as well as how to apply acoustic or satellite transmitters. This year Cocos volunteers will help add to the 150 sharks and 74 sea turtles tagged on previous expeditions and recover data from underwater acoustic receivers. Mark Stabb, a mechanical engineer from San Diego who recently participated in his seventh Cocos Island shark and sea turtle research trip, says he combines diving with volunteering for two main reasons: "First, it's an experience you're not likely to get anywhere else. You're working with researchers, seeing and doing things that you can't always see and do. If you go to Hawaii and put your hands on a turtle, you'll pay a big fine, but at Cocos I've personally caught probably a dozen green turtles so they can be weighed and measured. Second, you're also doing something beneficial for the world by helping to make sure that others will be able to see these animals as well."


STEPHEN FRINK


STEPHEN FRINK

From left: **Longline fishing is efficient and destructive. Apex predators like sharks are particularly susceptible.**

The Seahorse Trust uses volunteer divers to help them protect seahorses, 150 million of which are taken from the wild each year for traditional Chinese medicine.

Capturing a sea turtle on a dive is an amazing experience, but volunteer divers at Cocos can do as much or little of the scientific work as they want. Stabb, who considers himself a hands-on person, tries to do everything, but he also recognizes the value of volunteers who choose to observe: "I've seen plenty of people who come and are happy just to watch, and Todd [Steiner] is happy to have them. Having people along is effectively funding the research."

For volunteers at Cocos, the opportunities to engage in a variety of tasks are many. Nonie Silver, a Washington, D.C., business owner and participant on many of the Cocos Island expeditions, says she often serves as the logistics person: "The shark tags need to be prepped and tasks defined for each of the dives, whether we're retrieving receivers, catching turtles or tagging sharks. For example, when we catch a turtle, there are a series of steps that need to be completed before the turtle can be released back to the sea.

"It makes you feel good that you're doing something to help," Silver continues. "In other places you see the lack of fish or coral, and it makes you appreciate the fact that this one little thing you're doing may help the ocean."

Volunteers can also help by taking photographs; the researchers maintain a photo identification library in cooperation with local dive operators. These photos, Steiner explains, help him track individual animals even when he isn't there in person.

Tagging sharks is a bit trickier because it involves using a spear to inject a tag at a specific point on the shark's body. The Cocos Island National Park's rules require that volunteers who would like to help with this task have a scientific background and relevant experience, but anyone can help count sharks and rays, which is an important element of documenting population trends. For these jobs, divers receive instruction in species identification and survey techniques and then use an underwater slate to record location, time and depth at five-minute intervals for each species they spot. Still other volunteers remain on the boat and record this data on computers.

Cocos Island provides only one of the many opportunities to contribute to marine science and conservation work. In other locations, the Reef Environmental Education Foundation (REEF) asks volunteers to help cull the increasing numbers of invasive lionfish prowling their favorite dive sites. The organization is documenting the consequences of the lionfish invasion in hopes of ultimately minimizing its effect on native fish populations. Under the direction of Lad Akins, REEF director of special projects, and Peter Hughes, founder of DivEncounters Alliance, up to 20 divers at a time can participate in lionfish collection and dissection in addition to reef fish surveys.

Pam and Terry Hillegas of Englewood, Colo., have taken six REEF lionfish trips to various locations and say that their trips have made them more aware of the ways that invasive species can affect the ocean. According to Terry, the service and educational aspects of the trip added an enormous amount of value to his experience: "That really made the whole experience more interesting for us. I feel like I'm doing something beneficial and not just enjoying recreational diving."

"Lad and Peter are very knowledgeable and show you how to correctly handle lionfish so you don't have any mishaps," Pam adds. "It's amazing how comfortable they can make you feel handling these fish." Those who are interested in taking these expeditions but don't care to spear or bag lionfish can also do surveys to count the lionfish and the other species on individual reefs.

Organizations such as REEF have a larger effect on the environment than one might think. "I dive quite a bit in the Caribbean and realize the damage that lionfish do," says Calvin Roggow, a volunteer from Oklahoma. "REEF seems to be at the forefront of actively trying to control them. We go back because the trips are so enjoyable; it's really a great time, and you're doing a good thing for the ocean."

For divers looking to travel a bit farther afield, Projects Abroad offers two land-based volunteer diving projects in Southeast Asia — one in Cambodia and the other in Thailand.

On the Cambodian island of Koh Rong Samloem, a two-hour boat ride from the coast, divers help survey marine habitats as well as coral and fish diversity,


COURTESY PROJECTS-ABROAD.ORG


STEPHEN FRINK


COURTESY REEF

Clockwise from upper left: **Volunteer divers conduct a salvage dive to remove fishing line and other debris from a coral reef in Thailand. Peter Hughes and Lad Akins often lead REEF expeditions to count lionfish populations, and for those comfortable doing so, spear and bag them. Lionfish are an invasive species in the Caribbean, and volunteers are helpful in eradication efforts.**

focusing specifically on seahorses. "We work with an organization called The Seahorse Trust, which collects data to track migrations and populations and support their preservation," says Projects Abroad program advisor Christian Clark. More than 150 million seahorses are taken from the wild each year for use in traditional Chinese medicine, while the souvenir and pet trades take another million or so each. These programs aim to help protect seahorse species from exploitation.

The beachfront, four-person wooden bungalows at Koh Ron Samloem have bathrooms, bucket showers and a few hours of generator-provided electricity each evening. Everyone dines in a communal area with space to relax, play games and enjoy the view from a hammock. "Sea turtles are commonly seen on the reef, and you're pretty much guaranteed to see seahorses, which are fairly rare and very cool," Clark says.

Volunteers can assist in beach and underwater clean-up, in addition to teaching conservation and sustainable practices at the village school and through community projects. Program participants also help tally shark sightings for the organization's Global Shark Campaign, which spans 18 countries.

The Thailand project aims to protect and rehabilitate Thailand's coral reefs, marine ecosystems, tropical forests and the animals that live in these habitats. For these efforts, volunteer divers conduct reef and debris surveys, collect data and perform salvage dives to remove fishing nets and other debris from the reefs. For the land-based work, the program teams up with a local conservation organization that focuses on the forest. Volunteers also work with locals: "We have done school programs, such as working with children to start a tree nursery," Clark says, "and we also do beach clean-ups and other activities in the community." One particularly popular activity, for example, included a release of mangrove crabs and sea snails.

In the Caribbean, the Oceanic Society monitors and assesses the overall health of coral reefs around Turneffe Atoll off the coast of Belize. Society researchers provide training in sampling techniques and the identification, behavior and distribution of local fish and invertebrates. During six days of diving, volunteers spend about four hours a day collecting data and are able to enjoy purely recreational diving the rest of the time. The research helps direct marine management efforts, providing evidence of how human activities affect the reefs.

For these projects and similar opportunities, voluntourists come from all over the world. The opportunities are ample for divers, but nondiving family and friends can also participate in land-based activities or take advantage of dive certification courses (up to advanced open-water level) that are offered as part of the trip package.

Combining volunteering with a dive trip not only benefits the marine environment and local communities, but it also proves to be memorable for those who participate. "It provides life-changing experiences for travelers," Nahill says. "There is no deeper way to build a connection with a place than by leaving a legacy of conservation behind." AD

Doctors trained in dive medicine recommend against diving for people with symptoms of an illness. Even minor problems such as congestion or discomfort can amount to dangerous distractions or be hazardous at depth.

STEPHEN FRINK

Communicable Diseases and Close Quarters

TIPS FOR STAYING HEALTHY AT SEA

BY JIM CARUSO, M.D.

One of the most enjoyable aspects of liveaboard dive boats, cruises and group dive travel is the social environment. You can meet some terrific people with diverse backgrounds and sit around in the evenings sharing stories of the day's adventures and previous great dives. Some of the new friendships may last long past the time spent at sea. Unfortunately, with the good may come the bad — and sometimes the ugly. Communicable diseases can be passed among people who share confined living spaces such as those found on cruise ships, liveaboards and commercial aircraft.

While working at Duke University Medical Center in the mid-1990s, I was in the microbiology lab one holiday weekend when a large bag of specimens from more than 35 patients unceremoniously arrived from the student infirmary. The order slip for each specimen read "check for bacteria, ova and parasites," a routine request for patients with severe gastrointestinal (GI) complaints. The patients had been examined by various medical providers, none of whom were aware of the larger picture of the incident. It turned out that all the ill students were women who had spent the past few days going through sorority rush. An examination of a representative sample of the specimens with an electron microscope identified the responsible pathogen as a virus that commonly causes such outbreaks of gastroenteritis. No antibiotics were necessary, and all of the ill students were reassured that their recoveries would be swift and complete.

You would have to be living in a media vacuum to have missed the large number of reports of disease outbreaks on cruise ships in the past several years. Some were so severe that the cruise had to be cut short and medical assets had to be deployed from shore. Reports and images of passengers enduring difficult conditions were broadcast by the media and made quite an impression on the public. Nearly all of these illnesses were caused by viruses belonging to the norovirus family, viruses in the same group as those responsible for the Duke sorority rush outbreak.

There is nothing about these viruses that makes them any more likely to cause disease at sea — wherever there are large groups of people living together for days at a time, the risk of communicable GI and respiratory infections is significant. The additional variable of food service increases the risk.

SHARED LIVING SPACES

The most common diseases spread among people who share living spaces are those that cause upper-respiratory-tract infections (the common cold) and those that cause GI problems. These diseases are typically spread from person to person via respiratory droplets or direct or indirect contact with oral fluids. Fortunately, most of these diseases are self-limited and cause relatively minor symptoms. In rare instances, however, they may cause severe disability or even death. Despite the generally non-life-threatening nature of most of these afflictions, they tend to put an end to the activity that may be the entire reason for the trip: diving.

Viral diseases are by far the most common in close-quarters settings, but bacterial pathogens are also a hazard. Some bacterial pathogens cause disease directly, while others produce toxins that make people ill. This article will provide an overview of the contagious diseases you're most likely to encounter in close or confined living spaces (such as those found on boats), give suggestions for managing or treating them and, perhaps most important, offer suggestions for avoiding these nasty bugs altogether.

STEPHEN FRINK

STEPHEN FRINK

Before traveling, visit *www.cdc.gov/travel* to learn what vaccinations are recommended for the areas you plan to visit.

Opposite, from left: Microbiologists use cultures to help diagnose illnesses. Frequent hand washing reduces your risk of contracting communicable diseases.

VIRUSES

Most of these viral pathogens cause symptoms approximately 36 to 48 hours after contact with an infectious individual. The most common viruses that cause cold symptoms are the rhinoviruses and coronaviruses. These viruses are spread from person to person by respiratory droplets and do not generally cause severe illness. They can, however, affect dive plans by making it difficult to breathe through a regulator or inhibiting a diver's ability to equalize pressure in the ears or sinuses.

While over-the-counter medications may ease symptoms, they may also have problematic side effects or wear off at inopportune times. Some over-the-counter preparations are advertised as curative, but the U.S. Food and Drug Administration (FDA) generally classifies these as nutritional supplements because there is no proof of their effectiveness. Most doctors trained in dive medicine recommend against diving for anyone who has an acute illness — especially if the illness is serious enough to warrant the use of medication.

One problematic group of respiratory viruses is those that cause influenza ("the flu"). Influenza is characterized by respiratory symptoms, fever, body aches and general malaise (i.e., feeling just plain lousy). While the symptoms are more severe than those of the common cold, the treatment is pretty much the same: Address the symptoms. There are effective antiviral medications that are sometimes prescribed for patients with the flu, but in otherwise healthy adults most health-care professionals opt to let the infection run its course. There are fatalities from influenza every year, but these most often occur in the very young, the very old and people who suffer from significant chronic diseases.

Viruses that affect the gastrointestinal tract cause more serious and unpleasant symptoms. The previously mentioned norovirus group is the prototype for these pathogens. These viruses are spread by person-to-person contact as well as contact with objects upon which there are droplets that contain the infectious organisms. Such objects include doorknobs, computer keypads, telephones, exercise equipment and dive gear such as regulators, masks and snorkels.

Most of the large-scale outbreaks that made the news in the past few years were due to these viral GI pathogens. The symptoms typically include nausea, vomiting, fever and diarrhea. Severe cases pose a risk of dehydration and loss of critical electrolytes. Otherwise healthy adults generally do just fine with fluid replacement and treatment of symptoms, but children, the elderly and people with other significant medical problems may require more aggressive medical care. Intravenous fluids and replacement of electrolytes may be required, and prescription medications can be employed to combat the nausea and vomiting.

BACTERIA

Occasionally, bacterial pathogens rather than viruses cause severe outbreaks of gastroenteritis. Bacteria such as salmonella and shigella wreak havoc directly on the cells that line the intestines. Salmonella typically causes fluid loss through watery diarrhea, while shigella can be more invasive, causing bloody diarrhea. Both of these bacteria can cause serious illness.

Most people are aware of the effects of the bacteria *E. coli* — it is the primary reason some restaurants won't serve rare hamburgers. There are various types of *E. coli,* some of which behave more like salmonella and others more like shigella. Treatment for infections caused by these bacteria is very similar to treatment for viral gastroenteritis, but in some cases an antibiotic may be helpful. The means of transmission are identical.

Bacteria that create toxins can cause GI symptoms, and ingestion of the toxin causes illness. The bacteria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STEPHEN FRINK

most often responsible for such infections are in the staphylococcus and bacillus groups. The toxins made by staphylococcus and bacillus bacteria are formed in situations where refrigeration is inadequate or food is left out for prolonged periods, as occurs with salad bars, condiment bars and buffets. Bacteria also produces the less-common but well-known botulism toxin. Symptoms from ingesting these preformed toxins usually manifest in the upper GI tract (as nausea and vomiting) and typically begin soon after ingestion of the tainted food. Foods notorious for this type of infection are creams, soups and desserts. Symptoms in the lower GI tract may follow the period of nausea and vomiting. The illness is self-limited, and only symptomatic treatment is needed.

TRAVEL MEDICINE

Less common but more severe infectious diseases include hepatitis A, malaria, yellow fever and dengue fever. Of those, only the hepatitis A virus can be spread from person to person. While this can be a serious disease, the symptoms do not usually occur until after the afflicted person returns home from a trip. Malaria, yellow fever and dengue fever are commonly encountered medical problems associated with traveling, but they are transmitted by mosquitos and typically acquired during excursions away from the dive boat or cruise ship. A wise traveler will check appropriate travel-medicine websites to ensure he or she is prepared to enter areas where these tropical diseases are common. For the most part, preventive measures such as mosquito repellent and prophylactic medications such as Malarone will do the trick. Symptoms may not occur until long after the traveler returns home.

As mentioned previously, treatment for the GI illnesses commonly encountered during dive travel boils down to supportive care — relieving the symptoms of vomiting or diarrhea while ensuring adequate intake of fluids. Acetaminophen (Tylenol®) may be used to combat the fever and muscle aches that often accompany viral illnesses. In vulnerable populations and extreme cases where there is concern for severe dehydration, intravenous fluids and/or prescription medications to combat the nausea may be required. In the worst cases, patients will need to be evacuated to shore-based medical facilities for treatment.

PREVENTION

Not contracting a communicable disease in the first place is of course preferable to needing treatment. Prior to leaving your home country, ensure all of your vaccinations are up to date, including those for tetanus and hepatitis A. It is also good practice to obtain the annual flu vaccination. When living in tight quarters, whether on cruise ship, a liveaboard dive boat or at a dive resort, wash your hands with soap frequently. Avoid foods that are likely to encourage growth of toxin-producing bacteria; these include meats, sauces or pastries that are left out for prolonged periods, and items on soup, salad and dessert bars that aren't kept hot or cold. The water, and therefore the ice, on cruise ships is generally safe for drinking and brushing teeth, but the same cannot always be said for the water at some resorts and other public places on shore.

By taking these general precautions you can avoid becoming a victim of some common diseases during your time onboard. No one wants to spend thousands of dollars on a trip only to be confined to his or her cabin or, worse yet, sick bay. After all, the goal is to enjoy the underwater world and dive some sites worth talking about during the next trip. AD

IMAGING

CRISTIAN DIMITRIUS

An American crocodile lies low in the mangrove ecosystem of Jardines de La Reina, Cuba.

FILMING THE UNDERWATER WILD

PHOTOS BY CRISTIAN DIMITRIUS / TEXT BY STEPHEN FRINK

It can be difficult to communicate in print the story of a person who is at heart a filmmaker. Cristian Dimitrius readily admits to film being his primary muse, an inspiration nurtured as a young child in suburban inland Brazil. Fortunately, Dimitrius' passion extends to images in any medium, so we have still photos to help tell the story.

Growing up three hours from the sea, Dimitrius' youth may not have been filled with walks along the seashore, but nature in a broader sense was an overwhelming influence. Few of his childhood memories don't involve nature; this is not to say that mundane small-city life did not influence him, but it served more as confirmation of what he wanted his life *not* to be.

He joined the Boy Scouts to learn camping and fieldcraft and eschewed traditional sports such as volleyball and soccer for nature sports in school. His sports were mountain biking, rock climbing, hiking and, on those occasions when his family would drive to the coast, snorkeling near-shore reefs and surfing.

His father was president of a local country club that had a large swimming pool and offered scuba instruction to its members. By participating in a self-study program, Dimitrius learned the academics of scuba and did all the training he could handle on his own in the pool. He realized he needed certification to go farther, so he officially took the scuba class.

What started out as a hobby ramped up considerably around the time he joined the Brazilian army. While enrolled in officer's school Dimitrius had the opportunity to improve his diving skills and taught some basic classes. After moving to the island of Florianopolis to become a biologist, he became a divemaster and an instructor through the Professional Association of Diving Instructors (PADI). His commitment to the scuba lifestyle was now established.

SHOOTER: CRISTIAN

DIMITRIUS

A black caiman in the heart of the Amazon, Brazil

From left: Mythical pink river dolphins in the Amazon; a freshwater stingray in the Pantanal, the world's largest wetland

STEPHEN FRINK// I see now how scuba as a recreational sport and profession became an important part of your life, but what motivated you to pick up a camera and become an image-maker?

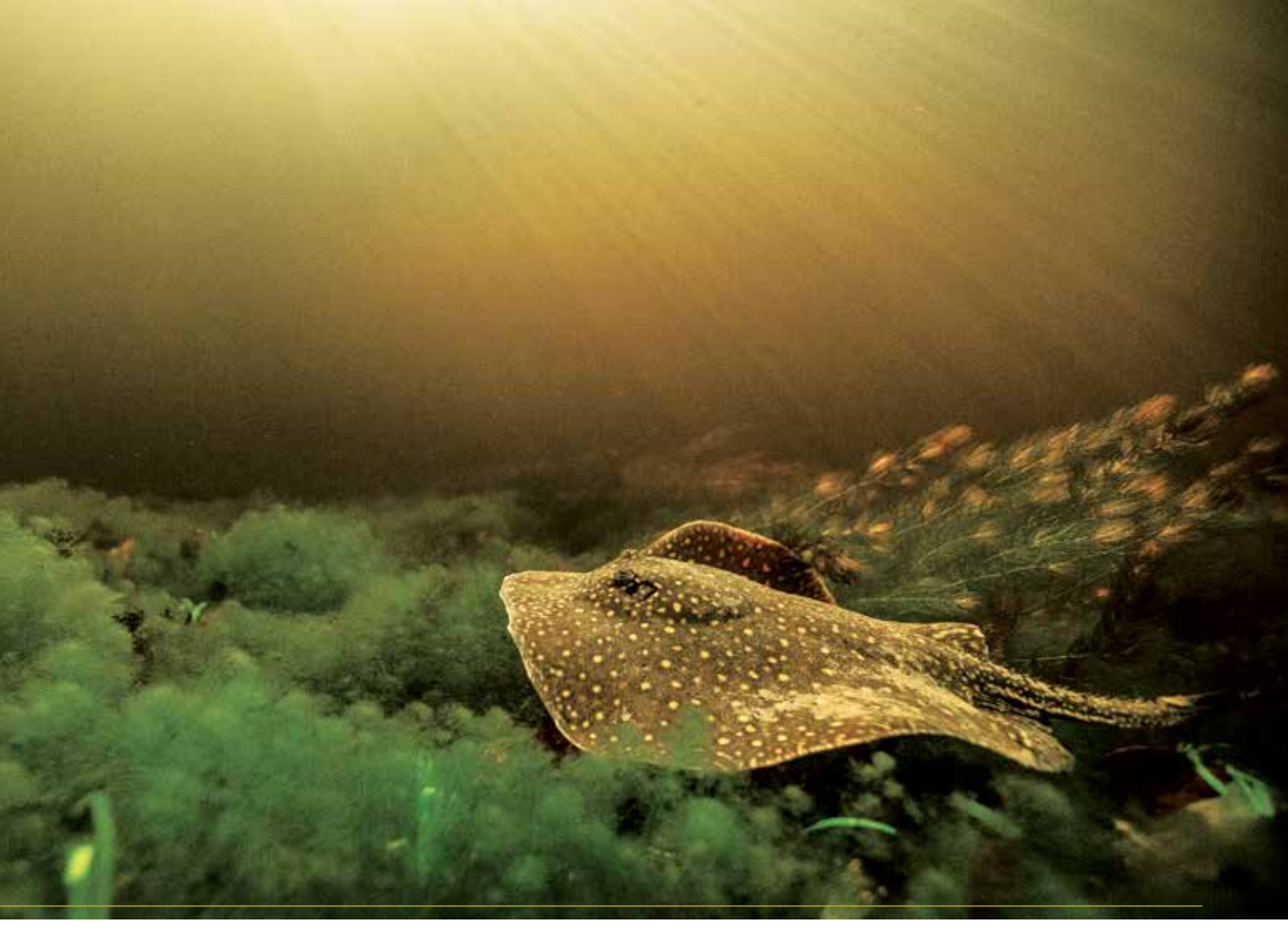
CRISTIAN DIMITRIUS// I was always inspired by the nature documentaries I saw on TV. What motivated me might have been the films of Jacques Cousteau or Stan Waterman and definitely Howard Hall, but I wasn't necessarily inspired only by underwater filmmaking. I remember a documentary about big cats in Africa by Dereck Joubert, for example. If it had to do with nature, I was absorbed. I watched these television shows constantly and imagined myself as the storyteller, the one having the adventures.

SF// Did you migrate to filmmaking right away, early in your career, or did you shoot stills first?

CD// I improved my fieldcraft before I moved to filmmaking. My first camera was a Sea and Sea Motor Marine II, which truthfully was pretty limiting, especially compared with the tools I have available to me today. The dive center I was working for had a Hi8 video camera, and they encouraged me to take it out on dives with clients and shoot movies of them as souvenirs. Sometimes I could sell the videos, and I made a little extra money, but more than that I was learning to previsualize, to edit in-camera and imagine what the finished clips might be. Learning to shoot video wasn't so hard, but learning to edit video was ponderous at the start. So I tried to see it all in my mind's eye first; this way I could turn around a video faster and not have to work so hard.

We weren't shooting many videos at that point, so my experience remained pretty basic. I also had a lust for travel. I backpacked because that's all I could afford, but for a year I traveled along the Brazilian coast. I made it as far as Argentina, where I got a job at a biological research station for a while, and that took me to Antarctica. Summer is the high season for diving in Brazil, and I found I could market my skills as a dive instructor and videographer, at least for those few months every year.

SF// It sounds like an old TV show we had in the U.S., *Have Gun — Will Travel*. You were the gunslinger for hire, but your video camera was your six-shooter.



CD// Yes, it was exactly like that. After a good season in the North Region or Rio, I would travel to the Caribbean to take it all to the next level, mostly because the diving was so seasonal in Brazil. I landed first in the Dominican Republic and worked there for one year, doing both scuba instruction and videography.

My big break — the one job that most advanced my career — happened when I got a job with Stuart Cove's Dive Bahamas on the island of New Providence in 2000. There I was a dive instructor, a shark feeder and a boat captain. Eventually I began to work with their photo center; I learned more about cameras and video as a photo pro there than at any other time in my life. It was a time for hard work, and I loved it every aspect of it.

The foundation for my career as a filmmaker today is a reflection of what I learned at Stuart Cove's. I had to be efficient there. It was very busy all the time, and our guests were sometimes cruise-ship passengers, or maybe they were staying at a hotel on Cable Beach or in Nassau. They would often be there just for the day, and we had to get the videos and stills ready for them to review very quickly or, no matter how inspired and creative the shot, the customer would never see the images.

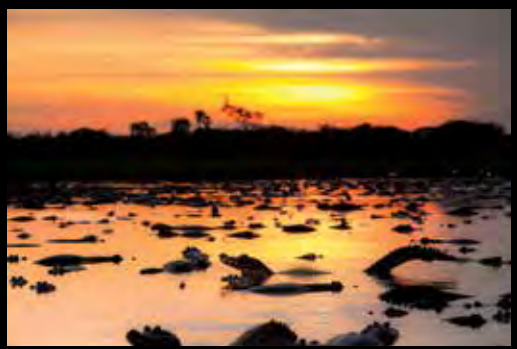
I had to get it right the first time and deliver the content quickly. But that didn't mean it had to be boring. In a 30-minute shark dive I would shoot different angles, different cuts. Maybe I'd include some shots from above to establish the scene and to show how many sharks there were, or maybe other angles right at the feeder's spear would help capture the forced perspective of the bite shot with the customers in the background. The opportunity was there, and I had the will to try to make it different and better on every dive. For me it was a very good education about discipline and the business of filmmaking. I spent three years working with Stuart and Michelle Cove, and I remain grateful for the learning and inspiration they provided.

It was hard work though, often seven days a week. When it was time to move on, I took a sabbatical year to go diving, hiking and rock climbing. My personal batteries needed to be recharged, and I needed the clarity to decide what was next for me.

I was an itinerant cameraman for a while, mostly shooting tourist videos around the various dive hotspots in Mexico. My travels to the Riviera Maya, Holbox, Cozumel, the cenotes and Baja made good content for

A bluespotted cornetfish swims off the coast of Sao Paulo, Brazil.

Below, clockwise from upper left: **A giant river otter in the Amazon; a sloth swimming in the Amazon; spinner dolphins; a caiman aggregation in the Pantanal, Brazil**



my blog. People in Brazil started following me every day; this was before Facebook or Instagram. Back then I was shooting a Sony DCR-VX1000 on digital videotapes. It was certainly different technology to capture the action and different tools of sharing, but it still had a viral aspect to it, and I had a pretty vast audience even then. When I was ready to move on to something else, people wanted to send money to keep me on the road. My travels had become a part of their life, a vicarious adventure for them.

SF// How do you manage to integrate your still photography with your filmmaking now?

CD// I was early to embrace hybrid cameras, digital single-lens reflex (DSLR) cameras that could take high-quality stills and also shoot video. In many ways I learned to like those cameras better. They might not have the convenient form factor of a dedicated video camera, but the larger sensors allow me to control the depth of field to my artistic preferences. If I want shallow depth of field in the background to draw the viewer's eye to some natural behavior from a fish in the foreground, my full-frame DSLR can accomplish that.

Sometimes I prefer to shoot stills rather than video. If I go on a trip by myself, just for fun, I tend to shoot almost all stills. The postproduction workload is less, and I still have the joy of creation. Pictures are great for sharing on social media, or I could potentially use them for a future book or to promote a film. These days when I am hired to do a job it is usually as a filmmaker, but I always try to find time for some stills.

The tools I travel with depend on the kind of assignment I have. For serious broadcast television work I'll pack my RED digital cinema camera and my Canon EOS 5D Mark III. Fortunately, the same Canon lenses work on both cameras; my favorites include the 8-15mm fisheye zoom, the 16-35mm II wide-angle zoom, a 12-22mm Tokina and the 100mm macro, often with a Nauticam Super Macro Converter. I have Nauticam housings for both cameras, and I use Inon Z-240 strobes for stills and Keldan

Luna 8 lights when shooting video. Like almost any working pro these days, I also travel with several GoPro systems because they are so awesome for the point-of-view action I like to shoot.

SF// While I had known of your work, the first time we spent on the road together was during your assignment to document the Bahamas Underwater Photo Week (see Page 64). I was impressed with your dedication to your craft, for you were never without a camera in your hand. I can't imagine how many digital gigabytes you shot that week, as video represents huge chunks of data to manage and archive. Yet you found time to post to social media every day — not just a casual photograph but often an edited video. To me that says your postproduction skills must be impressive.

CD// It is true that I have had to become an efficient editor in the field, or I could never do what I am tasked to do for clients. Often I am traveling alone, without an assistant or an editor or a soundman. I go to remote places, and getting myself there is hard enough. A large team would be expensive and often intrusive for the intimate behaviors I am trying to film about some shy marine animal or even a dangerous predator. I can manage myself, but a larger crew might actually get in the way.

To prepare me for what I currently do, I got a job with a production company in Sao Paulo. I started out as an assistant cameraman and then was promoted to cameraman, editor and finally producer. In less than a year of on-the-job training I learned how to make a TV show.

What was most immediately obvious was that I needed to know more about topside filming, because underwater shots alone weren't going to cut it for the network. I'm now happy and comfortable shooting above and below the surface. I film only nature though. I don't do fashion, products, news or events. To keep me engaged, my work has to be about the natural world.

Having a background in biology has been helpful, because I know when I am seeing unique behaviors; however, just as when I was a Boy Scout, fieldcraft is very important. I need to know how to spend time in the field without suffering. An underwater photographer will never achieve excellence without being a good diver first, and a nature cinematographer requires field skills to flourish, or sometimes even to survive, on some of these assignments.

SF// Who are your primary clients these days? It seems you've come a long way from shooting souvenir videos of scuba divers.

CD// In Brazil I stay very busy with National Geographic, Discovery Communications and the BBC. If they have projects happening anywhere in Brazil, I'm likely to get a call. I also shoot a lot for our Brazilian dive magazine, *Mergulho*. I recently had the opportunity to work on an IMAX project in the Bahamas as well, shooting 6K video.

The one project that keeps me most occupied is our television show, which airs to 50 million viewers each Sunday. I am the researcher, shooter and presenter on an adventure segment. We specialize in different locales; lately it has been the Bahamas, U.S., Norway, Africa, etc. I tell about 15 stories each year — it could be about polar bears, elephant seals, lampreys or even mayflies. As long as it is a strong story, one that is compelling for our audience, I'll go anywhere on the planet to shoot it. My main goal is filming, of course, but I shoot stills on location as well and one day soon will do a book about my adventures.

If I may leave your readers with one final thought about my work, please understand it is all about cultivating a passion for nature. I want my viewers to fall in love with the planet. All nature photographers and filmmakers need to have a conservation mindset they carry through to their work, for unless we protect what we love we'll be out of a job and, more important, out of a place to live on this earth.

The things I do with sharks or tigers or crocodiles is not to prove I am brave but to show we can all share the same planet and coexist in peace.

SF// Are you on the road as much as it seems? Whenever I see one of your Facebook or Instagram posts, you are in some distant and very remote place.

CD// I'm on the road about 70 percent of the time at the moment, which is a lot, but I'm well adapted to this lifestyle. My wife works with me and supports my travels, which is extremely important. I know that right now is the time for me to do what I do. I'm 39 years old and recognize that I won't do this forever, but for now I have momentum and I like this crazy existence. Next week I go way south to Patagonia and then way north to the Artic. Life is too short to be bored. AD

A snow monkey enjoys a hot spring in Jigokudani Snow Monkey Park, Japan.

A lionfish hunts at 50 feet off Komodo. The hard corals at the top of the reef blocked the majority of the mid-day sun, which prevented the top of the image from being overpowered by an overexposed sunball.

The Dark Side of the Sun

Working with the most powerful light source of all

TEXT AND PHOTOS BY ANDY AND ALLISON SALLMON

I was about to begin my ascent when I realized I was being watched. I glanced around, finally locating my observer 25 feet above me. A California sea lion blinked down at me from the water's surface, his sleek shape perfectly outlined by the afternoon sun. Just as I was lifting my camera, the sea lion abruptly charged toward me, its mouth wide open.

I could hear the divers next to me cheering into their regulators as I depressed the shutter. The sea lion

swam off, and I boarded the boat to exclamations of jealousy and demands to see my images. As I scrolled through the pictures, however, my heart sank. Instead of the shot I had envisioned — a defensive sea lion rimmed by strikingly defined sunrays — the image I had taken looked like a white ball of death rimmed by an ugly aqua halo. Was there even a sea lion in the middle of that blazing orb?

Instantly I knew what I had done wrong: My camera's exposure settings, so perfect for the earlier images I'd taken with the sun at my back, hadn't been adjusted to shoot into the sun. How humiliating. I turned to the other divers and shook my head sheepishly as their sympathetic laughs echoed around me. It turned out I was in good company; for the entire journey back to the harbor, the other shooters on board regaled me with similar tales of missed opportunities.

The mid-day sunrays here appear to converge at a point below the blue whale's head, an optical illusion that enhances the subject.

THE SUNNY SIDE OF DIGITAL IMAGING

Open any book or magazine on diving, and the chances are excellent that you'll find references to and photos of the sun. Rays filtering through the water, an incredible creature silhouetted by a sunburst, light piercing the entrance to a cavern: All are worthy of enthusiasm, and all have frustrated camera-toting divers. Finding and capturing those beautiful sunrays requires patience, effort and luck. Even if your camera settings are appropriate, clipped highlights, banding or general loss of detail could easily mar your photographs.

Film was better able to record contrast and subtle color detail than most digital sensors, so a properly exposed sunburst was more likely to yield a pleasing result. However, most photographers have long since transitioned to digital imaging, and we have learned to adjust from old to new media. Digital sensors are constantly improving, and digital cameras offer several tools to help photographers take full advantage of each opportunity.

Shooting images in RAW format ensures that we retain the maximum dynamic range for each image file. Reviewing images and histograms throughout each dive provides constant opportunities to adjust exposure settings, and bracketing (shooting several slightly different exposures of the same subject) provides a digital safety net to lessen the chances of exposure mishaps.

SUNRAYS AND SUNBURSTS

If you have ever spent an extended safety stop mesmerized by the effects of late-afternoon sun as it strikes shallow water, you are familiar with shallow sunrays — also commonly called "God's rays" or dappled light. Water is far denser than air, so while some of the sun's light energy is reflected at the water-air interface, the rays that penetrate the water are refracted and scattered. Depending on the time of day and surface conditions, we can actually see defined, golden beams of light in the water column.

Although the optical explanation seems simple, this beautiful light effect requires a very particular set of circumstances that aren't encountered on every dive. First, the deeper you go, the more light energy is diffused, so the "beam" effect mainly occurs in shallow water. Second, if there is a chop on the water's surface, the sunlight will be more scattered, which may prevent the formation of distinct beams. Third, particulate in the water column, a nuisance in many other imaging situations, actually help define the sunrays. Finally, timing plays an enormous role in capturing this effect. This phenomenon is most likely when the sun is low in the sky; therefore some photographers may plan early-morning or late-afternoon dives to attempt to capture the effect.

Many of the principles for viewing and photographing sunbursts with defined rays are the same as for shallow sunrays. The key factors include shallow water containing some particulate matter, calm surfaces and a low-hanging sun. Deeper water or different times of day can present a sunball with different visual characteristics but that's no less compelling of a compositional element.

SETTING YOURSELF UP FOR SUNRAY SUCCESS

Whether shooting sunrays or sunballs, you'll probably need to limit the amount of light that reaches your sensor. The most powerful tool in your camera to prevent the sunball from looking more like a sunblotch is shutter speed. If you're using strobes, set your shutter to the fastest speed that permits strobe synchronization (1/160 sec to 1/320 sec for most cameras). If your image still looks overexposed and your ISO is as low as possible (100 for most cameras), then try decreasing the size of your aperture to reduce the size of the sunball. Note that ISO and aperture adjustment will also affect your foreground — a complicated issue addressed later in more detail.

Clockwise from upper left: **Particulate in the water column and an afternoon sun created a sunburst with sharply defined sunrays above this jellyfish at 10 feet in the Solomon Islands. With the brightest part of the mid-day sun carefully hidden, particulate in the water helped to create sharply defined sunrays with these schooling mackerel in the Channel Islands. Not only is this oceanic whitetip shark a captivating subject, but it also covers the strong, mid-day sun, preventing an overpowering sunball.**

A common tactic to compensate for a bright sun is extreme underexposure. While this approach will help dampen the brightness of your sunball and can result in striking, high-contrast images, it sometimes does so at the expense of capturing the true color of the water, rendering rich blue or green hues nearly black at the periphery of the frame.

Unfortunately, there are some occasions when shooting toward the sun simply will not produce an acceptable image. In very clear, shallow water at mid-day, for example, the chances are that your sunball will look like a whitish blob rimmed in thick cyan and aqua halos — no matter what camera settings you've chosen. A popular troubleshooting technique is to use reef or wreck structures, marine life or silhouetted divers to block the majority of the sun. Another option is to adjust your composition to include only the edge of the sun or its rays. One final option can be applied postdive: If you have taken a shot that inadvertently or unavoidably contains an overexposed sunball, a bit of creative cropping may allow you to rescue an otherwise unsalvageable image.

If you are over deep, clear water, there is an additional way to incorporate the sun into your image in very bright conditions: Shoot at a downward angle with the sun behind you. The rays will sometimes appear to converge to a point below you, creating an optical perspective effect that can add creative components to images, particularly pelagic marine life portraits. Since you're not shooting toward the sun, this technique is more forgiving in terms of settings, although fast shutter speeds may still be necessary to freeze the light beams and capture sharp images of your primary subjects.

CATHEDRAL LIGHT

With photography, there are confusing exceptions to the rules. Cathedral light refers to the focused beams of sunlight that you can see within shipwrecks and caverns or adjacent to overhanging marine or plant life. Because this effect is viewed against dark or shadowed backdrops, demarcated rays are visible in relatively deeper water. Also, because these rays are viewed when the sun penetrates the crevices of the backdrop structure, they require a bright sun at a specific angle. Mid-day might be the best time to capture the effect in a kelp forest, but a cave opening facing east might work best in the morning light.

Since the backdrop in most of these scenarios is dark, your approach to exposure may be quite different than for shooting sunrays during shallow reef dives. A fast shutter speed will help to freeze the light beams, but if it's too fast your image won't show the detail of the surrounding structure. In this case, a bit of experimentation will help fine-tune the balance between sharp sunrays, detail and visible open-water colors. Metering the light of the open water and adjusting your settings accordingly can provide a good starting point. Or you can simply bracket. A digital LCD screen will reveal a good approximate starting point, and exposures with apertures above and below that are good insurance to ensure an optimal RAW image.

FOREGROUND FORETHOUGHT

When you incorporate strobe-lit foreground subjects, shooting toward the sun can get very tricky. We've mentioned that in extremely bright conditions it's often necessary to adjust camera settings to limit the amount of light reaching your camera's sensor. Increasing shutter speed is one way to decrease background exposure, but when you are shooting with a strobe illuminating foreground subjects, your adjustments are limited by the top synchronization speed of your camera. Once you begin decreasing your ISO or aperture size, assuming your strobe light to be constant, you are also decreasing the exposure of your foreground subject. When you alter either of these settings for ambient light, you should simultaneously adjust your strobe output accordingly, either by means of the strobe's power settings or the strobe-to-subject distance.

For ISO a good starting point is to double your strobe power each time you halve your ISO; i.e., if you are shooting at ISO 200 with your strobes at ¼ power, then decreasing your ISO to 100 should prompt you to increase your strobes to ½ power. No doubt, this thought process relies upon a basic understanding of the interrelationship between ISO, aperture and strobe power, but your skill at this technique will be accelerated using a trial-and-error approach that incorporates careful review of images and histograms throughout your dive.

This image of a reef and diver near Fiji was shot at 80 feet, so the sun appears as a loosely defined ball.

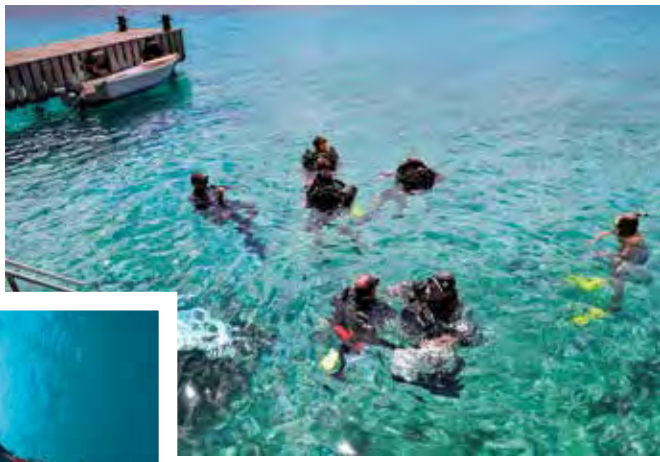
Even the most powerful strobes produce a finite amount of light that is puny compared to the sun. If you cannot adequately light your foreground subject, you might have to adjust your expectations more rigorously than your camera settings. Selecting smaller subjects, for instance, such as individual branches of soft coral as opposed to coral-covered bommies, will allow you to get closer, which will increase the potential light intensity on your subject. Light-colored or reflective subjects also require less strobe power than dark-colored or absorptive subjects.

If all else fails, one creative trick remains: the silhouette. By using an unlit subject to block the sun, you can singlehandedly mitigate the limitations of strobe synchronization speed — and potentially inadequately exposed foregrounds. For silhouettes it's best to choose subjects with distinguishable shapes, such as divers or large, iconic marine life. With luck, the silhouette becomes a critical compositional element, allowing you to take full advantage of the sun's rays. AD

MEMBER TO MEMBER

Eyes Wide Open

TEXT AND PHOTOS BY PETE NAWROCKY



Looking down at the water, time can seem to slow down. The next time you are about to dive, ask yourself what emotions you are feeling — excitement, nervousness, self-doubt, even boredom? Diving is more than just a physical activity; it involves every aspect of an individual's self. The unique approach each diver takes sets the tone for his or her dive. After several decades as a diver and dive instructor, I try approach each dive with fresh eyes.

For all divers, including beginners, preparation is key. Research the dive conditions you are about to encounter. Consider what type of suit you need for thermal protection. Determine whether the visibility fits within your comfort zone. Remember to consider currents, waves and even methods of transportation to the dive site. Will you get there by boat, car or perhaps even a mule? Showing up to a dive site and discovering there are 199 steps down a steep hill may not be your cup of tea, and these steps are only going to feel longer after the dive on the way back up.

Knowledge is power. As a diver gains time in the water, his or her self-doubt will disappear and comfort level will increase. For some divers, an end point is reached in which the level of training is maxed out. If you are one of these divers, take advantage of events to help build your knowledge base. Work on your buoyancy skills to keep you efficient in the water. Learn to send up surface markers from depth to make drift dives less stressful. If diving in cold water doesn't seem attractive, try a drysuit, which will make you warmer and require that you gain new skills. Either you'll love cold-water diving, or the Caribbean will become more attractive than ever.

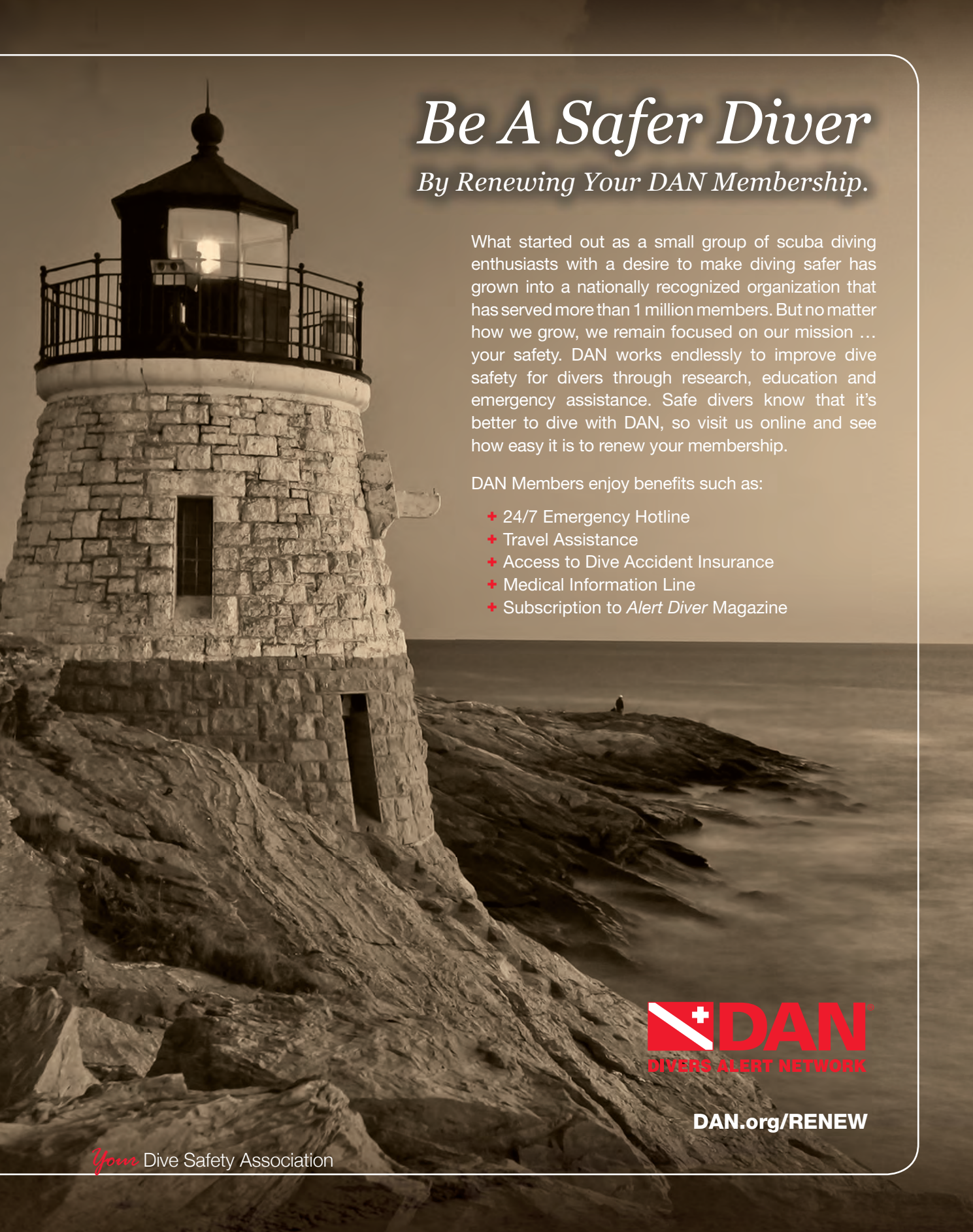
Evolving technology also provides opportunities for you to continue to build on your experience. For example, sidemount and closed-circuit rebreather (CCR) events can expand your level of understanding of that equipment. Visiting trade shows will also give you insights into new technology and information. There is much to be learned by attending various lectures and chatting with other divers. Choose subjects that interest you enough to get you in the water more often. Consider putting together a presentation for a local club, library or civic organization. Sharing insights with a dive community is a great way to help your peers and yourself come to each dive with your eyes open to new information.

I practice what I preach by actively teaching advanced and technical classes. I organize demos on CCR and sidemount diving. I recently volunteered to work with a marine archeologist in Lake Michigan on a CCR trimix photo dive, and I've signed up to volunteer at my third aquarium. By the time you read this, I will have already lectured at the Museum of Coastal Carolina in Ocean Isle, N.C.

After decades of diving, the water still looks great. AD

SHARE YOUR STORY

Do you have tips, advice, travel strategies, dive techniques, lessons learned or other words of wisdom to share with your fellow divers? *Alert Diver* wants your story. Email it to M2M@dan.org, or mail it to "Member to Member," c/o *Alert Diver*, 6 W. Colony Place, Durham, NC 27705.



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Choosing Extinction

The Hawaiian monk seal

TEXT AND PHOTOS
BY DOUG PERRINE

More than 20 million years ago, a weasel-like progenitor to today's monk seals foraged in Canada's lakes. By 15 million years ago, the animal's descendants had evolved into seals similar to present-day monk seals. By 8 million years ago, monk seals had spread to both sides of the North Atlantic and to the eastern-central Pacific. When the Isthmus of Panama separated the two oceans about 3 to 4 million years ago, the species diverged into the Caribbean monk seal on one side of the continent and the Hawaiian monk seal on the other, while seals in the eastern Atlantic region evolved to become the Mediterranean monk seal.

At that time, the lower five of the main Hawaiian Islands (MHI) had not yet emerged from the sea, so monk seals inhabited what is now known as Kauai and the Northwestern Hawaiian Islands (NWHI), stretching out past Midway to Kure, colonizing new islands as they appeared. Hawaiian monk seals had no terrestrial enemies until humans arrived in the MHI around 1,000 years ago. It is believed that within a century Polynesian settlers and their dogs had all but extirpated the seals from the MHI.

Today the International Union for Conservation of Nature and Natural Resources (IUCN) lists the Hawaiian monk seal as critically endangered, but some islanders are protesting recovery plans proposed by the National Oceanic and Atmospheric Administration (NOAA).

Some Hawaiian residents argue that Hawaiian monk seals are not native to their land: "The history of the monk seals is based on

This young female monk seal became a public safety hazard and had to be removed from the MHI population after being illegally fed by humans.

a lie perpetuated by environmental groups," Kawika Cutcher testified at a September 2011 public hearing on Kauai regarding federal proposals to relocate some of the seals to the main islands. "There's no mention of it in Hawaiian history."

"I think they just branded it," Kenika Matsuda protested. "Who gave them the name *Hawaiian* monk seal?" Kimo Rose asked at another hearing. "Where's the proof?"

A NOAA Fisheries Service 2011 survey of beachgoers and fishers in Hawaii found that 62 percent of those asked believe that monk seals are a native species, while 38 percent either do not believe that or are unsure. Other islanders recognize monk seals as Hawaiian but consider them indigenous only to the uninhabited NWHI and not to the inhabited MHI.

Some locals, however, recognize the Hawaiian monk seal as an indigenous rather than invasive species. "We grew up with monk seals. They were just rare, that's all," Hawaiian activist Walter Ritte explained. "The people who were killing them for oil did a pretty good job. There was a period of time that when you saw a monk seal, it was a big deal. I remember that when I was growing up word would spread that there was a monk seal on the beach, and a lot of people would come and look. They're making a comeback now, so people are not used to having them around."

Hawaiian cultural and environmental consultant Trisha Kehaulani Watson maintains a website, *www.nameahulu.org*, where she lists evidence that monk seals were found in the MHI from the precontact period through the 19th and 20th centuries. The evidence includes Hawaiian chants, traditional stories, seal-inspired place names, old Hawaiian-language newspapers, journals from visiting ships, Hawaiian families who consider the seals to be "aumakua" (divine ancestors) and archaeological discoveries of seal bones in Hawaiian refuse piles from both pre- and postcontact periods.

Biologists say that Hawaiian monk seals are very distinct from other monk seals. A 2014 research article in *ZooKeys* (Scheel, Slater, Kolokotronis, et al.) places Hawaiian and Caribbean monk seals in a separate genus

Right: **A male monk seal spyhops to check the beach for females in the NWHI.**

Below: **A monk seal trying to rest on a beach near Kihei, Maui, is surrounded by curious onlookers, some of whom breached the safety zone and approached the seal.**

from Mediterranean seals. The Caribbean monk seal has not been seen alive since 1952, and there are only about 500 Mediterranean monk seals left. Hawaiian seals number about 1,100 and are declining at about 3 percent per year.

Problems for monk seals in the NWHI began when commercial sealers started harvesting seals for oil and skins in the early 19th century. By 1824 the Hawaiian seal was believed to be extinct; however, when King Kamehameha IV visited the NWHI in 1857, he found about a dozen of the seals — several of which he shot. In 1859 a sailing vessel returned from an even more distant island with 1,500 skins. For the rest of the 19th century and into the 20th, whalers and shipwrecked sailors along with bird, egg and guano harvesters harassed and consumed many of the few remaining seals.

Later in the 20th century, U.S. military and Coast Guard activity displaced seals from their prime habitats. After a reduction of these activities in the 1970s, some subpopulations in the NWHI began to recover, but the trend again reversed in the 1980s due to environmental changes, most likely related to commercial fishing, oceanographic oscillations, climate change or some combination of the three. By the 1990s every region in the NWHI saw monk seals dying more rapidly than they were being born. Seal numbers have continued to decline since fishing was phased out with the establishment of the Papahānaumokuākea Marine National Monument in 2006.

Throughout the recorded history of the region until a few decades ago, nearly the entire population of Hawaiian monk seals was relegated to the remote NWHI. In the 1970s some seals established themselves on Niihau, at the north end of the MHI, and began to reproduce. As Niihau's population multiplied, seals began to migrate down the island chain, populating the rest of the MHI. This expansion of the MHI population was beneficial to the seals, as some of the specific problems affecting the NWHI do not extend to the MHI.

Currently, only one in five Hawaiian monk seal pups born in the NWHI survives to maturity. Some are snatched by sharks; others starve due to increased competition with large predatory fish for shrinking food supplies; still others drown after becoming entangled in fishing nets and other debris floating in the North Pacific "garbage patch" that drifts onto beaches and reefs. "What we're trying to do right now is to stop the bleeding," NOAA branch chief Jeff Walters said. "We're not expecting the population to increase. We're just trying to make the decline less steep."

Females in the MHI, on the other hand, give birth younger, have more pups, nurse their pups longer and wean fatter, healthier babies. MHI pups grow faster, and four out of five survive to maturity. Seals need to come ashore to rest and reproduce, so the MHI's 1,400 miles of shoreline offers more opportunities than the 50 miles in the NWHI. Moreover, as rising sea levels and erosion accelerate the loss of land, some of the NWHI are subsiding into the sea. There isn't much land in the NWHI that sits more than a few feet above sea level, and some islets used by the seals have recently disappeared, leaving the MHI as the main hope for the survival of the species. Studies project that if conditions remain the same, from 2010 to 2030 the population in the NWHI will drop from 900 seals to 200, but in the MHI the population may increase from 200 to 400. Unfortunately, not all MHI residents are thrilled with the increasing presence of seals.

Kenika Matsuda, for example, doesn't see any benefits from it. "The only thing I see is cons. They're eating the fish. They chase the fish away. I heard of them chasing people, too," he explains. "I think it's changing the ecosystem."

"These animals interfere with our traditional way of life," Timothy Oga wrote in a letter to *The Garden Island,* a Kauai newspaper. "When we lay our nets, soon there will be a hole in it. The monk seal makes it in order to steal our catch.… According to Hawaiian traditions, if an animal causes damage to your property, you kill him and eat him. That should be the fate of the Hawaiian monk seal."

These types of statements do not represent idle threats. From 2009 to 2012 at least eight seals were found dead on Kauai and Molokai with "suspicious" injuries. Only one of the deaths led to an arrest. For shooting and killing a pregnant female, the courts sentenced Charles Vidinha to three months in jail and a $25 fine. Four of the seals had apparently been bludgeoned to death during the three months following the public hearings on NOAA's seal-management plan, which proposed to temporarily move starving juveniles from the NWHI to the MHI, where they would be more likely to survive. That proposal was tabled due to public opposition and logistical concerns. Instead, starting in 2014 NOAA is bringing some of the at-risk youngsters to a captive facility in the MHI to fatten them up for six to 12 weeks before taking them back to the NWHI.

Suspicion that seals are reappearing in the MHI due to government intervention derives in part from a

From left: **A young male shares a resting spot with a green sea turtle. After its release by NOAA scientists, a seal heads back toward the water loaded with a *National Geographic* crittercam.**

1994 translocation to the MHI of 21 aggressive males that had been biting females (sometimes fatally) at Laysan Island. The operation successfully rebalanced the sex ratio at Laysan and ended the assaults, but it was a public relations disaster. Walters argues that NOAA bringing the males to the MHI did nothing to change the population growth because no females were included; however, his argument often falls on deaf ears. NOAA scientist Charles Littnan includes in his public presentations a denial of rumors that he transports monk seals to the MHI at night in black helicopters.

Apart from the controversy surrounding the seals' historical habitat, the fact is that for these seals to survive they must coexist with humans in the MHI. Because of the greater human presence, seals in the MHI understandably face different problems from those in the NWHI. The beaches on which they need to sleep and raise their young are increasingly occupied by humans, and not all are considerate to seals. Several animals associated with human habitation endanger seals either directly or indirectly. For example, dogs are known to kill seals and drive them off of beaches, and they also have the potential to transmit canine distemper. Cats transmit toxoplasmosis through their feces; five seals have already died from this parasite in the MHI. Rats transmit leptospirosis, which has been found in seal carcasses. Additionally, seals sometimes drown in nets, are run over by boats and get hooked, speared, shot, clubbed and pelted with rocks.

Unlike the issues the seals face in the NWHI, most of the problems for monk seals in the MHI are ones that can be solved if there is a will to do so. Even if Hawaiian residents are divided in this regard, U.S. law mandates full protection of marine mammals and recovery efforts for endangered species.

The Hawaiian monk seal is the most critically endangered marine mammal under sole U.S. jurisdiction. On some days there are more sea lions on Pier 39 in San Francisco than there are Hawaiian monk seals in existence. A NOAA analysis estimates that nearly one-third of Hawaiian monk seals are alive only because of interventions by its personnel. The number of interventions is directly related to the length of the field seasons for the NOAA team in the NWHI, and that is determined by the recovery budget. NOAA's monk seal recovery plan requests $7.5 million per year to conduct activities necessary for population recovery, but actual funding was only $2 million to $3 million per year from 2011 to 2014. By contrast, when Alaska's population of Steller sea lions dropped to 25,000, the government allocated $40 million per year for recovery efforts, perhaps due to varying degrees of political influence.

Increasingly, monk-seal management and recovery activities in the MHI rely on assistance from unpaid volunteers and nonprofit organizations. After budget and staff cuts, NOAA manager David Schofield told volunteers: "I used to ask you to do more with less. Now I need you to do everything with nothing." The Monk Seal Foundation, which was founded in 2011, manages networks of volunteers on two islands and supports seal protection and education activities statewide. In 2014 the Marine Mammal Center in Sausalito, Calif., opened Ke Kai Ola, a hospital for monk seals, on Hawaii Island. The small facility treats injured, diseased and malnourished seals from throughout the MHI and NWHI and then returns the seals to their places of origin for release.

Volunteers and nongovernmental organizations are helping to slow the seal's march to extinction, but the ultimate result will not change unless both the federal government and the citizens of Hawaii choose another destiny for this rare and remarkable species.

"Hawaiians were always taught to keep everything in balance. Everything in the ocean was revered," Ritte said. "Today in Hawaii we haven't managed our ocean, and now there's not enough for everybody. The fishermen are angry about it, and the monk seals are smart enough to take fish from their hooks right in front of them. That's why they're angry with the seal, but the seal was here first. As a Hawaiian, what I'm saying is whatever happens to the monk seal, the same thing's going to happen to the Hawaiians." AD

FOR MORE INFORMATION

www.monksealfoundation.org
www.marinemammalcenter.org
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Weight Up!

BY MARTY MCCAFFERTY, EMT-P, DMT, AND PATTY SEERY, MHS, DMT

Early in dive training, students learn that there are three elements involved in buoyancy control: the buoyancy compensator (BC), weights and lung volume. Although most divers are familiar with the need to be properly weighted, many do not understand all that it entails. Students and experienced divers alike make two common errors when it comes to weighting: diving while overweighted and failing to adjust the amount of weight used in response to changes in equipment and environment.

DON'T WORK TOO HARD

Improper weighting makes it harder to achieve neutral buoyancy. Many divers who wear too much weight do not even realize they are overweighted. The excess weight means that to achieve neutral buoyancy the diver has to put more air into the BC bladders, which can create a more upright profile in the water. The upright position increases drag when swimming, causing the diver to expend more effort and consume more air. Underweighted divers can also become significantly fatigued while trying to stay down. In addition to increasing breathing-gas consumption, extra exertion can elevate decompression stress.


STEPHEN FRINK

GET IT RIGHT

You may have heard a diver say, "This is how much weight I always use." While field testing and prior experience can be useful, this statement shouldn't be the endpoint of a dialogue about weighting. Proper weighting requires thought and practice, and the amount of weight worn is not fixed. Over the course of our lives, we experience change in muscle mass, body fat and physical fitness. Equipment, including wetsuits, wears out and gets replaced. Dive environments differ. All these factors affect buoyancy and require adjustments to the amount of weight used.


STEPHEN FRINK

To determine how much weight you need, consider your body weight, the exposure protection you will be wearing, the weight of your equipment and the environment in which you will be diving. Start with weight equivalent to 10 percent of your body weight, which is a good baseline for a 6mm full wetsuit. For a 3mm suit, use 5 percent of your body weight. Remember that these percentages are simply starting points.

Drysuits and thick neoprene necessitate more weight to counter the suits' buoyancy than do thin neoprene or dive skins. Body composition (muscle density, for example) will influence whether more or less weight is needed. Diving with an aluminum tank requires more weight than diving with a steel tank.

Saltwater is denser than freshwater, thus increasing the buoyancy of immersed objects and requiring more weight to descend. Dive training typically begins in freshwater environments such as pools, quarries or lakes, so new divers should consider that even if they are wearing the same exposure protection they will need to add weight for ocean diving. The exact amount of additional weight needed will vary from person to person. Performing a buoyancy check in each situation will help determine the correct amount of weight to add.

SECURE IT

There are several options available for how and where to secure your weights. A weight belt is the most common method of wearing weights; there are belts that accept slide-on weights as well as pocket belts that can accommodate either solid weights or soft weights (bags filled with lead shot). Weight belts are easy to ditch in an emergency as long as you keep other gear clear of the belt. A shoulder harness is sometimes used when the buoyancy of thermal protective suit requires more weight than can comfortably be worn around the waist.

Integrated weight pockets and harness systems offer a couple of advantages over belts: They can be considerably more comfortable, and they offer improved ability to adjust trim. But unlike belts, which have a single point of release, harnesses and integrated systems may have more than one release point. This is crucial information for the diver and dive buddy to discuss prior to diving — and to remember in the event of an emergency. A downside to using weight pockets is that it may be more difficult to add or remove weights if adjustments need to be made.

HOW TO PERFORM A BUOYANCY CHECK

Start in water too deep to stand in, and release all the air from your BC. Inhale a normal breath, and the water should be at eye level. When you exhale, you should sink so that the water is just over your head and then rise to eye level as you inhale normally again.

Adjust your weights in small increments (e.g., two pounds at a time). Consider adding a little extra weight to offset the potentially positive buoyancy of a partially emptied aluminum cylinder at the end of the dive.

If you are properly weighted, you should be able to hover effortlessly at 15 feet at the end of your dive with 500 psi in your aluminum tank and no air in your BC.

STAY TRIM

In addition to wearing the right amount of weight, make sure it's positioned to optimize underwater trim. Creating a level profile in the water makes you more hydrodynamic. Distribute the weights as equally as possible from side to side; you should never feel as though you are listing to one side while diving. You should also consider the weight of your scuba tank and the style of your BC when placing your weights. The tank can be moved up or down in the tank band to facilitate optimal body positioning in the water. Back-inflation BCs have a tendency to push the diver forward (face down) in the water, so placing weights toward the back can help to counter some of this forward pitch, especially at the surface. While weight pockets on the back of your BC can help with trim, they also present a hazard in an emergency because buddy assistance is required to remove them if ditching weight becomes necessary.

Fins can be positively, neutrally or negatively buoyant, and each type may require compensation. Ankle weights can help offset a more buoyant lower body half, but they may be a challenge to ditch, because you have to reach to release them. If your fins are negative and create a downward pull on the lower half of your body, moving weights higher on your body or shifting your tank higher in the band can move up your center of gravity to promote a more level profile.

Reviewing where and how your buddy's dive weights are placed is an essential component of every predive check. Each buddy needs to know how to jettison the other buddy's weights in an emergency.

Learning to determine proper weighting will enhance your enjoyment of dives as well as your safety. Having a good understanding of your baseline weighting needs and the factors influencing your buoyancy will aid you in adjusting to a variety of environments and conditions. AD

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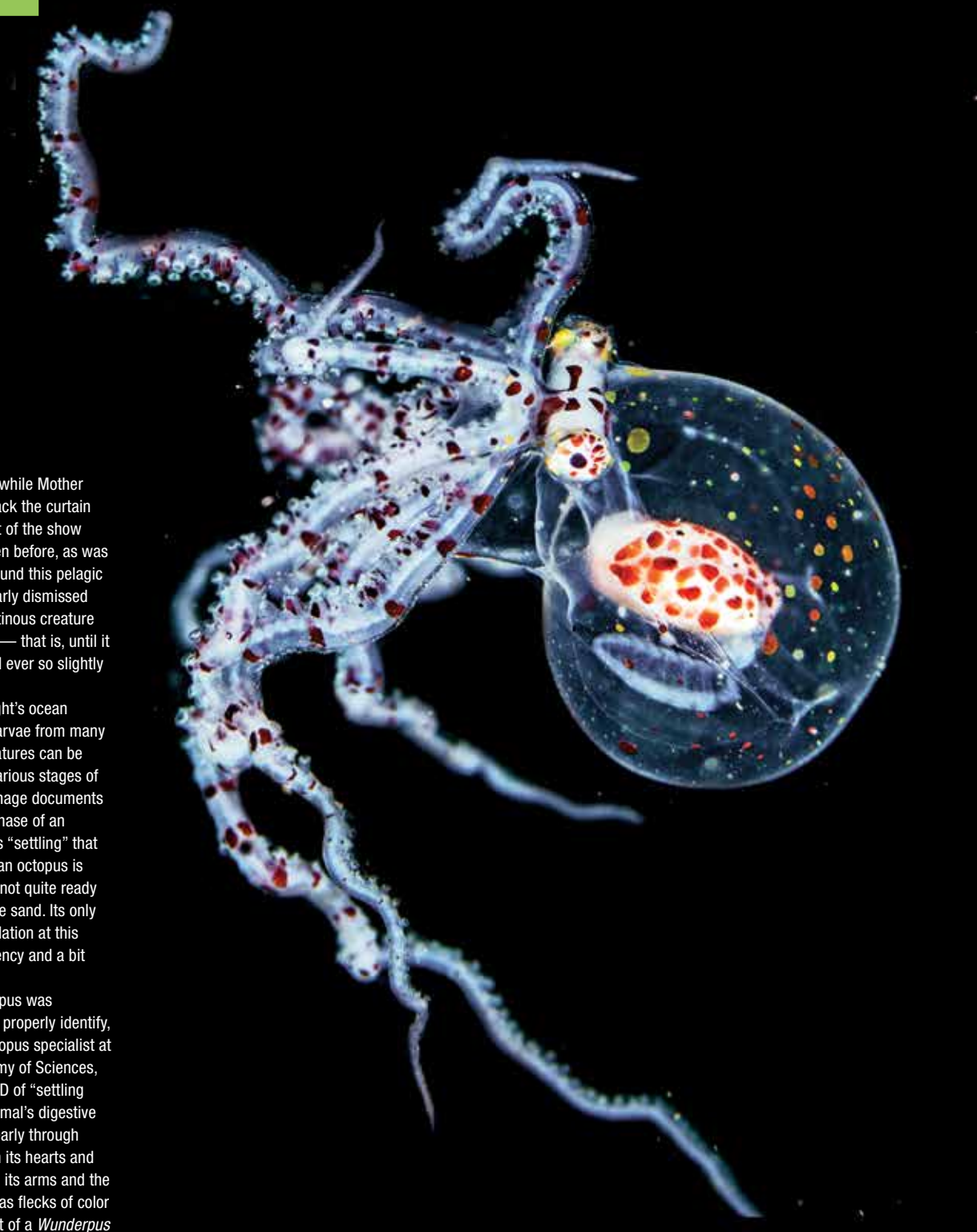
PARTING SHOT

By Mike Bartick



Every once in a while Mother Nature pulls back the curtain to reveal a part of the show that I have never seen before, as was the case when we found this pelagic octopus. At first I nearly dismissed the transparent gelatinous creature as a piece of plastic — that is, until it began to pulsate and ever so slightly change directions.

Drifting on the night's ocean current, planktonic larvae from many different marine creatures can be found midwater in various stages of development. This image documents the developmental phase of an octopus described as "settling" that briefly occurs when an octopus is no longer larvae but not quite ready to begin its life on the sand. Its only defense against predation at this stage is its transparency and a bit of luck.

Although the octopus was extremely difficult to properly identify, Richard Ross, an octopus specialist at the California Academy of Sciences, gave it the possible ID of "settling wunderpus." The animal's digestive tract can be seen clearly through its mantle along with its hearts and brain. The barring on its arms and the pigments appearing as flecks of color closely resemble that of a *Wunderpus photogenicus.*

EQUIPMENT: Nikon D7100, 105mm macro lens, Sea and Sea MDX-D7100 housing, Sea and Sea YS-250PRO strobes (2) on low power
SETTINGS: 1/100 sec. @ f/10, ISO 100
LOCATION: Anilao, Philippines

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