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Quest

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Diving Rules for the 21st Century • Sulphurean Cave Survey Project • Ultraviolet Photography • Project Baseline: Adding Depth to Your Dive • Incorporating Training into the Life of a Busy Diver

Letter from the Editor

Many of us not blessed with year-round diving conditions anxiously look forward to the time when we can dust off our equipment, don our dry suits, and get into the water. Unfortunately, unbeknownst to us, the intervening months may have taken their toll on our skills, our fitness to dive, and our equipment. So, in the interests of safety, prudent divers should evaluate their state of diving readiness before "picking up where they left off".

Skills require consistent repetition to remain skills. This is because skills are in large part an assembly of automatic, or what some would call "sedimented," practices that free the individual to perform more complex tasks. In other words, skill at running a reel is a result of running a reel often enough that the reel becomes an extension of one's arm, that one no longer has to account for as one scooters, explores new cave, ties off, wraps, communicates with team members, gas manages, etc. Once an action, through repetition, becomes a skill, it frees the individual to perform other more complex tasks rather than present itself as a task.

But with diminishing frequency of repetition, skills erode. This is the experience of being "rusty," of "having to think about" what one is doing, or of being "all thumbs." As a result, by reasserting itself as a task that needs to be addressed, the diminished skill closes off what it once released the individual to take on. If divers fail to recognize this and try to pick up where they left off, they can put themselves and their team members at greater risk.

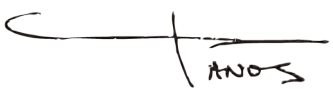
So, before undertaking any challenges underwater after a hiatus from diving, it would be wise for divers to assess their skills as objectively as possible, and seek to remedy what weaknesses they can identify with some practice sessions.

The state of one's health should also be a vital consideration before "picking up where they left off." Weight gain, loss of fitness, lingering illness, injury, and other changes will most certainly affect how well they perform underwater. Therefore, before returning to the water, divers would be wise to assess their physiological readiness for diving, and what, if any, changes in their overall physiological state would impact the diving they are planning to undertake.

Lastly, after a hiatus, divers should also carefully examine their equipment and whether any maintenance is required. Having examined their equipment before going on a dive may save them from the inconvenience of discovering that a piece of equipment is non-functional or, worse yet, from a failure at the worst possible moment of a dive.

These associated concerns speak to proper dive planning and the growing realization that, in an important sense, safety in the water is more choice than chance.

Safe diving,



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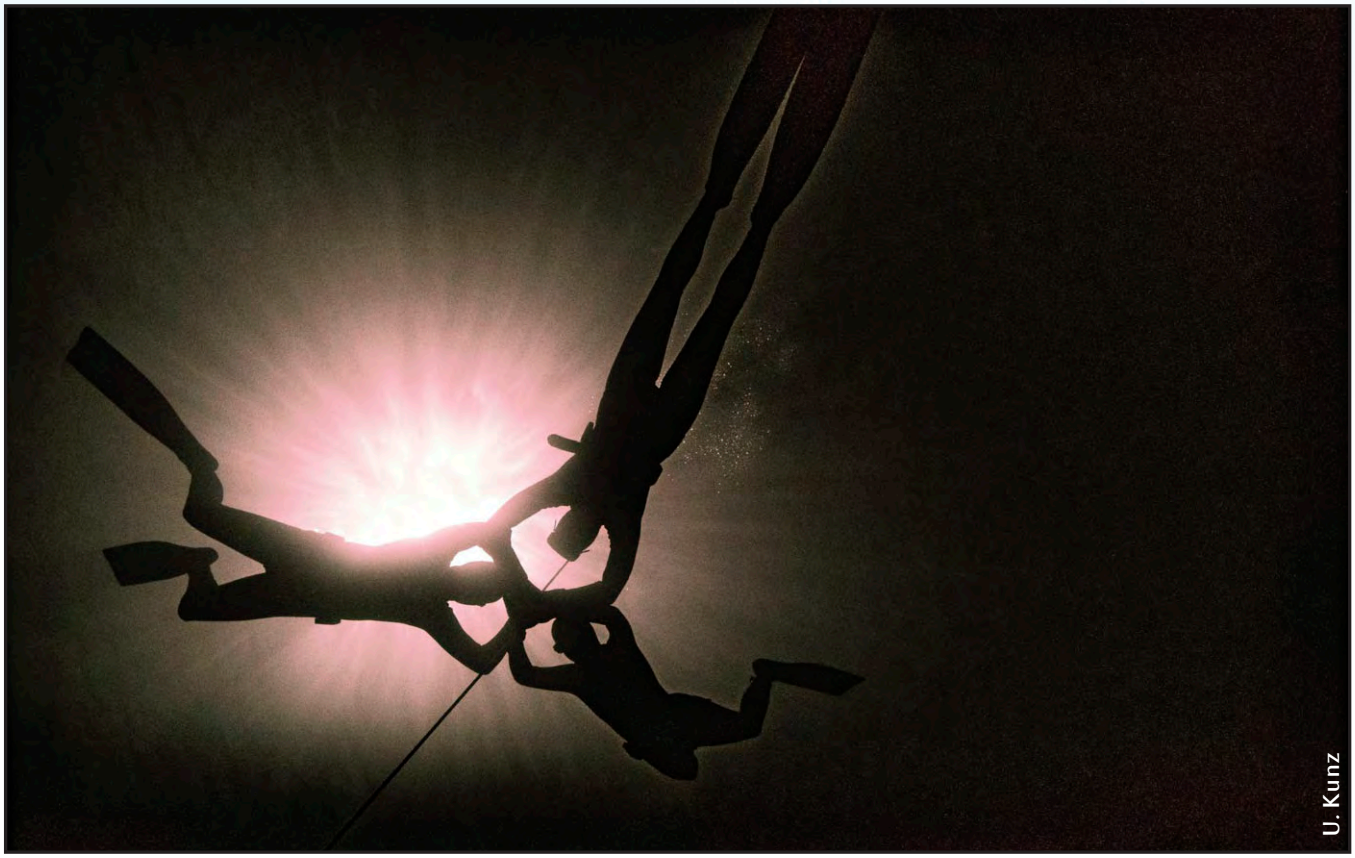
By Maren Isigkeit



"The scuba diver dives to look around, the freediver dives to look inside." – Umberto Pelizzari

INTRODUCTION

GUE's TRAINING STANDARDS require students to demonstrate their ability to do a breath hold swim over varying distances according to the level of training they are pursuing. For some, this seems to be an annoying or even frightening task. In what follows, I will outline how one can accomplish one's objectives with great ease, and maybe even enjoy improving their performance.

As Germany's first female free-diving instructor (CMAS), I have been intensively involved in fostering the free-diving community in Germany and I have seen all kinds of divers show up to class—all with different motivations. They range from individuals looking to become competitive free divers to scuba divers who are fearful of being without gas one day. What all participants of my free-diving classes ultimately discover, however, is that it is the mind that does the trick. For a free-diving novice, ninety per cent of performance is driven by the mind and the signals it sends out to the body. It is not the body that can't cope with

the absence of breathing for a little while—it is the mind. Yet, naturally, it is important to learn about the body's signals and understand how to interpret them.

It is natural for a human being to experience anxiety if faced with the prospect of being unable to breathe. As evolution has it, *Homo sapiens* are meant to stay on dry land. We need to drink, we need to eat and … we need to breathe. If we don't drink for a while, we get thirsty. If we don't eat for a while, we get hungry. Yet we are able to cope with hunger and thirst for at least a little while. However, the very thought of not being able to breathe has us feeling breathless and anxious, even panicky—even though from a physiological perspective, there may be time to cope with the problem that has caused the lack of oxygen.

This is the reason why the breath hold swim was incorporated into the GUE training program. It was intended to have divers realize that they can manage without breathing for a while. So, no matter whether you find the breath hold swim desirable or undesirable, there are three key aspects to successfully executing it: your safety, your environment, and your preparation.

SAFETY CONCERNS

Safety is the most critical aspect of your training and there is one rule that we all know and should never, ever forget: *always have a buddy with you!* After being a member of the free-diving community for some time now, I can attest to the fact that there have been too many tragic losses that could have been prevented if only there had been a buddy present. So, when in the water training for breath hold skills, divers should ensure that somebody is monitoring their efforts. Especially during the last meters of a swim, divers need the support of a safety diver to swim, as close as possible, on the surface along with them. Safety divers need to be aware of the risk of a blackout during and after a breath hold swim, as well as possible collisions with other people or even walls. After the diver in training has surfaced, the safety diver should pay close attention for at least a minute, making sure the diver is okay, since it takes time for the oxygen just inhaled to circulate through the body and reach the brain. It also makes sense to have safety divers use fins to be fast enough to keep up with the breath hold diver.

Divers should not try and trick their bodies by hyperventilating, which entails breathing more than needed, before beginning their swim. This technique disables the body's most vital alert mechanism—the urge to breathe, driven by CO_2 accumulation. It is a common mistake that hyperventilating is supposed to increase the amount of oxygen in the blood. In fact, the blood is naturally saturated ninety-eight per cent with oxygen. When a diver hyperventilates, they are lowering the amount of CO_2 naturally stored in the body. This causes the urge to breathe to come later, when oxygen levels are lower. This in turn extensively increases the danger of a blackout. So do not hyperventilate!

ENVIRONMENT

We all love beautiful dive sites, fish, caves, and wrecks. Scuba diving is our hobby. It's relaxing. For breath hold training, divers should try and create a similar atmosphere in which they can relax. The importance of the water temperature cannot be underestimated. For temperatures less than twenty-six to twenty-seven degrees Celsius, suitable thermal protection is mandatory. Swimming pools shouldn't be too crowded, but if divers practice outside, visibility needs to be good enough for safety divers to monitor them along their entire breath hold swim. Divers should always begin from the "unsafe" area and head toward the "safe" area (e.g., from deeper to shallower water or from a darker to a lighter area). The end point should be shallow enough to stand up in. If this is not possible, a flotation device should be used to have something to hold on to (e.g., an inflated long SMB or a wing). A reference at the bottom or at the end of the swimming distance (e.g., a line at the bottom) will help divers stay on track and stay relaxed.

PREPARATION

With the appropriate training site selected and a buddy there for support, how does one get started? As with every sports activity,

Freedivers playing around at an airplane wreck in a Canadian quarry.

Training in open water may require thermal protection.

Integrate glide phases in the swim.

Stretching out arms and legs improves the pulling phase.

The buddy is monitoring, especially during the last meters.

divers should begin with a warm up. This can be done in or out of the water, depending on the environment. Afterwards, they can do a bit of in-water work to help get their mind and body used to a bit of CO_2 accumulation. This will lead to a delayed response to the impulse to breathe.

If the water temperature is warm enough, divers should conduct a few static breath holds without moving. The buddy should keep time while monitoring the diver. Trainees should float on their back, breathing naturally, and let go of all tension. When completely relaxed, they should take three deep breaths and simply roll over, laying face down in the water, and hold their breath for thirty seconds. After thirty seconds, they should break for one minute and relax completely. They should not talk during this time. After one minute they should do another static breath hold for forty seconds with a one-minute break, followed by a fifty-second breath hold. Have the buddy hold the trainees arm so they don't float away, and give them a little squeeze every ten seconds, which the trainee can confirm with an OK-signal.

Making sure that they are still warm and relaxed, divers can now begin their breath hold swims. It is important they do not rush, but take their time. Buddies need to be told how far divers expect to swim, so that they can swim a bit ahead. After this, divers should relax, take three deep breaths, and—if they are in a pool—give a strong push from the wall to start their swim.

Divers need to remember not to worry, given that a buddy is on the surface monitoring them. They should relax and perform strong strokes with a long glide in between. They should feel the water and look at the bottom, watching the distance pass and relaxing every muscle that they don't need. It is advisable not to look up to see where they are going, as this will be distracting. They should not allow their mind to swim away with them. They should stay focused, trying to optimize their strokes and glide phases, and accept a bit of breathlessness before they surface.

Training this way, divers will have a safe and fun time while automatically improving their performance. While training, divers should be curious and try to listen to their body: learn to read its signals and understand its needs. Above all, they should enjoy the water.

"The scuba diver dives to look around; the free diver dives to look inside." - Umberto Pelizzari, former world champion and record holder from Italy

We Are Water: An Environmental Initiative

By Robert McClellan

Jill Heinerth enjoying one of her favorite pastimes: swimming with manatees. (Courtesy of Jill Heinerth)

Jill Heinerth is perhaps more qualified than most to comment on the state of the world's drinking water—she spends her life diving in it. During a twenty-year career, the underwater explorer and filmmaker has crisscrossed the globe, diving in what she calls "the veins of Mother Earth." Along the way, she's dived deeper into the planet than any woman in history and has been to some extraordinary places. She's dived in caves underneath the remote Ural Mountains of Siberia, tickled the bellies of manatees near the Gulf of Mexico, and explored the sacred desert springs of North Africa.

Of all her remarkable adventures, diving inside a giant Antarctic iceberg remains one of the most extraordinary experiences of her expeditionary life. "It was the largest moving object on the planet," she recalls. "It was called B-15 and the size of this iceberg was so enormous that it had enough fresh water locked within the ice to supply America's drinking water needs for two years! It was absolutely incredible—and also probably the most dangerous diving I've ever been involved with."

During the grueling two-month expedition, Heinerth, 47, made repeated dives into the frozen belly of the iceberg using rebreather equipment. On this project, Heinerth says that "our job was to intercept B-15 and be the first people to dive deep inside the caves and crevices of an iceberg and really see the full mechanics of how they work."

"It was exceptionally dangerous," she adds. "It's a very dynamic environment, shifting and changing constantly, and we encountered a lot of hazardous situations. We didn't expect such

A sea of homes in a deed restricted community in Florida. Once a home is planted, it is the terminal crop.

unusual currents. In one case, regardless of how hard we swam against it, we were swept through the iceberg and deposited on the other side, out of sight of our recovery crew on the research ship. We were lucky that a crew member saw us through his binoculars, bobbing against the ice on the frozen horizon. On a subsequent dive, ascending against a tidal shift, we almost didn't get out, and the culmination of the expedition occurred when the cave we had been diving in minutes before literally exploded and shattered into a field of icy shards. It was incredibly demanding," she recalls, "but also amazing. We photographed ecosystems that had never been seen before and gathered DNA samples of a new species of killer whale."

Now, the underwater explorer is embarking on perhaps her most ambitious personal expedition to date—she's launching **We Are Water**, a campaign to make people think about where their drinking water comes from and do what they can to protect their most precious resource. "We take it for granted that nice clean water comes out of a tap but we can no longer do so," says Heinerth.

Today Heinerth is engaged in making a documentary film that takes viewers on a breathtaking journey through the Earth's watery arteries, from deep underwater caves to North America's Great Lakes—as well as some unlikely locations. "I swim under your homes, your businesses, golf courses, bowling alleys—all kinds of places where people don't imagine their drinking water is flowing," says Heinerth. The film entices viewers with the natural beauty of our watery world, challenging them to make simple changes to protect and preserve the Earth's clean water," she adds.

The film also looks at humanity's traditional spiritual connection to water, from modern baptisms to its significance in ancient mythology. "Every time I slip beneath the surface," says Heinerth, "I feel a spiritual connection to the Earth and a deep reverence for water. I realize that I am swimming through the very essence of the planet. The Earth embraces me and I get to share, through my photographs and films, a breathtaking world few people will ever experience for themselves. As a kindergarten kid who loved 'show and tell,' I realize that I never stopped doing that, even forty years down the road."

One of Heinerth's favorite diving experiences is to swim with manatees near her home in Florida. "They are very playful, curious animals that enjoy interacting with humans. They'll nudge you and push your hand underneath their little flippers where they can't reach, encouraging you to give them a scratch. They're just the most amazing, gentle, intelligent animals you could imagine. "

Heinerth grew up in Canada and wanted to be a diver ever since she was a kid watching the exploits of Cousteau on TV. Unfortunately, though she loved the water, she was sometimes prevented from getting in and swimming because of local industrial pollution. As a result, she's always been passionate about taking positive environmental action. Her life-long advocacy for water, through photography and film work, was recently recognized with the prestigious Wyland Icon Award, an honor she shares with Cousteau.

"More recently, living in America, I've seen a decline in the Florida Springs systems. Things are not the same as when I started cave diving here. Some places are better but most are worse. People don't intentionally pollute; they just don't realize how their actions on the surface, things like fertilizing a green lawn, affect their fresh water resources. I think I can be that voice from inside the planet—letting them know how they're connected and how to do a better job."

The documentary was released January 1st and Heinerth is issuing a call to action for people to pledge their support via the website www.WeAreWaterProject.com, which also provides a schedule of premieres and speaking engagements. On the site, users can learn about how they can minimize their water consumption and discover why the world's natural water resources are disappearing. As Heinerth puts it, "one of the most important things that I want to encourage is to simply take a child to a river, a lake, a spring, or the ocean. Reconnect yourself and your family with water. Enjoy it, dive it, swim it, paddle it, experience it, because when you love it, you'll want to protect it ...This project is the most important thing I've done in my life," Heinerth adds. "Water is the most important thing in everyone's life."

IN JILL'S OWN WORDS

For the first time in history, fresh water has become a finite resource. Many experts agree that, without significant changes in water policy, wars of the 21st century may be fought, not over oil, but for control of clean water. I live over the most abundant aquifer on the planet, yet my neighbors scarcely understand where their water comes from or how they might be unintentionally

polluting that scarce resource. Ask a child in North Florida where their water comes from and he or she will tell you "the tap." Somehow most children have lost the real connection to the water that flows underground between the grains of sand or through the vast cave tunnels that I call my workplace.

After leading an incredible life filled with great adventures around the world, I decided it was important to put the pieces together for people and to help them understand that all we have wrought upon the surface of our land will be returned to us to drink.

Livestock farms may be appropriate in some landscapes, but North Florida's porous karst limestone is not a good place for high-density cattle operations. Intensive irrigation for feed washes excess nutrients into the groundwater, sending nitrates into water bodies that eventually become choked with filamentous algae.

My late colleague, Wes Skiles, inspired a good part of my environmental stewardship as he pursued the Florida Springs' protection efforts and legislation. I recognized in him a great desire to help others have meaningful and positive interactions with water as a vehicle to make them care about how to protect it.

We look for life in space by searching for water, yet we have taken our own for granted. Earth is a water planet, shining a unique blue in the vastness of space. Yet less than three percent of the water on this planet is fresh and most of that is locked up in ice. Less than one percent of the water supply on Earth can be used as drinking water. There is nothing more precious than usable fresh water and nothing is shrinking faster as we overpopulate this big blue orb.

On a local level, we can all take small actions to conserve and protect water resources. Americans use five times more water than Europeans and many times more than the rest of humanity. Our wasteful actions include our love affair with a golf-course style lawn and wasteful use of a cheap and plentiful supply within our homes. Our contribution to pollution comes through actions at home and work as well as a disconnect with our water footprint. We wantonly use up bottled water without understanding that it takes five bottles to make one and more to deal with the trash.

On a regional level, we have somehow become disconnected with using resources and food that are produced locally. The glut of the last two decades has led to habits that use and pollute water on a grand scale.

Globally, we have forgotten that many people are not as fortunate as we are. Millions of women spend their entire day walking on dangerous roads to fetch water for their families. They become the victims of desperation and miss out on the opportunity for education and advancement. They tend to their children who are sick from water tainted with toxic chemicals and dangerous microbes. They do whatever they need to do to nourish their children, and their desperation leads to global conflict and unrest.

Yet even with these dire observations, I have to remain optimistic about our ability to understand the issues and do something about it. We're in the eleventh hour, yet it only takes a determined collective will and simple action to move towards a more harmonious and sustainable future.

My goal with the We Are Water Project is to help people learn about their local watershed and promote general water literacy. I want people to understand where their water comes from, how they might be polluting it, and how they can conserve it for future generations. With knowledge comes power and I believe when people are better connected with their water resources, they will want to do something about it. Most importantly, I want to inspire people to have a love affair with water. If they swim, dive, or paddle in it, they'll want to do it again. We will protect what we love and understand, and if everyone considers that both our bodies and our planet are seventy percent water, they will understand that We Are Water.

An Introduction to Cave Biology for the New Cave Diver: Part II

By Thomas R. Sawicki, Ph.D.

Remipede

In Part I of this series, we began a discussion of caves by exploring the language of cave biology and by looking at selected fauna in freshwater cave systems. Now in Part II, we will look at selected fauna of anchialine caves.

SELECTED FAUNA OF ANCHIALINE CAVE SYSTEMS

Anchialine caves are another type of system commonly explored by cave divers. The word "anchialine" is derived from two Greek words: *anchi*, from the Greek for "near", and *halin*, from the Greek for "the sea". Divers can encounter anchialine caves in the coastal regions of the Yucatan Peninsula in Mexico, the islands of the Caribbean, the south Pacific, or Western Australia. An anchialine body of water is often a sinkhole with a vertical shaft connecting to a solution tube. The surface water of the cave is relatively fresh, but deeper within the water column denser salt water is found beneath a *halocline*—a zone in the water column in which there is a sharp change in salinity. The depth at which one passes through the halocline largely depends on the distance to the sea from that point. In order to understand why this is the case, it is useful to consider what happens as water flows down a river to the sea. Far inland, river water is completely fresh at

L-R: Isopod, Mysid, Shrimp (Photos courtesy of Thomas M. Iliffe)

all depths. As one moves closer to the coast, a salt-water wedge begins to form. Given that salt water is denser than fresh water, as one nears the coast, fresh, surface water sits on top of a gradually deeper layer of denser salt water, with the two layers separated by a halocline. This is one reason why anglers can catch marine fish in a river, even miles upstream. As you continue to move toward the coast, the halocline gets shallower and shallower, until eventually you reach the ocean and the water is fully saline.

Karst is a terrain characterized by underground drainage, with many cavities and underground passages caused by the dissolution of soft rock (e.g., limestone or dolomite). Water migrates down through this porous rock until it reaches a confining layer (a layer of rock with low permeability), at which point it begins to flow. Thus, the caves in which cave divers explore can be thought of as underground rivers—easily seen in anchialine systems, which have a halocline and can be tidal. Like surface rivers, as one travels toward the sea in an anchialine cave, the halocline gets shallower and shallower. As one might imagine, the complexity of these habitats, with their varying salinities, lends these areas to incredible biological diversity. Some of the most exciting taxonomic discoveries of the latter half of the 20th century have come from these environments.

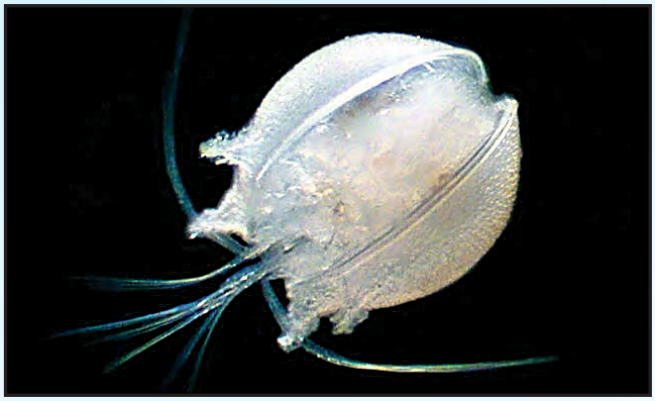
Amphipod (Courtesy of Thomas M. Iliffe)

Yager (1981) described a new class of crustaceans, the *Remipedia*, from an anchialine cave on Grand Bahamas Island, Bahamas. To the average observer this may not seem like big news, but to biologists this was remarkable. As is commonly known, organisms are classified in nested hierarchies. Traditionally, the most inclusive taxonomic classification has been the kingdom (modern taxonomy uses the level domain as the most inclusive classification, followed by kingdoms). Classified within the various kingdoms are phyla (singular phylum). Within phyla are classes, within classes are orders, within orders are families, within families are genera (singular genus), and within genera are classified species. New species and even new genera are discovered all the time. But the discovery of a new class of animals is quite remarkable.

So what do remipedes look like? They are actually very unique-looking crustaceans. Most crustaceans, like amphipods and crayfish, have three distinct sections (called tagmata): a head, thorax, and abdomen. The heads of remipedes look very similar to other crustaceans, with two antennae, mandibles, and other accessory mouthparts. The remipede body, however, is not divided up into distinct thoracic and abdominal sections. In fact, the average observer would be forgiven for thinking he or she was looking at a tiny swimming centipede—or if one is familiar with marine organisms, a remipede may be confused for a tiny polychaete. The body of the remipede, which is called the trunk, is composed of repeated segments, each bearing a pair of paddle-like appendages that the animal uses to swim. Depending on the species, remipedes vary in size from as small as about 1 centimeter, to as large as 4.5 centimeters.

To date, there are twenty-four described species of remipedes. All twenty-four described species are stygobionts, living within anchialine caves from the Caribbean and south Atlantic, to the Island of Lanzarote in the Canary Islands, to the coast of Western Australia (Neiber et al. 2011). The question of how this group, which is adapted to living within cave habitats, has such an incredibly wide distribution is an area of intense research. As it turns out, remipedes are not the only group of animals commonly found in anchialine caves with this extraordinary biogeographic distribution.

Other crustacean groups, including specific families of amphipods, isopods, ostrocods, and shrimps (to name a few



Ostracod (Courtesy of Thomas M. Iliffe)

Ostracod (Courtesy of Thomas M. Iliffe)

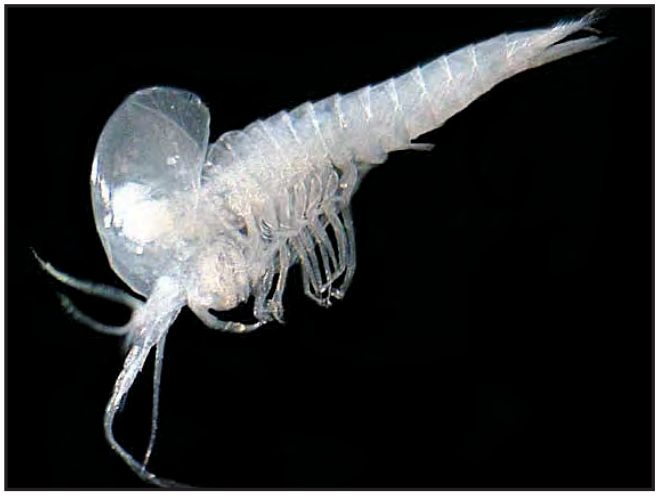
common groups) have been discovered to exhibit the same type of biogeographic distribution as the *Remipedia*. So, for instance, if a new species of remipede is collected within a cave in the Turks and Caicos, one could make predictions about a variety of other specific taxonomic groups that would likely also be discovered in that cave.

An interesting group of crustaceans found living in anchialine caves, with a biogeographic distribution similar to that of *Remipedia*, is the order *Thermosbaenacea*. Thermosbaenaceans are classified within the superorder *Peracarida* and are thus more closely related to isopods and amphipods than to decapods (crabs, lobsters, and crayfish). The first thermosbaenacean ever described was from a hot spring near Gabès, Tunisia, in 1923 (Monod 1924 a, b, as cited by Barker 1962). The temperature of the water in this hot spring is in excess of 40 degrees Celsius (thermo is Greek for heat). However, these little crustaceans (generally 1 to 2 millimeters in size) have been found living in anchialine caves along with remipedes and the other crustacean groups noted above. Most cave divers will go their whole diving career without ever seeing these organisms. If you find yourself diving in an anchialine cave, carefully examine the water column for specks of particulate matter. If you see a speck move, you may be looking at a thermosbaenacean. If you can carefully examine the animal, and you notice a crustacean whose head seems to be covered by a shield, with a compact thorax, and a relatively long abdomen, chances are good that you spotted yourself a species of thermosbaenacean—and chances are good you have excellent eyesight!

Although crustaceans are by far the most common group to be found in anchialine caves (and include, in addition to those we have mentioned, copepods, mictaceans, mysids, and crabs and others), they are not the only invertebrate group to have successfully invaded these habitats. Sponges, gastropod molluscs, flatworms, segmented worms, and even mites all have representatives living in anchialine caves (Iliffe and Kornicker 2009).

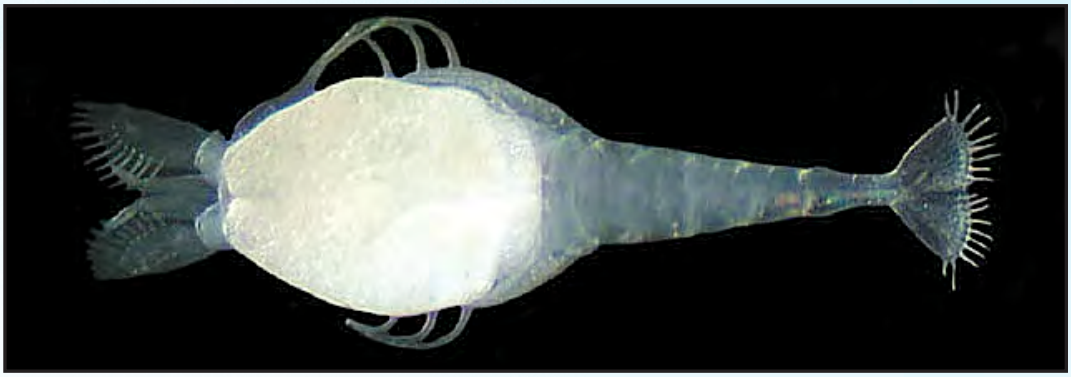
It is also important to recognize the obvious links that exist between organisms commonly found in both freshwater and anchialine cave environments. Naturally, stygobitic species found within freshwater caves have epigean founding populations that lived within lakes and streams. For instance, *Crangonyx hobbsi* and *C. grandimanus* are part of a very large group of freshwater amphipods classified within the family Crangonyctidae. However, Hadziid amphipods (a family of amphipods, members of which are commonly found in anchialine caves) have morphological characteristics that clearly suggest a relationship

Thermosbaenacean (Courtesy of Thomas M. Iliffe)



Thermosbaenacean (Courtesy of Thomas M. Iliffe)

to an epigean marine ancestor, although the exact relationships are still to be worked out (Sawicki and Holsinger 2004). These surface-dwelling ancestors often live in habitats that result in preadapations that facilitate their evolution into hypogean environments—for instance, living in the cracks and crevices of a coral reef or the interstices of a sandy bottom or being nocturnal. Additionally, metabolic constraints limit the types of organisms that can successfully found a cave population. Thus, whether the cave is freshwater or anchialine, similar taxonomic groups tend to be common within cave ecosystems.



Thermosbaenacean (Courtesy of Thomas M. Iliffe)

Of course invertebrates are not the only animals that can be found in anchialine caves. Although most species of stygobitic fish are found in freshwater habitats, a number of species have been described from anchialine caves (Romero 2009).

Considering the fact that anchialine caves are found in coastal regions of continents from Central America to Australia, and on oceanic islands across the globe, attempting to provide an exhaustive review of the biological diversity found within these habitats is well beyond the scope of this essay. However, it should also be clear that a variety of animals, especially crustaceans, are commonly found within these environments, and learning to recognize these groups can greatly enhance your exploration and appreciation of these unique and delicate ecosystems.

In Part III, we will look at the evolution of caves and their biological habitats, as well as examine some basic ecological concepts.

LITERATURE CITED

Barker, D. 1962. A study of *Thermosbaena mirabilis* (Malacostraca, Peracarida) and its reproduction. Quarterly Journal of Microscopical Science 103 (2): 261-286.

Iliffe, T. M., and L. S. Kornicker. 2009. Worldwide Diving Discoveries of Living Fossil Animals from the Depths of Anchialine and Marine Caves Smithsonian Contributions to the Marine Sciences 38: 269-280.

Monod, T. 1924a. Parasitologia Mauritanica. Materiaux pour la faune parasitologique en Mauritanie (II Isopoda). Bulletin du Comité d'études Historiques et Scientifiques de l'Afrique Occidentale Francais 9: 67-84.

Monod, T. 1924b. Note sur la morphologie et la distribution géographique de *Meinertia collaris* Schioedte et Meinert. Bulletin de la Société Zoologique de France 49: 31-34.

Neiber, M. T., T. R. Hartke, T. Stemme, A. Bergmann, J. Rust, T. M. Iliffe, and S. Koenemann. 2011. Global Biodiversity and Phylogenetic Evaluation of Remipedia (Crustacea). PloS ONE 6(5): e19627.

Romero, A. 2009. Cave Biology (Ecology, Biodiversity and Conservation). Cambridge University Press, pp. 118-119.

Sawicki, T. R. and J. R. Holsinger. 2004. Systematics of the subterranean amphipod genus *Bahadzia* (Hadziidae), with description of a new species, redescription of *B. yagerae*, and analysis of phylogeny and biogeography. Journal of Natural History 38: 1397-1414.

Yager, J. 1981. Remipedia, a new class of Crustacea from a marine cave in the Bahamas. Journal of Crustacean Biology 1: 328-333.

Stygiomysid (Courtesy of Thomas M. Iliffe)

Shrimp (Courtesy of Thomas M. Iliffe)

Modern-Day Cave Exploration

By Mark Messersmith & Andreas Hagberg

It sometimes takes motivation and effort in the form of paddling to reach a remote cave.

"I thought everything has already been discovered…"
"You need six DPVs and a rebreather to see any virgin cave…"
"Only the locals know where all the leads are located…"

The fact is that assumptions such as these are just plain incorrect. In the past twenty-four months alone, new line has been laid in more than a dozen cave systems in Florida with discoveries occurring simultaneously in Mexico, Italy, Sardinia, Bosnia, China, Texas, Russia, Papua New Guinea, and Australia—just to name a few. In fact, two systems being explored by my dive buddy Andreas Hagberg and I are located in High Springs, the world's most popular cave diving area. And, despite the continuous stream of visiting cave divers, new tunnels, new caves, and new opportunities are available to those with a little initiative.

GETTING STARTED

So where to start? The best location to start your search for virgin caves is often in areas of other systems. While most divers will visit a popular, local site, quite often other smaller, more remote sites that share the same underwater system are not far from these sites. It may be a dive site that hasn't been visited in years or a sinkhole

located on a farmer's property. Reviewing maps and talking with local residents can oftentimes yield leads worth investigating. You should realize that the process may take some time and it is quite likely you will finally obtain access or knowledge about a site that upon closer inspection doesn't have water or is clearly not connected to the aquifer. To those dedicated to finding new underwater caves, these discoveries are still part of the fun and contribute to the reward when a new site is found. Conversely, if you expect the discovery of a new system to be easy—think again. The entire process is an adventure that is really a lot of fun and will likely create lifelong memories.

The better you understand the local karst and related underground water movement, the more effective your research will become when exploring potential opportunities. When we learn the water flow around a river, we can predict with some level of certainty water movements underground. As cave divers, we recognize that the tunnels make some interesting directional changes, but, when viewed macroscopically, patterns can be determined that will assist our exploration. Another example of utilizing surface data to find a new dive site is recognizing water temperature differences. If we are considering a sinkhole in the dead of winter, we will have fairly convincing evidence that the water is connected to the aquifer by its temperature. While this caveat applies year-round, in the winter when the surface temperatures can be near freezing (even in Florida), the aquifer water remains twenty-one degrees Celsius and often produces steam when it reaches the cold surface air. We call this a clue and it is just one of the many insights we seek when searching for new underground dive opportunities.

LANDOWNERS

Finding a potential dive site is oftentimes only half the challenge. If the target sinkhole or point of access is on private property, obtaining permission to make one or more dives is equally challenging. We must first find the name and contact information of the owner before developing a strategy to successfully obtain access. Most landowners are not strongly interested in knowledge of caves or water bodies located below their land. As long as they are able to continue to use the land for its current purpose, they are content. Further, when we request to dive in the identified hole to discover the extent of the water body, most owners quickly recall the stories they have heard or read about the demise of a cave diver. It is important to recognize that people know very little about cave diving and what they do know comes from a naïve, sensationalized view printed in the local newspaper after an accident. For these reasons, it is valuable to learn everything possible about the owner, their business, their lifestyle, their hobbies, and their current use of water on the property. With a properly devised strategy, the opportunity for obtaining permission to dive is increased.

To be an explorer you must be able to work harmoniously with all types of people. It is necessary to make your goals for cave exploration rewarding for all involved, including the landowner. Promises of a map depicting the location and depth of the tunnels may be interesting but be assured that, whatever is promised, the landowner will be weighing this reward against the perceived risk and liability of the adventure. Remember, the landowner was happy and content before we arrived on the scene and really does not need any additional stress in his or her life. We should look and sound professional. We should be prepared to demonstrate competence and experience in cave exploration and we should definitely have one or more Liability Release Waivers available to be completed for everyone who comes onto the property during our dives (yes, even wives, girlfriends, and surface support), thus allaying as many perceived fears of litigation as possible. If you arrive at your first meeting with the landowner prepared, the odds of gaining access will be greatly increased. This, of course, also applies when meeting with government officials. One final point in working with landowners: if you can discover a relevant interest of the landowner, you can quite possibly become a hero in his or her eyes. Said another way, if you are able to help accomplish a goal or overcome a problem currently faced by the landowners, they will be most grateful and accommodating. Two examples: in the city where we live, I was able to map the exact location of the tunnels using radio location beacons and thus provided valuable data to the local government, the developer, and interested environmental representatives as they discussed the pros and cons of building a Walmart on or near the cave system. Second, at a dive site in Tallahassee, FL, we were setting up for an extended exploration effort and while we had access to the underwater cave via another sinkhole, a more convenient entry/exit point existed. After talking with the people who controlled the property, we discovered that a liter of gin would make everyone happy. Thus, for very little time and money, we were able to make the owners happy (quite literally) and were granted better access to the cave system.

Stick map colored by depth and marked with a few sink holes

Looking at a cave from a different perspective may yield something one did not see before.

CONFIDENTIALITY

Sharing your plans and the results of your dives should be conducted thoughtfully. Regretfully, if you discover a new tunnel and immediately post your findings on Facebook, don't be surprised if someone else visits your new tunnel by the time you return. This is fine if your efforts are complete, but if you have multiple leads and are systematically exploring each new opportunity, it is highly likely other divers will happily pick up where you left off and continue your efforts, with or without your consent. On more than one occasion, I have shared the location of a lead with colleagues who subsequently added line to tunnels I was exploring—which fortunately at the time was not really a problem. If this bothers you, then maintain confidentiality. In contrast, Andreas and I have been exploring a couple of local caves over the last few years that we decided to keep quiet. Interestingly, we have discovered some old line in the caves but also many, many new tunnels. By early 2012, we had explored over three thousand meters of cave and learned a great deal about water flow in and around these sites. By maintaining strict confidentiality, we have been able to work without concern of other divers finding our leads and taking over our exploration for one simple reason: we haven't told anyone the location of our work. While not always easy as we fill up (yet again) multiple stages, spools of exploration line, and a pocket full of cookies and arrows, keeping our location confidential removes some of the time pressure of our work and allows our fun to continue at a more comfortable pace.

MAPPING TECHNIQUE

While being the first person to ever see a cave is a tremendous joy in itself, another dimension to the experience is gained by mapping what you have explored. While a line-drawn map on a white sheet of paper can be of value to divers, today we have simple means of expanding this tool by overlaying cave maps on the excellent world map called Google Earth. There are multiple software programs available to download and use to create cave maps, with several being able to export maps to a Google Earth KML or KMZ files. To get started, Google Earth requires one or more GPS coordinates to correctly locate the cave survey data onto their world map. This is accomplished in the cave survey software. The easiest method to obtain GPS coordinates for one or more points in a cave is to simply find the cave entrance on Google Earth and record the coordinates for this location. If Google Earth does not have sufficient coverage or your cave system is hidden under foliage, an independent GPS navigator will produce the desired results. A hand held unit can be taken to the cave entrance or even along on the dive within a waterproof container. The latter option is particularly useful if another entrance to the cave is discovered during the dive. In the unlikely event that obtaining GPS coordinates is still problematic, another device can be deployed. Radio locator beacons or "cave pingers" utilize a magnetic transmitter in the cave and a receiving device on the surface. When precise tunnel locations are required, such as in preparation for drilling an access hole for scientific equipment or in the example above when planning for the potential arrival of Walmart, radio location equipment provides fairly accurate results.

Most cave mapping software programs are still free to download and use. Some of the most popular include Ariane's Line, Compass, OnStation and Survex. Each has their strengths and weaknesses, but Ariane's Line is made by a cave diver for cave divers and has become our personal favorite. Found on the

internet and downloadable for free, most software programs are fairly easy to understand with an appropriate investment of time for learning. Ariane's Line has a video tutorial to help you get started. Once you learn the basic software functionality and are able to see your cave map appear as a layer in Google Earth, you will be quite pleased. It is rewarding to see your work attached to the reality of the surface and this new dimension will quickly become an invaluable tool in enhancing future exploration efforts. Everyone from landowners to family members will gain a much greater understanding and appreciation of the exploration project when they can identify the tunnel location in the context of surface topography.

MAPPING ERRORS

Errors in mapping are to be expected for a whole list of reasons. One of the quickest ways to discover errors is when the tunnel being mapped loops back and intersects a previously mapped tunnel. Rarely will your survey data be so accurate that your map will correctly display a connection point without tweaking your data. This can be frustrating, but it is something even the most experienced divers will have to manage. When surveying a line in a cave, opportunities for error arise for several reasons. First is simply sloppiness. Not reading the compass correctly and not counting the knots on the line (tied every 3m) accurately are the most common error sources. While seemingly easy to do, when monitoring gas consumption, light and DPV management and hoping to minimize decompression obligations, haste sometimes leads to errors. Another potential for error appears when trying to create a 2-dimensional map from a 3-dimensional cave. Each measurement – azimuth, distance, depth, width, and height – provides an opportunity to erroneously record the exact dimension. Additionally, rounding errors can be caused by the equipment even if properly operated. For example, a depth gauge depicting whole numbers in Imperial can potentially be inaccurate by 6 inches at every station. The compass can also be a source of inaccuracy, as anyone who has used a compass underwater knows the challenge of obtaining a heading with 1-degree accuracy. Modern digital compasses mounted on an aligning aid (a 0.3-0.6m stick or small slate) will normally produce good results. Unfortunately, digital compasses can be more sensitive to magnetic fields produced by the metal and electronics of the dive equipment, consequently making their readings haphazard. While there are many other methods for improving survey results, with time, patience, and practice, accurate, reproducible numbers can be recorded.

Hopefully we have given you something to think about when planning your next dive adventure. Diving is fun, cave diving can be quite fun, but discovering a place on this earth that no man has ever seen before is truly a gift from God. Even the most rough and tough explorers will tell you that making a new discovery, underwater or above, is truly a wonderful experience. So what are you waiting for? Get out there and find some virgin caves, but before you get started there's one last thing…don't forget to send us your GPS coordinates.

Andreas' survey equipment (wet notes not included). The digital compass is mounted on a 2-foot stick with a marking in the middle; this reduces the guess work from a station to the nearest knot on the line. The yellow sonar measures distance, useful when measuring the width and depth of a passage.

Diving Rules for the 21st Century

By Gareth Burrows

It is much more pleasant being at home and wishing you were diving than diving and wishing you were at home.

Many years ago, "rules" for diving did the rounds of the internet and were quoted in newsgroups and forums as if they were law. I find this fascinating because, of course, we teach people to *think*, not to blindly obey rules. However, I thought it would be worthwhile to revisit those rules for the 21st century and discuss whether they have any relevance for GUE divers today.

RULE 1: DO NOT DIVE WITH UNSAFE DIVERS

This first rule has raised the most emotion and vitriol in the past as it has been interpreted in a variety of exclusionary ways; for instance, it has been interpreted to mean "don't dive with people outside your team" or "don't dive with people from other agencies" or "don't dive with non-DIR divers". This is an error.

Forget the agency, training, or background. Anyone can be an unsafe diver under certain conditions, including your best friend and most trusted GUE teammate. An unsafe diver is someone who is not physically or psychologically prepared to safely conduct the dive you have planned. Maybe their kit looks cobbled together because they rushed. Maybe something on their kit looks like it needs maintenance. Perhaps they are so focused on themselves that they are not taking an active team role in preparing for the dive. Perhaps they haven't analyzed their gas or haven't conducted a proper pre-dive briefing with you. Perhaps you are not on the

same page regarding the dive plan or the decompression strategy. Perhaps they are using a kit they are clearly not comfortable with or are trying out a new kit on an inappropriate dive. There might be a million and one things, but I'd come back to interpreting this as someone who is not, in your opinion, prepared to safely conduct the dive. This rule at least, seems to make as much sense today as it ever has.

RULE 2: DO NOT LISTEN TO UNSAFE DIVERS

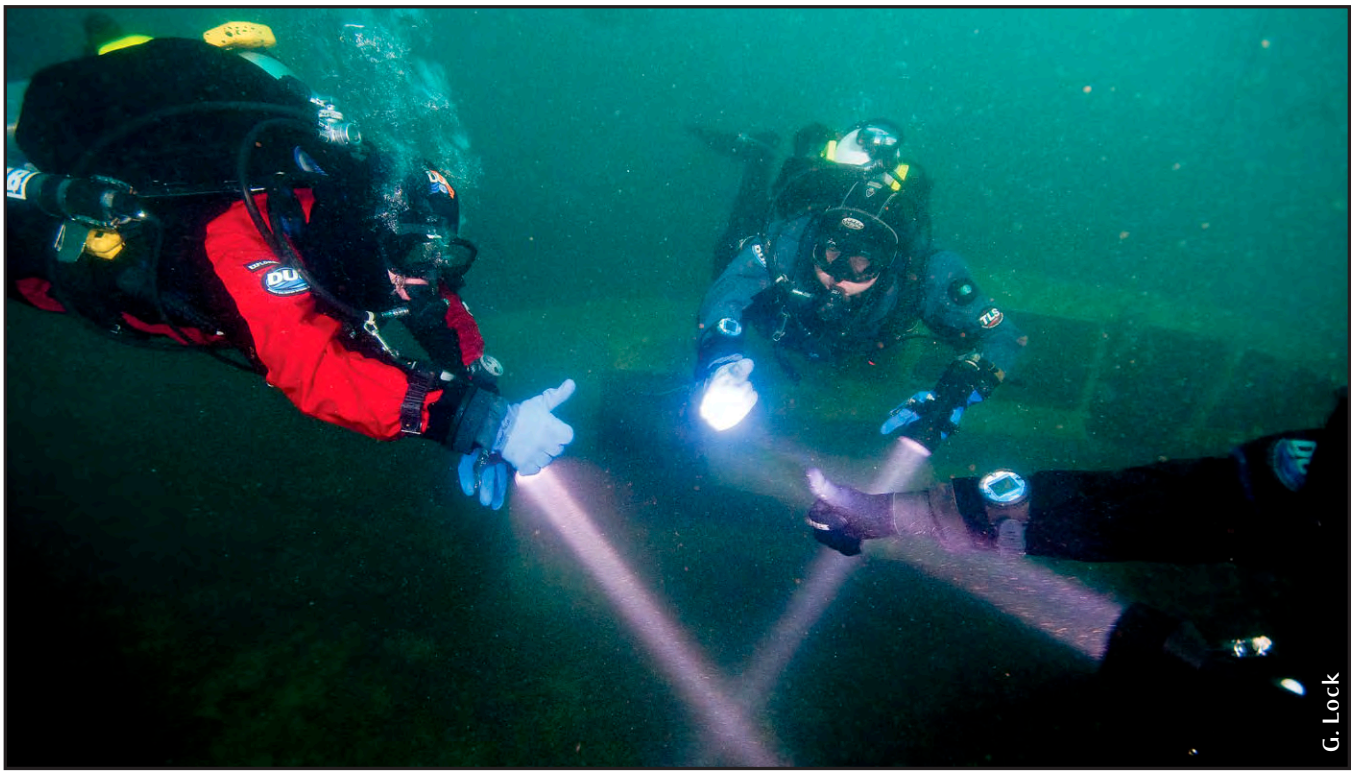
If you have decided someone is acting in an unsafe manner, you probably don't want to listen to any arguments they might have for continuing to act in the manner that they are. Again, this does not mean "don't listen to non-GUE divers." It means "don't take advice from people you believe to be unsafe." For instance, if your best mate is behaving unsafely because the cylinders they are about to use offer no evidence that they have analyzed their gas—e.g., no tape or dated sticker—you should not follow their lead. Compel them to analyze their gas before you get into the water and do not let them convince you that it is "no big deal" to undertake the dive.

RULE 3: THERE IS NOTHING UNDERWATER WORTH DYING FOR

Surely this is obvious to everyone. Yet we keep hearing of people who stayed just a little bit too long or perhaps went a little too deep. If you've made a plan on the surface, stick to it in the water, as you made it for a reason. You won't make a plan on the surface that will kill you. If you happen to stumble across the treasure of the Sierra Madre but you have reached minimum gas, tough. Come back tomorrow. I can personally attest that it's far more pleasant being at home wishing you were diving than being diving wishing you were at home. There really is nothing underwater worth dying for. This is a simple rule to remember and live by. Come home safe.

RULE 4: ALWAYS ANALYZE YOUR GAS (BEFORE EVERY DIVE)

Logic would dictate that this would be the least controversial rule. However, every now and then, someone dies because they failed to adhere to it. A couple of years ago, I tested my twinset on the boat as I prepared for a forty-meter dive and found to my consternation that I had 200 bar of pure oxygen in my twinset. I think it's fair to say the dive would have been both brief and somewhat eventful if it had gone ahead. Another diver I know blacked out while sitting on the side of a rib as he prepared to roll off the side into the sea. He can be thankful to an anonymous gas filler for the low price he had been charged for a very expensive fill, and thankful to his body's swift reaction to the one hundred percent helium in his twinset for probably saving his life. Stuff like this happens. Most of the time, it gets caught in time. Tragically, sometimes it isn't. Gas accidents sicken me, because their results can be so easily fatal and yet so easily avoided. Analyze your gas before every dive. Do not make any assumptions based on what people are telling you. Analyze anything you might potentially have to breathe. Mark your cylinders with the current date, and check your team mates to make sure they have done the same. If they haven't, see rules one and two. If problems arise, you might have to breathe what's in their cylinders, so check those stickers before you hit the water, and stand firm if you are not happy with the labeling.



When diving, the most important rule to remember is that any diver can call any dive—at any time and for any reason.

It is important that divers demonstrate that they are safe divers and have a safe mindset.

RULE 5: DON'T DIVE A REBREATHER UNLESS IT IS NECESSARY

GUE's stance on rebreathers is fairly simple. There is a balance of risk and need. GUE divers on the whole believe that diving with rebreathers is, generally speaking, riskier than diving open circuit. However, there are certain dives where the risks of open circuit outweigh the risks of a rebreather. Where gas logistics become prohibitive—extremely long exposure cave exploration or very deep wreck diving, for example—then there is an argument that a rebreather is the tool of choice.

RULE 6: ALWAYS LOOK COOL / FABULOUS

This seems a bit silly, doesn't it? Perhaps, but let's just assume for a moment that the rule does not mean "only wear black" or "only buy Halcyon." Divers who make the assumption that this is what the rule actually means are missing the point.

Let's imagine you are on a boat. Your prospective team member's equipment looks messy or poorly maintained. Maybe the hose routing looks untidy. They are clearly in breach of rule six. What's important is not that their configuration is not neat or their equipment knackered. What's important is that they have rushed their setup or failed to maintain their equipment, which renders them potentially unsafe or without the correct mindset for that dive.

Assume your team member's cylinders have fifteen different stickers on them, and this violates rule number six. Again the important thing is not the aesthetics but rather that you might not be able to identify a current analysis sticker or, heaven forbid, misread the maximum operating depth. Again, it is an issue of safety.

Now you're in the water. Your buddy is dropping in and out of trim. They are waving their arms about. They are not looking "cool." If you have your head switched on, you now know that they are uncomfortable for some reason. Don't ignore it. Find out why.

Rule six is not about looking cool for the sake of cool. It's about looking in control, prepared, calm. In short, it's about demonstrating you are a safe diver and have a safe mindset.

CONCLUSION

These are the rules as they would apply today. One small addition I would like to make to wrap things up is something I call "Option One." Option One is very simple: *any diver can call any dive at any time*. Any diver can call any dive, before or after they hit the water. No debate. No questioning. No argument. The dive is over. Why someone calls a dive is irrelevant. They have decided they want to be out of the water, or don't want to get into it. Diving is supposed to be fun. So respect that decision. Would you really want to be in the water with someone who doesn't? If someone tries to convince you to dive when you don't feel comfortable, please refer to rule one.

GUE Divers Continue their Work in Palinuro, Italy

Sulphurean Cave Survey Project

By Giovanni Marzari, Cristian Benedetti, & Francesco Forieri

Project diver at work.

In *Quest* (Vol. 12, No. 2), we reported the first part of a project during which we placed a main line in the amazing Sulphurean Cave near Palinuro, Italy.[1] Following this effort, we needed two years to gather the team, the skills, and the time off for the second part of our project: the survey.

Cristian and Giovanni began to plan the trip six months prior to departure, so they had ample time to get in touch with Francesco to arrange all the logistical needs, such as boat support (the cave is only reachable by boat), fillings, and spare gear. During the winter they also prepared the small items that surveys require, such as measuring tapes, survey compasses, new cookies, survey sheets, and of course, a plan.

In order to have as precise a plan as possible, we began looking at previous maps and sketches made by explorers in the late 1980s.[2]

Project member taking measurements.

We decided to focus our efforts on the last and less-visited part of the cave, where explorers provided us with only an incomplete sketch. This section can be divided into a restricted tunnel ("condotta forzata"), a wider restriction ("laminatoio"), a main room, a main side tunnel, and an inner fresh water lake. Even with all of our planning, we only managed to spend a week in Palinuro, with five days of diving.

In April, we finally had a precise dive plan[3], divided by day:

Day 1: Introduction to the cave, reel positioning, setting jumps, and placing all markers (start of the line, jumps, end of the line);

Day 2: Picture shooting dive;

Day 3: Main line survey, side tunnel line survey (azimuth, distance, depth);

Day 4: Survey up, down, left, right of main line; and

Day 5: Survey up, down, left, right of side tunnel.

After the first day of diving, we realized that our plan was really optimistic. Cave conditions were not good enough for shooting pictures, we forgot to include the survey of the section where we put in the reel, and sea conditions were getting worse.

On day two we had to stop diving because of hard rain and rough seas, but a rainy day sometimes helps: we talked to many people who became interested in our project. Our team now gained a boat driver (Davide Felicetti), who also helped us with some great suggestions, and a photographer (Martin Wychera).

On day three, we were able to dive in the cave only in the afternoon, but with everything in place, our experience during previous dives, and better cave conditions, we were able to achieve much more than expected. Thanks to Martin and his son Dominic, we managed to both survey the side tunnel and do the first photo shoot dive. The surveyed distance almost doubled and our communication and roles became smoother and more precise.

From this day forward, every evening was almost a party. Cristian and Giovanni met after showers in front of their tent. Seated on their camping chairs, they first entered all the day's data from their Wet Notes onto survey sheets and then extended the limits of the existing map. After that, everyone met at the camping bar for an Italian "aperitivo," where they enjoyed a slideshow of the day and planned the next diving day.

Although day four offered much better cave and sea conditions, it also offered us the most challenging dive. Our plan was to survey the very last part of the main line, including the inner lake and the "condotta forzata." Even though the current wasn't as strong as day one, we had a hard time communicating in the small twenty-meter passage. We needed one more dive to finish the work and do the clean up.

On day five, hoping for even better conditions, we decided to add one more photo session to the last meters of survey. For this last photo session, we planned to take pictures of the entire

cave from the sea entrance to the inner lake thereby hoping to document the evolution of the system from sea cave (in the first ninety meters) to dissolution cave. Fortune smiled on us and we were blessed with perfect conditions throughout the cave—i.e., more than twenty-meter visibility and no flow. Cristian's photographic efforts were fully rewarded with more than one hundred remarkable images—and Giovanni took a few nice pictures of Christian, even if his experience was limited.

Although we did not fulfill the original objectives of days four and five, we were fully satisfied by our first survey experience. We all grew as people, as divers, and as a team. We dealt with the frustrations and different personalities that we encountered on the challenging path to fulfilling a common goal.

Cristian dedicated the next week of his holiday to the post production of the collected data and the pictures. Using CAD software, we were able to create a map showing all data gained during our dives. Even if we had to hand-draw our progressions every evening, it was very satisfying to see it finally appear on Giovanni's laptop.

Finally, we were amazed by the cooperation of the people who helped us simply for the enjoyment of the experience.

The team would like to thank Centri-Immersione Capo Palinuro for all logistical support, Davide Felicetti for the teachings and all the boat rides, and the Wychera family for the enthusiasm, the pictures, and the cooking!

We are looking forward continuing the project as soon as possible!

REFERENCES

[1]Forieri, F., Marzari, G., Wychera, K., and Wychera, D. "Placing a Main Line in the Sulphurean Cave." *Quest,* vol.12, no. 2: 22–24.

[2]Muscio, G., 1985. Il fenomeno carsico dell'area Camerota-Palinuro (Salerno-Campania), Mondo Sotterraneo, n.s., 9 (1-2): 13–42.

[3]Burge, John W. Jr., 1987. "Basic Underwater Cave Surveying." NSS.

Project member retrieving spool.

An Introduction to a Fascinating World

Ultraviolet Photography

By Matej Simonic

Proteus, Kompoljska Cave, Slovenia

My interest in the ultraviolet (UV) spectrum began to emerge over twelve years ago, when I discovered a few underwater UV photos on the Web that captured my interest. I immediately decided that I had to see this world with my own eyes. Because at that time underwater ultraviolet light equipment was unavailable for purchase, I decided to build some myself. I took a small, black light fluorescent tube (similar to those used in night clubs), made some electronics to drive it on a pack of batteries, and sealed everything together in a transparent tube made of acrylic glass (I had no clue then about needing a filter on my mask!). I took it to Egypt, eager to experience UV fluorescence myself. On the night we arrived, I went straight to the jetty and turned it on; it worked very well on the surface even though it was not very powerful. When I dove into the water, however, it leaked—and I drowned my dreams for a long time.

Certain corals and animals emit fluorescent light when struck by ultraviolet light. The right equipment will allow these to "glow in the dark" in spectacular fashion, the result of energy at short wavelengths being absorbed by light-sensitive proteins and re-emitted at longer wavelengths. Some animals also see in the UV spectrum, enabling them to find suitable mating partners more easily, as well as otherwise transparent prey. Fluorescence probably also plays a role in other processes. Even as biologists are slowly revealing the role of UV pigments in different species, there are still more questions than answers in this field.

To date, UV photography has remained the domain of professional photographers. Probably the most influential was that represented in in the *National Geographic* article by David Doubilet, "A New Light in the Sea," published in August 1997. Stunning photographs were taken underwater with a powerful HMI (mercury-halide) ultraviolet lamp powered by a surface generator. Gradually, however, UV photography is entering the domain of the hobbyist as modern SLR cameras are equipped with very perceptive sensors that enable us to take photos at higher ISO settings.

To take UV photos, divers will require a very powerful source of UV light. This is usually accomplished with either a powerful array of UV LED diodes (mostly for video) or a high-pass or "excitation" filter that is put on the source of light (HID light, LED light or flash). These filters excite the fluorescence by removing wavelengths longer than blue. As a result, when looking at a scene lit by such a source, everything will appear violet or dark blue in color. Therefore, in order to better see the fluorescence, we need an additional low-pass filter, which is placed on the camera and/or on the mask that blocks the excitation light but allows us to observe or photograph the longer-wavelength fluorescence.

The best results are achieved on the darkest nights, when there is not much light from the moon. All other light sources without a filter should be turned off, since it is very disturbing and prevents the fluorescence from being seen. However, unfiltered lights should always be at hand in case of an emergency.

POTENTIAL UV PHOTOGRAPHY ISSUES

When divers place filters over their normal light and mask, very little light remains; therefore, maintaining a high degree of situational awareness becomes critical—much more so than during normal night diving—since the visibility is even more limited. In order to avoid damage to the environment, a good teammate is recommended (with his or her own light and filters), and dive plans should be adjusted to avoid fragile areas. This is especially true if trying to take UV photos in an overhead environment.

When very powerful UV lights are used (LED, HMI), some animals run away and coral polyps retract; therefore, photos of these subjects must be taken very quickly. This is not an issue when photographing hard corals, so much more time can be afforded for taking the perfect picture, even incorporating the use of a tripod if the UV light source is too weak.

Since filters take away most of the light, the biggest obstacle facing the UV photographer is a lack of light. To overcome this obstacle requires a combination of strategies, among which are: 1. UV photos should be restricted to small macro subjects; 2. Very sensitive cameras that can take quality images at high ISO settings are optimal; 3. Noise reduction should be turned on (in the camera or in post-production); 4. Very low aperture settings are vital, which dictates that suitable lenses be used to capture images in low-light conditions. With the resulting low depth of field appropriate objects must be selected; 5. Two or three strobes

Scorpion fish, Adriatic Sea

Cave shrimp

as powerful as possible are essential; these should preferably be ones that have a higher color temperature (as many Kelvins as possible); and 6. Manual focusing or additional powerful focusing light should be employed; autofocus is usually problematic, due to a lack of light.

HOW I DO IT

As an illustration of the points made above, I will here describe my own equipment and the way I make use of it to take UV photos. To date I have only undertaken a limited number of UV dives in locations like the Sudan, Egypt, the Adriatic Sea, and a Slovenian cave. While my experience in UV underwater photography is not extensive it is adequate to determine what results can be obtained with the setup I employ. I should probably mention that I used equipment I already had. If I were to start buying equipment purely for UV photography, some choices (strobes and camera) might have been different.

I use a Canon 7D camera and EF 100mm f/2.8 USM and EF-S 60mm f/2.8 USM macro lenses. I often shoot at ISO 1600—in caves, sometimes even at 3200—with noise reduction in the camera turned on. Results would most likely be better if I used external noise reduction filters for Photoshop or something similar. I use a Sealux housing (www.sealux.de/) with ports for the above-mentioned lenses. The Sealux housing is very convenient, because it has three attachment points for three strobes. Two Halcyon HID 18 lights (www.halcyon.net/) serve as focus lights and are operated by my buddy. This light is very powerful and its main advantage over LED lights is that it is focusable. I keep it focused all the time to provide sufficient light to enable the normal operation of autofocus. I use three DS161 Ikelite strobes without diffusers and with video lights turned on. These video lights, despite being 3 x 10W LED, are by themselves not powerful enough to allow autofocus to work properly even if the strobes are very near the subject. The lights are intended for normal video work (not UV), and since they are dedicated video lights they are dispersed, not focused; therefore the filtered light is too weak. All filters—on the lens port, the two HID lights, the three strobes, and the masks—are supplied by Nightsea (www.nightsea.com).

Still, there was plenty of do-it-yourself work involved. I manufactured arms, flanges for the lens, light and strobe filters, and some other minor details. Since I have all the necessary tools available to me at my place of work (i.e., a turning and milling machine), this was not an issue. I manufactured all filters so that their flanges were equipped with elastic cords that allowed them to be put on or removed from the lens port, strobes, light, and mask while underwater. This provides me the flexibility to decide during a dive whether I want to take ultraviolet or normal photos, as well as to take photos of the same subject with and without filters to demonstrate the difference between normal and ultraviolet underwater photography. Another advantage of this configuration is that, in case of an emergency, I can convert the HID focusing lights into a primary dive light, which is especially important for cave diving. A disadvantage of this setup is that the low-pass filter can get damaged easily; however, because it is not very expensive, it can be replaced. The other option would be to put the low-pass filter into the housing, where versatility is lost but where it is more protected.

UNDERWATER CAVE UV PHOTOGRAPHY

Because I have been cave diving for many years, I decided to try out a UV cave dive to see if there were any cave animals that would

"glow in the dark." Since I live in Slovenia, where there are more than ten thousand (mostly dry) caves, I decided to undertake a dive in Kompoljska Cave, which is short, shallow, and accessible, with plenty of cave creatures inside. I was also very familiar with the cave, as I had done more than one hundred dives in it. I did not expect too much. There is no UV light inside the cave, so I did not know why cave animals would use such pigments.

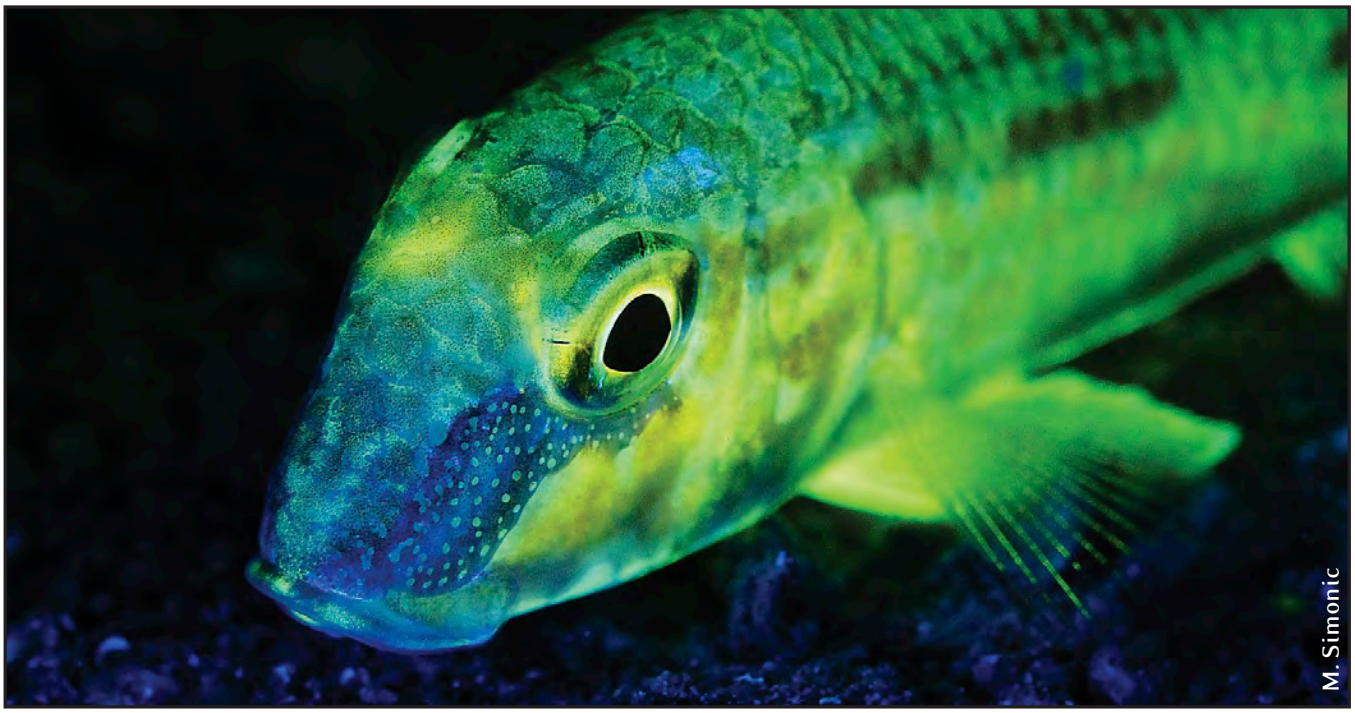
I was in for a big surprise, however, when I saw how beautifully a Proteus glows in the dark. A Proteus, or cave salamander, is a blind amphibian endemic to the subterranean waters of caves of the Dinaric karst of Central and Southeastern Europe. It can reach over thirty centimeters in length. Later I also noticed some glowing parts of cave shrimp claws, cave worms, and some smaller cave animals. I did not understand what role these pigments could play in cave biology. Perhaps there is none? Perhaps they were inherited from times when their predecessors lived outside the caves, a long time ago? Or perhaps there are some substances that are better visible under UV light?

I spoke with Mr. Gregor Aljancic, a cave biologist who runs Cave Proteus Laboratory Tular, and he told me that in the case of the Proteus, it is probably the pigment riboflavin that emits fluorescent light. Riboflavin is a kind of vitamin B and it is located in the skin of the Proteus. On the claws of the cave shrimp, the cause of fluorescence could be certain bacteria that gather from the sediments on the floor. After a discussion with Mr. Charles Mazel, who has studied fluorescence for a couple of decades, I discovered that today's science is still just beginning to understand the function of fluorescent substances and their role in nature. Perhaps, riboflavin protected the Proteus' ancestors from damaging UV radiation in times when they were living outside of caves, since the ozone layer, which is also a UV filter and which protects us today, could have been very different in those times. The several cave biologists I spoke with were not able to explain what the fluorescent elements in other cave animals could be.

Last year a friend, Cic, and I did a UV-video shoot dive in Krizna Cave. During that dive I noticed that some dripstones also "glow in the dark." Apparently, inside these are minerals that can emit florescent light; some of these minerals are described in the book *Cave Minerals of the World*. Unfortunately this light was too weak, so we were not able to capture it in the video or stills.

After the dive in Krizna Cave, Cic published some of his video results on a Slovenian dry caving list. Immediately, some dry-cave colleagues warned us that we could be damaging cave animals with our UV lights. We explained to them, and I also want to mention it here, that we understood that cave animals do not have any UV protection. However, when doing UV photography, cave animals receive less—not more—UV light than during normal photography, since we use a high ISO setting, wide-open shutters, and filters that reduce the quantity of light to the minimum.

Cave diving requires a great deal of training and skill. Because filters reduce the amount of light to the minimum, cave divers who want to try shooting UV photos should have a very good buddy, should pick a short, shallow, easy, and familiar cave, should have very good environmental awareness, and should have plenty of experience with photography in an open-water environment. All non-UV lights should be turned off, but should be readily available in case of an emergency. I believe UV photography is best done in a team of two, so that the photographer can listen to the breathing of his or her buddy when looking into the eye-piece of the camera. My buddy and I also usually stay almost within arm's reach. Fortunately, the compass and SPG glow in the dark, so they can be seen all the time.



Goat fish

Cave shrimp, Kompoljska Cave, Slovenia

With underwater cave UV photography, we are at the start of a path that will hopefully be long and interesting, since no one has pursued it extensively thus far and what has been done has been mostly for technical reasons. With the development of better, more sensitive cameras introduced during the last couple of months, results will be dramatically improved. Cave biologists who saw our photos of glowing animals were very interested in them. Hopefully they will soon be able to answer the two simple questions that probably even kids would ask: What is that glowing in the dark? And why is it glowing? I also hope that the childlike curiosity that still resides in many of us will soon be satisfied.

CONCLUSION

More than ten years and a thousand dives have elapsed from my first UV experiment to my first UV experience. Obviously, I was not ready when I first attempted it. Since then I have completed many courses and improved my trim, buoyancy control, and awareness, and I also ventured into underwater photography. Ultraviolet photography opened a completely new world for me. Diving with only UV lights turned on is very special. I experience a very strange feeling that is hard to describe—it is as if I'm in another world, like in space perhaps. This feeling is present especially on very shallow open water dives where I can relax (as opposed to in caves, where divers have to be focused on diving and on the cave at all times). It feels different, as if it were a secret world. I see things that other people cannot see, so it is probably similar to some drug-induced state.

The effect of a UV dive does not end with the end of the dive. My very good friend described it some time after the first UV photo dive in Sudan in the following manner: "I feel like a UV filter . . . It is fantastic. It is like doing my fist dive in my life." It was also like that for me. It is very rewarding that after so many years of scuba diving I could experience that feeling again. One's experience of the UV world is one of a stark contrast: it is either dark or it is glowing—light emitting; as a result, images are somehow branded into memory. When I close my eyes, these images return more often and more powerfully than normal pictures. Of course, this is a very subjective state that fades after a couple of days, but I have experienced it as have some of my buddies. I also found this to be a very humbling experience, forcing me to ask: "This is just one layer of biology that we now see, but do not yet understand due to our sensory and other limitations. Some animals see UV light with their eyes. How many layers are there? Will we ever be able to detect or understand them?"

It is a beautiful and surprising world and I hope you will experience it.

Project Baseline: Adding Depth to Your Dive

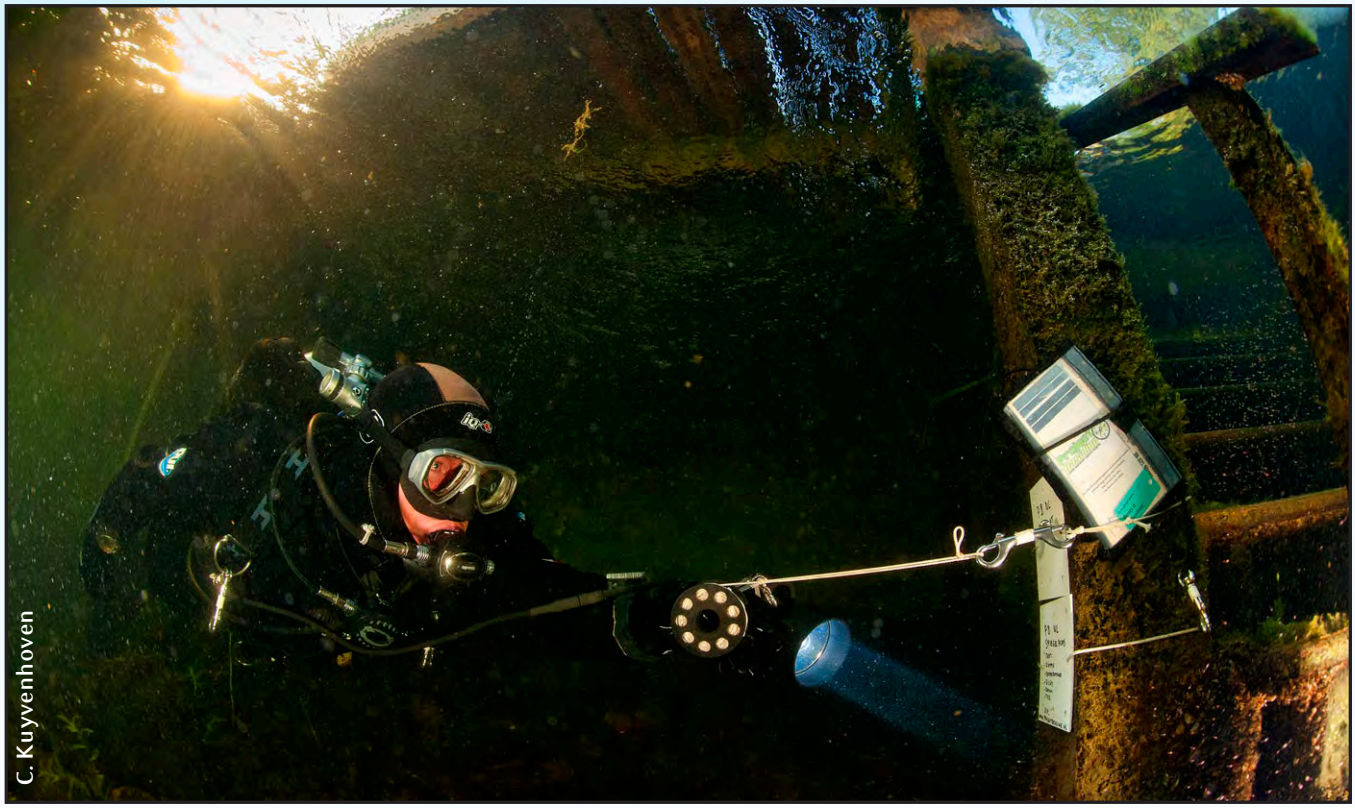
By Vanessa L. Belz

Divers perform a survey for the GUE Project "Mediterranean Deep Corals".

Project Baseline is not really about diving. It is not about developing buoyancy or trim nor is it about fin kicks or diving vacations. It is not about the release of the latest piece of equipment nor is it about a particular level of training or certification.

Project Baseline is about the common thread that ties everyone on this planet together: water. It is about being part of something greater than oneself. It is a call to anyone who cares about their world's water supply to work with their respective communities towards a future that holds the clean, consumable, available water required for survival and recreation.

Chances are that the reader of this essay is a GUE diver with an affinity for the underwater world. If so, she is dedicated to upholding the standards of excellence that are consonant with the mission of the agency. As such, she is a skilled diver who has been trained to safely engage an environment that is inaccessible



Volunteer Cas Renooij measures point 1 in Spiegelplas. Also shown is the visibility meter developed by volunteers Ivar Klerks and Pim Jonker.

to many people. With this training comes an understanding that dives are compromised by unhealthy waters, that unless the water is suitable for diving, diving is not an option. Though at present there still exist viable bodies of water for diving—contingent on where one lives—the time may be approaching where such bodies do not exist. In part, the progressive degradation of the world's water quality is tied to a given culture's lack of knowledge of what constitutes a healthy ecosystem. In turn, this leads to a generational acceptance of new standards of what a degraded environment "looks like"; in other words, our "baseline" shifts to accommodate a progressively more or less degraded environmental "norm."

To participate in a solution to this persistent problem, persons need to look beyond themselves and become invested not just in diving, but in water itself. GUE recently started working with its diving community, and beyond, in search of a solution. That solution is called Project Baseline.

In December of 2011, GUE revitalized a long-standing commitment to its conservation initiative, Project Baseline. The initiative's guiding purpose is to produce comprehensive documentation of aquatic areas all over the world, allowing future generations to know the state of water through time. This is done through the project's empowerment of participants to observe and record changes in the world's aquatic environments in a way that fosters public awareness and supports political action. This vital endeavor provides the tools and expertise required to document aquatic environments critical to human existence and thereby provides the public with what will, in many cases, be the only observations of the state of the environment.

In less than one year, the program has witnessed remarkable progress in some areas, while fulfillment of its mission continues to demand growth and maturity in others. What started as a small, core effort with just four project areas, including its flagship area, Wakulla Springs, and a handful of volunteers, has undergone tremendous growth. Project Baseline owes much of its continuing development to its dedicated volunteers, who understand the critical nature of their contributions to a greater, conservation-focused purpose. Evidence of program growth is found in a number of arenas. Project Baseline is currently composed of over twenty project areas all over the world. Each project area contributes observational data from local dive spots to a global database that tells the story of underserved and under-documented aquatic environments. These environments are not unlike the ones individuals will find in their own backyard.

To ensure measurable progress is made towards the realization of program goals, a position was created for a program manager who would also serve as a volunteer and resource coordinator. Today, Project Baseline boasts an informative website that incorporates social media to provide daily project area updates from all areas of the world and reflects the efforts of more than thirty-five volunteers. GUE now dedicates a portion of all membership fees directly to Project Baseline.

But this environmental program continues to face a critical stumbling block that prevents it from becoming a widespread

success, namely, that it is only reaching the GUE community. This can only be overcome when individuals making up the GUE community become willing to focus on more global outcomes. GUE divers are exceptionally well trained, which allows them to go into the underwater world and see and record a great deal. To move this program forward in a way that increases its global impact, divers need to be willing to share their experiences and tell the story of water in a way that captivates and mobilizes the non-diving public, which constitutes the bulk of the population impacting our waters.

For Project Baseline to make a global difference it must establish a permanent, positive presence in sites all over the world that are managed by volunteers who contribute consistent, meaningful data to the Project database and use that data to win over public support and engage in environmental policymaking. For example, a relative newcomer to Project Baseline is stationed in Längelmävesi, Finland. This group's intent is to survey the historical and present state of the water in the Längelmävesi area, follow the water system changes, and upload the information to the Project Baseline database. In turn they will provide the Finnish Center for Economic Development, Transport and the Environment—the agency tasked with monitoring the most vulnerable bay areas near Längelmävesi—with data such as water quality, air temperature, water temperature (surface and bottom), and water clarity. These diving efforts assist the Finish Center because without them they would be lacking vital data on the basis of which to make their assessments. This Project Baseline contributor made the jump to public engagement very quickly and thus serves as an inspiration to all participants.

PROGRAM AWARENESS

Introducing the public to Project Baseline can be as easy as telling friends about it, showing them the target area of a group's interest, and explaining to them why individuals are spending their free time collecting data underwater.

As participants look beyond their immediate social circles, they should look to identify anyone in their community who might care about water. This should be everyone, but more receptive audiences might include shoreline homeowners on lakes, rivers or oceans, fishermen, property owners with wells for drinking water, and tourists who want to see something besides murky waters on a glass-bottom boat tour. Outreach can be as simple as working with a Project Baseline team to develop a flyer or website that describes how Project Baseline is working in a particular area, goals for that area, and how people can contribute to the effort. The more each entity committed to Project Baseline can demonstrate direct action with positive environmental impacts in their communities, the more people will be willing to contribute to the success of Project Baseline.

GUE MEMBERSHIP

There are a number of ways for an individual to get involved and support Project Baseline, but perhaps the most important way

Volunteers perform depth measurements along a delineated placemark. This placemark will be visited on a regular basis for years to come.

is to simply become a GUE member. GUE is a not-for-profit 501(c)(3) entity that relies heavily on a diverse membership base, donations, and volunteer support to fulfill its mission. This summer, GUE committed $39 of every membership level to Project Baseline. By joining GUE at the Conservation Membership level, anyone, divers and non-divers alike, can support Project Baseline as a standalone initiative. Those dedicated to GUE on a broader level can support simultaneously both GUE and Project Baseline with increased membership levels. These funds will help secure the necessary resources to ensure that Project Baseline continues well into the future, but it will also provide it with the credibility it needs to encourage local governments to take action. We believe that the enthusiasm and energy derived from the thousands of people constituting our global membership will foster a rapid expansion of Project Baseline to include many more sites worldwide.

MOBILIZE

There were hints of what is possible back at the inception of the program when the city of Tallahassee, Florida, committed itself to a $250 million renovation of their wastewater treatment facilities in hopes of reducing the nutrient contamination at Wakulla Springs. They didn't do this eagerly, but instead resolved to do so because of the persistent work of GUE's Woodville Karst Plain Project which engaged the public with their knowledge of the spring and caves. It was their work that galvanized public opinion, that inspired government agencies to work collaboratively, and that encouraged elected officials to take a chance on a conservation initiative.

All of the initiatives supporting Project Baseline stand to achieve the same results if they garner public support. Active divers who are not already part of this movement should consider joining a Project Baseline initiative or start one. For those already involved they should work to bring their experiences to the general public and get them engaged.

Project Baseline addresses the need for the establishment of environmental baseline data in undocumented, under-documented, and underserved aquatic locations all over the world. By contributing to Project Baseline as a diver, volunteer, GUE member, or donor, an individual stands to contribute to the health of humanity's collective resources. Their involvement will help ensure that future generations will enjoy the same water-based experiences underwater enthusiasts hold so close to their heart. Individuals have a unique opportunity to participate in a worldwide program that stands for action, awareness, and a positive long-term impact on water.

GUE Affiliates

- WKPP - www.globalunderwaterexplorers.org/projects/wkpp
- Ocean Discovery - www.ocean-discovery.org
- MCEP - www.gue.com/?q=en/node/136
- BAUE - www.baue.org
- AEG - www.globalunderwaterexplorers.org/node/137
- Rubicon Foundation - archive.rubicon-foundation.org
- GUE UK - www.gue-uk.com
- NEUE - www.ne-ue.info
- OUE - www.oue-japan.com
- TSRCP - www.threshersharkproject.org
- GUE Netherlands - www.gue-nederland.nl
- DIRezioneLago - www.direzionelago.it
- Diverevolution - www.diverevolution.it
- GUE Ontario - www.gueontario.com
- Project Baseline - www.projectbaseline.org
- GUE Seattle - www.gue-seattle.org
- Banyu Biru Explorers - www.banyubiru.org
- Korea Underwater Explorers - www.kue.co.kr
- GUE San Diego - http://gue-sandiego.org
- Ghost Fishing - http://www.ghostfishing.org

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- Aquanauts - www.aquanauts.co.uk
- Living Seas - livingseas.com.sg
- In Deep Dive Centres - www.indeep.co.uk

Guidelines to Make Exercise a Part of Daily Life

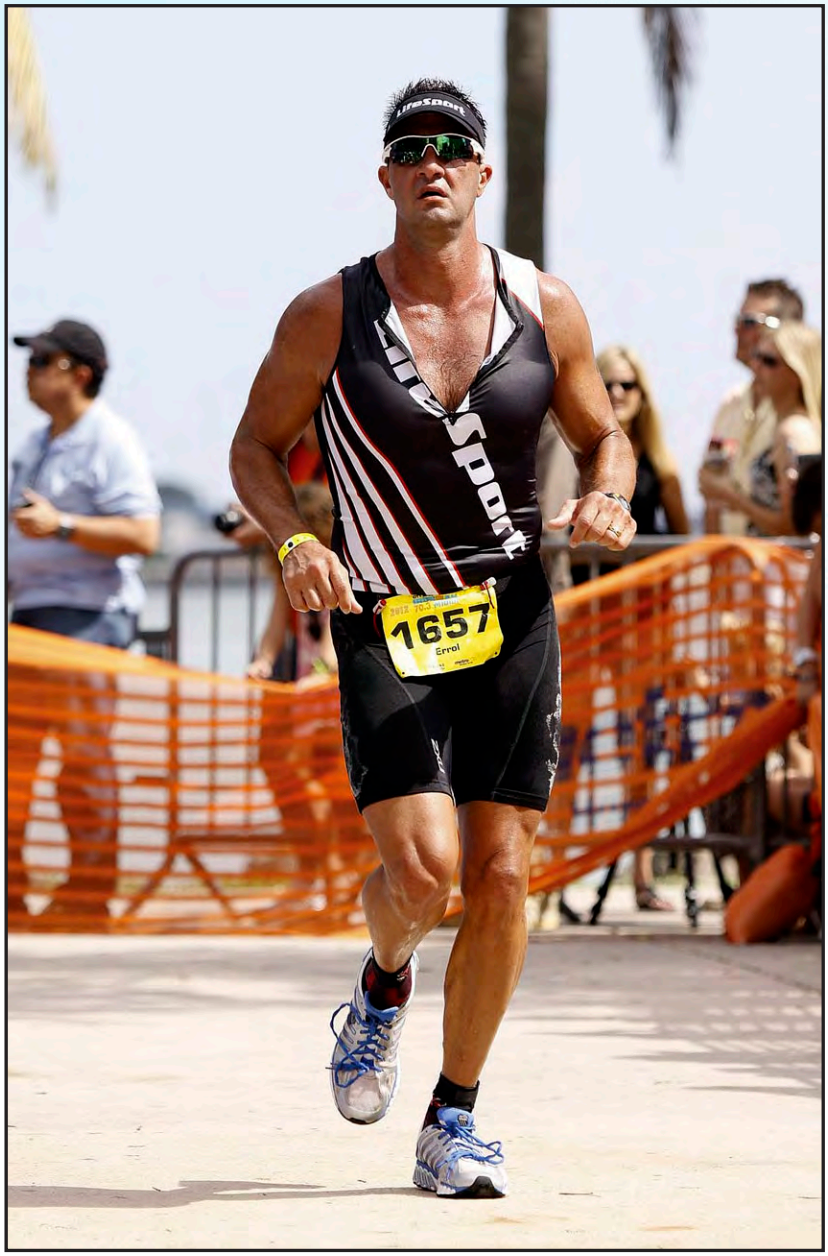
Incorporating Training into the Life of a Busy Diver

By Errol Kalayci

Errol riding a bike on a trainer during girls' soccer practice.

Quest (Vol. 13, No. 4) contained my article, "Swim-Bike-Run: Fun Ways to Prepare for Fundies," which explained how swimming, biking, or running can help divers prepare for Fundamentals by promoting fitness while doing exercise that directly relates to diving. This article was written with the intention of explaining how fitness can be incorporated into daily life.

Undoubtedly, many GUE divers lead very busy lives. Oftentimes, they are managing the demands of a challenging career with those of family and community while also trying to remain active divers. Too often, the time dedicated to fitness is sacrificed to make room for everything else, even though the importance of regular exercise to our health and diving is undeniable. Fitness, however, does not need to be sacrificed, nor should it



Running is an excellent way to exercise for individuals with busy schedules. (Courtesy of Brightroom)

be. With proper time management and planning, divers should comfortably be able to incorporate fitness and diving into the demands of their daily life.

Consistent training, not binge training, is the key to a healthy lifestyle and gains in fitness. For beginners, exercise performed at low to moderate levels yields greater health benefits than higher intensities. As in diving, exercise is frequency and quantity dependent. Too much too fast spells disaster. And since adaptation and improvement can occur only during recovery, recovery time is also vital.

This article will focus on quantity and frequency of exercise and how a diver with a beginner's level of fitness can incorporate it into daily life.

QUANTITY OF EXERCISE

Consistency is the secret to becoming more fit. The key to building a healthy lifestyle and to ensure that a person makes room for exercise in their schedule is to incorporate it into their weekly routine. Training should be a time a person looks forward to—it is personal time.

The amount of time a person commits to fitness should be the least amount of specific training necessary to make gradual fitness improvements at the right times. What this is will depend on what a person's goals are and what type of cardiovascular workout they are committed to. For example, running is a higher impact sport than swimming or biking and burns more calories. Beginners can tolerate longer bike or swim sessions than they can running. As a general rule, a half hour of running is equal to an hour of biking or forty-five minutes of swimming. If a person is looking simply to improve their health and be fit for diving, ninety minutes of running per week should be more than adequate to begin with, broken up over the week. If a person opts for swimming, then they should add forty-five minutes per week; if biking, they should add ninety minutes. Following this general rule will yield the greatest fitness returns on time. At the other end of the spectrum, for a competitive Ironman, twelve to twenty-four hours a week may be required for training and to improve just a small percentage each year. For an average-sized man, running ninety minutes per week may burn over 1,500 calories. Since there are approximately 3,500 calories per pound, a side benefit is possible weight loss of a pound every other week.

Once a person can comfortably exercise for ninety minutes per week at a moderate level, they can slowly increase the volume by no more than ten percent per week or two.

FREQUENCY

Assuming the need to perform cardiovascular exercise for ninety minutes per week as outlined above, should this exercise be done in one session, broken up into a daily session, or in some other way? Since moderation is vital for beginners and recovery critical for everyone, if running is one's cardiovascular training choice, the best approach would be to divide the total amount into three thirty-minute sessions and allow a day in between each session for recovery. Most typically an individual would run Monday, Wednesday, and Friday, leaving the weekend free for diving and family. Furthermore, thirty minutes is an easy block of time to fit into anyone's schedule. Many people perform their exercise first thing in the morning before anything else can interfere. This a great way to ensure it gets done, gives a person energy throughout the day, and makes their metabolism more efficient by burning a larger amounts of

fat than would happen later in the day after they have eaten. It is important however not to over-eat after a workout. A reasonable amount of protein and some fruit would be ideal along with some water or other fluids. Another approach is to fit cardiovascular training in during lunch. Many professionals have replaced the old two-martini lunch with the thirty-minute cardiovascular training session. This can reasonably be done during lunch, while having time to grab a quick shower and prepared bite to eat. If a person chooses lunchtime to exercise they should be mindful that work commitments may trump the time allotted to exercise. Having said this, lunchtime training can be a great way to relieve workday stress. Yet another option is to exercise after work. Personally, I find this the least attractive, as I may be tired or pressed for time given the hectic activity of the day. In any case, any of these timeframes works; it is just critical to formulate a plan and stick to it. A word of caution: cramming two sessions into the weekend may seem like a good idea, but there is not enough time for recovery—though one can certainly do one session on a weekend. Finally, as your weekly volume of exercise increases over time, individuals will want to add a fourth day once their daily run session reaches the hour mark.

INTENSITY

These training sessions need to be undertaken sensibly. The key is to get them in each week and to do so without going to exhaustion or becoming too sore. If persons exercise to exhaustion or become unreasonably sore, they are less likely to want to do the next session and may risk injury. Over time, the body will adapt as fitness improves and a person can tolerate more intensity or more frequent sessions. For more targeted training, individuals can purchase the least expensive heart-rate monitor they can find at a sporting goods store and determine their training zones with a knowledgeable athlete or coach. As a rule of thumb, in the beginning a person should not exercise so intensely that they cannot communicate with a few sentences (see RPE Scale). Until one's fitness improves, exercising more intensely will be counterproductive. As time progresses in a session and fatigue sets in, it may become harder to abide by this "rule." If this occurs, it is advisable to slow down or walk until exercise can be resumed at an intensity where communication with a few sentences is possible. Think of this as an analogue to a back gas break when on oxygen. Therefore, a person should resume their effort as soon as possible but leave the time running and include the slow period into their run time. By being consistent with frequency, fitness will improve and one will have to slow down or walk less and less.

LOCAL RESOURCES

As with diving—where new divers look for a GUE instructor or an experienced diver to mentor them and a local community—so it goes with exercise. Hiring a professional, properly licensed coach is a great way to reduce the chance of injury, manage time more efficiently, be held accountable, and have the greatest return on workout time invested. Other choices include finding a local running or triathlon club or joining a Master's Swim team. Running shoe shops, bike shops, and pools, as well as the Internet, are likely to provide enough leads to help a person find the help they could use.

SOME LAST THOUGHTS

Before embarking on this exciting lifestyle change, I strongly urge individuals to consult a doctor and have a physical. I also suggest that after they begin training, individuals write their workouts into their weekly schedule and record their data post-workout. Doing so makes it more likely that they will execute their exercise plan and provides objective feedback of fitness improvement, which over time is itself very rewarding. Finally, as long as one is not exhausted or dehydrated, studies have shown that diving after exercise is okay and potentially beneficial but exercising after diving is not a good idea.

CONCLUSION

In conclusion, consistent, frequent, moderate intensity training is the key to becoming more fit. Over time, the training and recovery cycle will produce amazing benefits for a person's health, and they will come to treasure their training sessions as a part of their very essence. In my opinion, every diver must make time for fitness and has no plausible reason not to do so.

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This Issue's Contributors

Cristian Benedetti has been diving since 2006 as a GUE Cave 1 and Tech 1 diver. With a degree in biology and a specialization in ecology, he is an avid photographer and lives in Brescia, Italy near Garda Lake, which is where he did most of his dives before discovering his passion for underwater caves.

Vanessa Belz has worked with Global Underwater Explorers since December 2011 as Program Manager for the Project Baseline conservation initiative. She leads all aspects of project development and serves as the primary contact for all volunteer Site Managers. Vanessa holds a degree in Adventure Education from Prescott College, and brings years of experience to her role with GUE, including nonprofit coordination, outdoor education and guiding, and outdoor equipment sales. She is excited to collaborate with GUE staff, members and volunteers to help make Project Baseline a household name in the conservation industry.

Gareth Burrows is a cold-water wreck diver and passionate educator based in the UK. He runs a successful GUE- and DIR-focused business and provides GUE instruction and personal dive coaching to divers from all backgrounds and levels. His detailed but easily accessible articles on www.divedir.com have been recommended by divers from all agencies looking to explain the basic tenets of GUE and DIR diving.

Francesco Forieri learned to dive in 1984 and later worked in Africa, Spain, and southern Italy as a CMAS instructor; he was trained by his father, Bruno, also a CMAS instructor. In 1997, Francesco founded Centri Immersione Capo Palinuro in Palinuro, Italy. He became a GUE Fundamentals Instructor in 2007 and besides teaching, enjoys sharing his passion and the beauty of Palinuro's caves and wildlife with GUE trained divers. He is now a GUE Tech 1 Instructor intern and hopes to join the Tech instructor ranks shortly.

Andreas Hagberg is a Swedish software engineer who moved to Florida to have easy access to underwater caves. He has been a diver for twenty years, and in recent years has become addicted to cave exploration. Today he works as a software- and website-developer for GUE in High Springs, and is also the Communications Coordinator for the WKPP. In his spare time he also enjoys photography and building new dive gear.

Maren Isigkeit is an IT-specialist, working and living in Northern Germany. In 1991 she did her first scuba dive in the Baltic Sea and realized that with a background as a competitive swimmer and water polo player, diving was just a logical addition to her love of being in the water. As a GUE Instructor, she teaches the recreational curriculum and is an addicted cave diver. Before these water-filled beauties attracted her attention, she had already fallen in love with the most elegant and pristine way of diving: free diving. Currently she is involved in cave survey projects in France, as well as projects focusing on the protection of marine habitats.

Errol Kalayci is General Counsel and COO of one of Florida's largest engineering companies and President of Technical Diving Solutions. He has been technical diving since 1990. Before leaving the dive business and taking a sabbatical to grow his family and corporate career, he was an explorer and instructor/instructor trainer for the various agencies and one of GUE's first instructors. He has explored caves and deep reefs in the Bahamas, caves in Norway's Arctic Circle, Sweden's Silver Mines and wrecks, and even taught the Swedish Navy. Further, he has written numerous articles and educational materials, appeared in print, video, commercials, and worked on numerous film projects for IMAX, BBC, VISA, National Geographic, Discovery, etc. Recently, he has begun some exploration again, published some articles, contributed to some course material, appeared in South Florida Dive Journal, and is a GUE Fundamentals Instructor.

Giovanni Marzari has been diving since 1995 as a GUE Cave 2 and Tech 1 diver. In 2009, he co-founded H-Diver to organize local events and transmit his passion for cave diving to other divers in his community. Giovanni works as a dentist in northern Italy where he lives with his wife Giuly.

Robert McClellan is a writer, photographer, and new media expert. He combines a lifetime of creative dexterity into a contemporary skill set that seamlessly compliments Jill Heinerth's efforts. An early adopter of podcasting, blogging, and other online communication tools, Robert has a number of professional internet broadcasts and weblogs to his credit. He wrote, produced and appears in the award-winning documentaries "Real Sobriety" and "Ben's Vortex." Robert's background includes stints as a Navy Seabee combat photographer, a rock and roll production

This Issue's Contributors

manager, and a prison nurse. He is currently writing his first full-length book, "Boom Baby Boom," and has a drawer full of film treatments and screenplays. Robert and Jill live a very happily hectic, married life in north Florida, with frequent sanity breaks on their small houseboat on the Humber River in Toronto, Canada.

Mark Messersmith has a B.S. in Biology from the University of California, Los Angeles and an M.B.A. from Pepperdine University. Mark's first breath underwater came in 1969 when his father returned home from Vietnam with a steel 72 and a Calypso regulator. In a few short years Mark earned his open water card and soon after became an instructor. After more than two decades of pursuing business ventures and enjoying diving recreationally, Mark and his wife Julie relocated to North Florida where he is currently a very active cave diver, GUE instructor, and Co-Training Director of the WKPP.

Dr. Thomas R. Sawicki is an Assistant Professor of Biology at Macon State College. He earned his Ph.D. in ecological sciences from Old Dominion University. His current research interests involve the phylogeny of the stygobitic amphipod family Crangonyctidae of the Floridan Aquifer, as well as the trophic structure of the fauna of the Floridan Aquifer. He is a frequent contributor to *Quest*.

Matej Simonic is a GUE Cave 2 and Tech 2 diver. He has been diving for thirteen years and doing underwater photography for five. Having participated in GUE cave projects in Mexico and Bosnia, Matej dives wherever and whenever it is possible. He enjoys diving in caves, wrecks, lakes, rivers, the Adriatic Sea, and tropical waters.

J. Heinerth

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Photo by Walter Chung