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Number 69



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HL Hunley

U-Boat Navigator
Britannic

Wide-Angle
Raja Ampat

South Africa
Sardine Run

France
Vercors Caves

Cognition in
Manta Rays

INDIAN OCEAN

The Maldives

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COVER PHOTO: *Nembrotha kubaryana* nudibranch, Anilao, Philippines. Photograph with artistic paint filter by Beth Watson
(Bethwatsonimages.com)

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Anemonefish in anemone, Maldives. Photo by Matthew Meier



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Be Sensible

Close encounters with marine life, in particular, megafauna—like manta rays, orcas and sharks—rank up there among the greatest and most fulfilling experiences I have had.

Recently, I learned that families have been mauled by grazing bison in Yosemite because they wanted to take a selfie with the animals close behind. The bison, however, were not amused about the intrusion into their comfort zone and let it be known in a quite physical manner. We've also seen reports that visitors wanted images close-up with black bears, resulting in equally painful experiences.

Just 10km from our office, there is a forest park noted for its large populations of red and fallow deer. At this time of year, the stags' testosterone production builds for the approaching rut (mating season) making them quite boisterous, getting them into fights over females. Joggers

and Sunday strollers are about, enjoying a walk in the forest and usually perfectly safe. But it never fails that some cocky youth, careless drunk, or clueless tourist with a selfie stick, gets too close and ends up with an unpleasant encounter with an antler resulting in a visit to the emergency room.

As docile as many of these creatures may appear, they are still wild animals!

In the ocean, too, we seem to have become more at ease with getting up close and personal with big animals. The movie *Jaws*' depiction of white sharks as scary indiscriminate eating machines now seems a distant memory, a notion from our ignorant past, as we now leave the shark cages—some even free-diving and grabbing onto white sharks in open water.

There is indeed a positive change to note that we, in the span of a generation, have

gone through a dogma-shift and found new appreciation and deeper understanding of marine life and learned how we can interact with these magnificent creatures in a mutually meaningful way.

Only ignorance is a mighty foe, and it is my concern that it's a just question of *when* and not *if*, some hapless diver or swimmer doesn't read the animal and moves in too close too soon with dire consequences.

Don't be stupid. Respect the wildlife.

— X-RAY MAG Team

“Being ignorant is not so much a shame, as being unwilling to learn.”

— Benjamin Franklin



News edited
by Peter Symes

NEWS

from the deep



MATTHEW MEIER

Channel Islands National Marine Sanctuary is now teeming with fish

Restoring ocean health *pays off*

Channel Islands Marine Protected Areas appear to be fulfilling their role as refuges for many fish and invertebrate species, a decade of monitoring data show.

Are Marine Protected Areas (MPAs) meeting their ecological goals? Marine scientists from the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) monitoring the rocky reef and kelp forest communities in

California state waters around the northern Channel Islands off the coast of Santa Barbara find positive results. Their study represents one of the first opportunities marine biologists have had to examine a network of MPAs,

rather than a single location.

The Channel Islands MPAs were formed in 2003, and an analysis of the first ten years of monitoring data shows they appear to be fulfilling their role as refuges for many fish and invertebrate spe-

cies. After the first five years of protection, scientists found that fish species targeted by fishermen had both greater density (numbers of fish per area) and biomass (total weight per area) inside MPAs as compared to reference sites outside—and this was still true in 2013.

Added bonus

More importantly, the researchers also found increases in fished species outside in the unprotected areas. When fishing is prohibited in one area, fishermen naturally turn their attention to less protected areas and it was feared that this extra effort would deplete the fish stocks outside of MPAs. However, there is no evidence of any depletion. In fact, fish stocks outside of MPAs have also increased over time, although at a slower rate than inside MPAs.

The scientists don't know if fish population increases beyond the MPA borders are related to reduced fishing pressure, spillover from MPAs, favorable environmental conditions, or a combination of all three.

50% protection needed

In a report recently published in the journal *Science*, researchers from Oregon State University point out that numerous international policy agreements call for protection of 10 percent of coastal and marine areas by 2020, while some conservation organizations and most scientists say 20-50 percent of ocean protection is needed.

The science of marine protected areas is now mature and extensive, they said, and the multiple threats facing the Earth's oceans warrant more accelerated, science-driven action. Marine protection can range from

"lightly protected", which allows some protection but significant extractive activity, to the "full" protection, usually identified as marine reserves. Such areas, covering an almost undetectable total area of the ocean a decade ago, are rapidly gaining attention as their social, economic and environmental benefits become clearer. To further speed that progress, the OSU researchers highlighted seven key findings, one of which stressed the need for fully protected areas.

Full protection works

Fully protected and effectively enforced areas generally result in quite significant increases in biomass, size of individuals and diversity inside a reserve. Those benefits in turn often spill over to adjacent areas outside the reserve.

In line with findings from the Channel Islands MPA, the OSU scientists also highlighted the need for connecting habitats. Many species move among habitats during their life cycles, so a range of protected areas will aid in protecting biodiversity and enhancing benefits inside and outside the reserve.

A network or set of reserves that are connected by the movement of juveniles and adults can provide many of the benefits of a single large area, while still allowing fishing between the reserves. Large and strategically placed reserves can also enhance resilience and assist in adapting to environmental and climatic changes.

It saves money too

Smart planning can reduce costs of creating reserves and increase their economic benefits, in some cases making them more valuable than before the reserve was created. ■ SOURCES: UNIVERSITY OF CALIFORNIA - SANTA BARBARA, SCIENCE

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Coral bleaching event now in progress worldwide

NOAA scientists have declared the current widespread coral bleaching to be the third global coral bleaching event ever on record. Besides the coral

bleaching taking place across Hawaii caused by record warmer temperatures, coral bleaching has spread to the Caribbean, having originated

from the Florida Keys and South Florida. As a result, the corals in Puerto Rico and the US Virgin Islands are under threat. This announcement comes from

the latest NOAA Coral Reef Watch satellite coral bleaching monitoring products, and was confirmed through reports from partner organisations. ■

Coral can protect skeleton against ocean acidification

Coral colonies of *Porites cylindrica* have a unique internal solution to the problem of forming their skeletons and building reef structure in the face of rising ocean acidification.

Porites cylindrica is also known under the common names cylindrical finger coral, jewel coral, and finger coral, and is a species that is considered highly susceptible to bleaching. Since it is also widespread, abundant throughout its range, and is often a dominant species where it occurs, it is therefore also likely to be relatively resilient to habitat loss and reef degradation because of an assumed large effective population size that is highly connected and stable with enhanced genetic variability.

Increasing acidity makes it more difficult for marine calcifying organisms, such as coral and some plankton, to form biogenic calcium carbonate, and such structures become vulnerable to dissolution, but Australian researchers have discovered that coral colonies of *P. cylindrica* within Heron Island lagoon on the Great Barrier Reef have a unique internal solution to the problem.

A species of coral living in a dynamic reef system has been found to be able to protect itself from the impact of ocean acidification.

"Our research shows that some corals living in dynamic reef systems (*P. cylindrica*) have the ability to maintain a nearly constant pH within their calcifying fluid, regardless of the pH of the surrounding environment," said Lucy Georgiou from the ARC Centre of Excellence for Coral Reef Studies. "This enables them to continue to form their calcium carbonate skeleton even under relatively low pH conditions."

Adaption only local?

The regulatory mechanism allows the coral to grow at a relatively constant rate, suggesting they may be more resilient in this environment to the effects of ocean acidification than previously thought. While the findings are positive, it is not yet known if the adaption is species-specific and limited to colonies in dynamic reef systems.

"This is most likely only typical to corals from reefs such as Heron Island lagoon where temperature and pH fluctuations vary greatly on daily to seasonal basis," said Georgiou. ■



Coral colonies of *P. cylindrica* within Heron Island lagoon on the Great Barrier Reef are found to be able to form skeletons even in acidic water



Porites cylindrica

Portable kit helps to preserve coral DNA while at sea

In the past, coral research has focused on radar and sonar mapping of the seafloor. With a new kit, which is being used for the first time, biological samples can also be collected for analysis.

Currently on board the Okeanos Explorer's *Hohonu Moana*, the compact kit can quickly extract tissues and preserve the sample's DNA for analysis. This enables scientists to archive large amounts of the genetic material. Doing so can reveal important information about the evolutionary relationships amongst species.

To extract the DNA material, the kit uses an off-the-shelf electronically-operated machine called a homogeniser that vigorously shakes three tubes filled with a liquid buffer and tiny beads that rub against the coral and scrap off the coral substance that contains the DNA. ■



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"We found that rabbitfish pairs coordinate their vigilance activity quite strictly, thereby providing safety for their foraging partner."

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Fishes look out for their buddies

Fishes, which are commonly considered to be cold, unsocial, and unintelligent, are, in fact, capable of negotiating reciprocal cooperative systems. Australian researchers find pairs of rabbitfishes will cooperate and support each other while feeding.

In pairs of coral reef rabbitfishes (*f. Siganidae*), one fish frequently assumes an upright vigilance position in the water column, while the partner forages in small crevices in the reef substratum. Both behaviors are strongly coordinated and partners regularly alternate their positions, resulting in a balanced distribution of foraging activity.

Impossible for fishes?

Reciprocity is frequently assumed to require complex cognitive abilities; it has therefore been argued that such behaviour may be restricted to animals that can meet these demands. While such behavior has been documented for highly social birds and mammals, it has previously been believed to be

impossible for fishes. Compared to solitary individuals, fishes in pairs exhibit longer vigilance bouts, suggesting that the help provided to the partner is costly. In turn, fishes in pairs take more consecutive bites and penetrate deeper into crevices than solitary individuals, suggesting that the safety provided by a vigilant partner may outweigh initial costs by increasing forag-

Our findings should further ignite efforts to understand fishes as highly developed organisms with complex social behaviours. This may also require a shift in how we study and ethically treat fishes.

— Professor David Bellwood
Center of Excellence for
Coral Reef Studies

ing efficiency. "We found that rabbitfish pairs coordinate their vigilance activity quite strictly, thereby providing safety for their foraging partner," said Dr Simon Brandl from the ARC Center of Excellence for Coral Reef Studies. "By showing that fishes, which are commonly considered to be cold, unsocial, and unintelligent, are capable of negotiating reciprocal cooperative systems, we provide evidence that cooperation may not be as exclusive as previously assumed." ■

Planned dolphin park on Turks and Caicos ignites controversy

A planned sea mammal park in Turks and Caicos Islands has been met with staunch opposition from environmentalists and locals alike. One of the most outspoken critics has come from within the government itself. Former Director of the Department of Environment and Maritime Affairs Kathleen Wood described the "exploitation of dolphins for economic gain" as "the moral equivalent of slavery". Wood argued the park would tarnish the TCI's image as a green destination and alienate tourists and travel agencies that boycott destinations allowing marine mammal parks. ■

Tourism harming Mexico's whale sharks

Although the practice pumps tourism dollars into Mexico's economy, experts are concerned increased human activity threatens the sharks' welfare. Despite regulations requiring boats remain five meters away, between 20 and 30 percent of the sharks are injured by boat propellers. Up to 116 boats at a time scramble for position around the sharks.

At first, only a handful of licenses were issued to boat operators, but the number has increased to more than 320. "Every year we ask them not to increase the number, and every year they increase the number," said Alistair Dove, marine biologist and director of research and conservation at the Georgia Aquarium in Atlanta.

No more than two snorkelers per boat are allowed in the water with a guide at one time, and time allowed in the water is limited. Snorkelers must maintain a minimum distance of a meter, but not everyone follows the rules. Dove believes most boat operators have good intentions. "They love the animals but get caught in a competitive situation. If they don't take people out there, the other guy will," he said. Scientists believe the Caribbean whale shark population, which numbers about 1,500, to be generally healthy. In 2011, more than 400 animals occurred off the Yucatan, the biggest congregation known to science. ■



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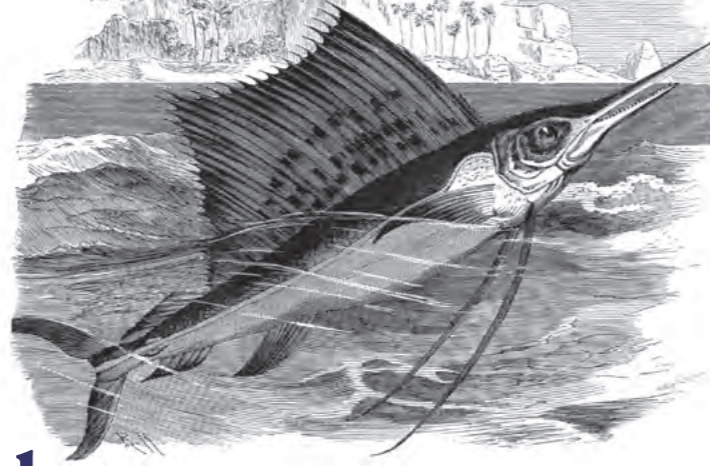
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Michael Lawrence / Bill Kitzberg



Fish are supreme athletes

Fish are far more effective at delivering oxygen throughout their body than almost any other animal, giving them the athletic edge over other species.

Haemoglobin (Hb) is one of the most well-studied proteins to date and is key to blood oxygen transport in nearly all vertebrates and some invertebrates, as it increases the total oxygen that can be transported in the blood and optimizes tissue oxygen delivery.

Teleost fishes—the large group that comprises most ray-finned fishes—represent over half of all extant vertebrates; they occupy nearly every body of water, and in doing so, occupy a diverse array of environmental conditions. Scientists find their success is relat-

ed to a unique oxygen transport system involving their extremely pH-sensitive haemoglobin (Hb).

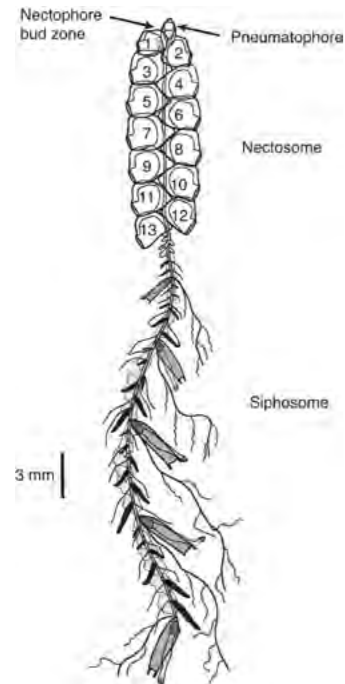
50x better than humans

"Fish exploit a mechanism that is up to 50 times more effective in releasing oxygen to their tissues than that found in humans," said study lead author, Dr Jodie Rummer, from the ARC Centre of Excellence for Coral Reef Studies at James Cook University. "This is because their haemoglobin, the protein in blood that transports oxygen, is more sensitive

to changes in pH than ours and more than the haemoglobins in other animals."

Because of these adaptations, fish can live in all kinds of conditions, warm or cold water, and water with high or low oxygen levels.

"This trait may be particularly central to performance in athletic species, such as long-distance swimming salmon or fast swimming tuna," added co-author Dr Colin Brauner from the University of British Columbia. ■



Siphonophores move about by jet propulsion

Nanomia bijuga is part of a group of organisms, known as physonect siphonophores, a group of chain-like hydrozoan predators and a relative of jellies, anemones and corals. This siphonophore navigates the ocean in colonies measuring about 30cm long.

Each section within a colony is a specialized group of genetically identical individuals that perform different jobs.

The jet-producing members of the physonect colony, called nectophores, are genetically identical clones arranged in a propulsive unit called a nectosome, which acts as an engine for the whole colony.

Thrust and steering

Each nectophore sphere produces a propulsion jet, much like its larger jellyfish cousins. But unlike single-jet jellyfish, a colony can have as many as a dozen jets propelling it wherever it wants to go.

When nectophores are small, they cannot produce much thrust, so they use their jets to turn the entire colony. This action of nectophores makes the colony redirect itself very quickly. Working together, they form a living propulsion unit that is rare in animals. ■

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wreck rap



Three dimensional scan of the *H.L. Hunley* submarine, courtesy of the Friends of the Hunley

Text by Brian Chamberlain
Scans and photos of Hunley
courtesy of Friends of the Hunley

Let me just come right out and say it: Everything about the *H.L. Hunley* is cool. And it is completely awesome to see in person. Among the crown jewels of Charleston, South Carolina, the historical and archaeological treasure of the *Hunley* submarine stands out.



COURTESY OF SEA RESEARCH SOCIETY



US Civil War Wreck

H.L. Hunley Submarine

Until the wreck's discovery, few, apart from history buffs and academia, would have associated this popular seaside town with such an intriguingly unique and important part of naval history. Humbly described as "probably the most important find of the century" by the Director of Naval History at the Naval Historical Center in 2011, the *Hunley* has become one of the city's biggest tourist draws. Currently housed at the beautifully renovated Warren Lasch Conservation Center, it is expected to bring in more crowds when it is relocated to its very own museum in the future.

But why is it so special, one may ask... Few shipwreck stories inspire such excitement and passion in their readers as that of the wreck of the Confederate submarine *H.L. Hunley*. In a claustrophobic nightmare scenario, the details of the *Hunley's* demise on 17 February 1864, during the American Civil War, remain among the greatest mysteries in maritime archaeology to date. The interpretation of the

evidence surrounding the discovery, recovery, ongoing conservation and archaeological investigation of this famous wreck makes for fascinating and gripping research material. Much has been written and debated, but a great deal more has yet to be brought to light. In fact, the biggest and most obvious questions about why the *Hunley* sank remain unanswered. This only adds to its allure and legendary status.

History

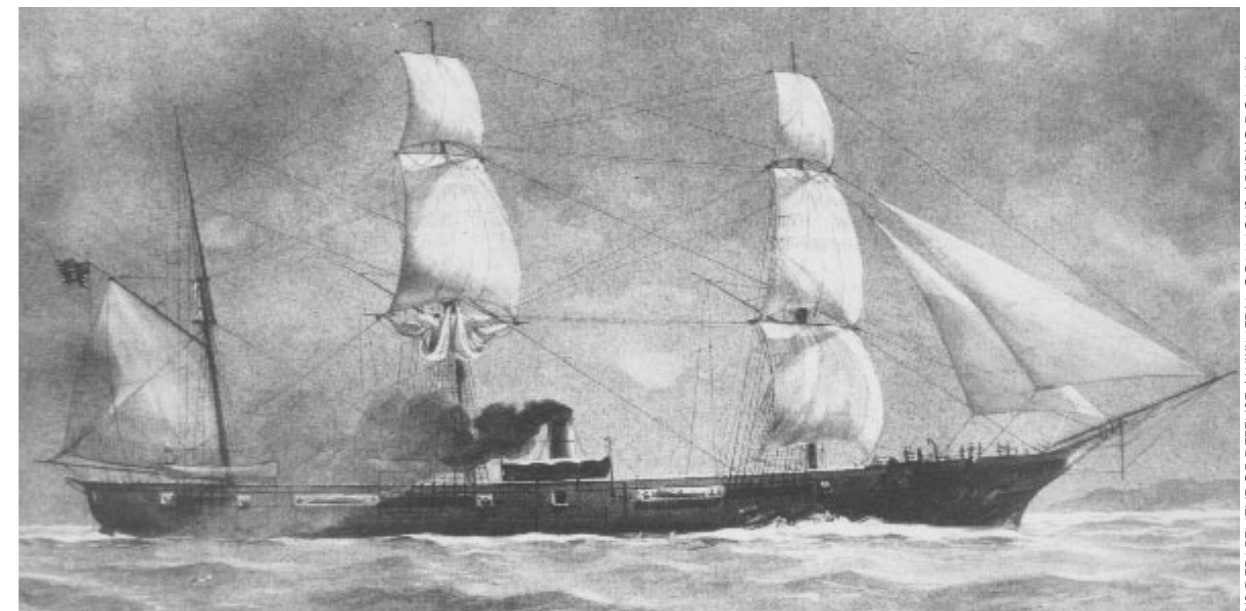
The *Hunley* earned its place in history the day it became the first submarine in the world to sink an enemy ship in battle. Its victim was the Union Navy warship *Housatonic*. When the *Hunley* failed to return after its successful mission, its story and resting place became the subject of intense speculation. For over a hundred years, many searched for it, especially after P.T. Barnum, "the greatest showman on earth," offered a reward equivalent to (in today's standards) millions of dollars in

gold for its discovery, intending to display the wreck in his museum in New York City; no one was able to claim that prize.

Discovery

Finally, someone with both skill and luck accomplished what no other had. In 1970, pioneer underwater archaeolo-

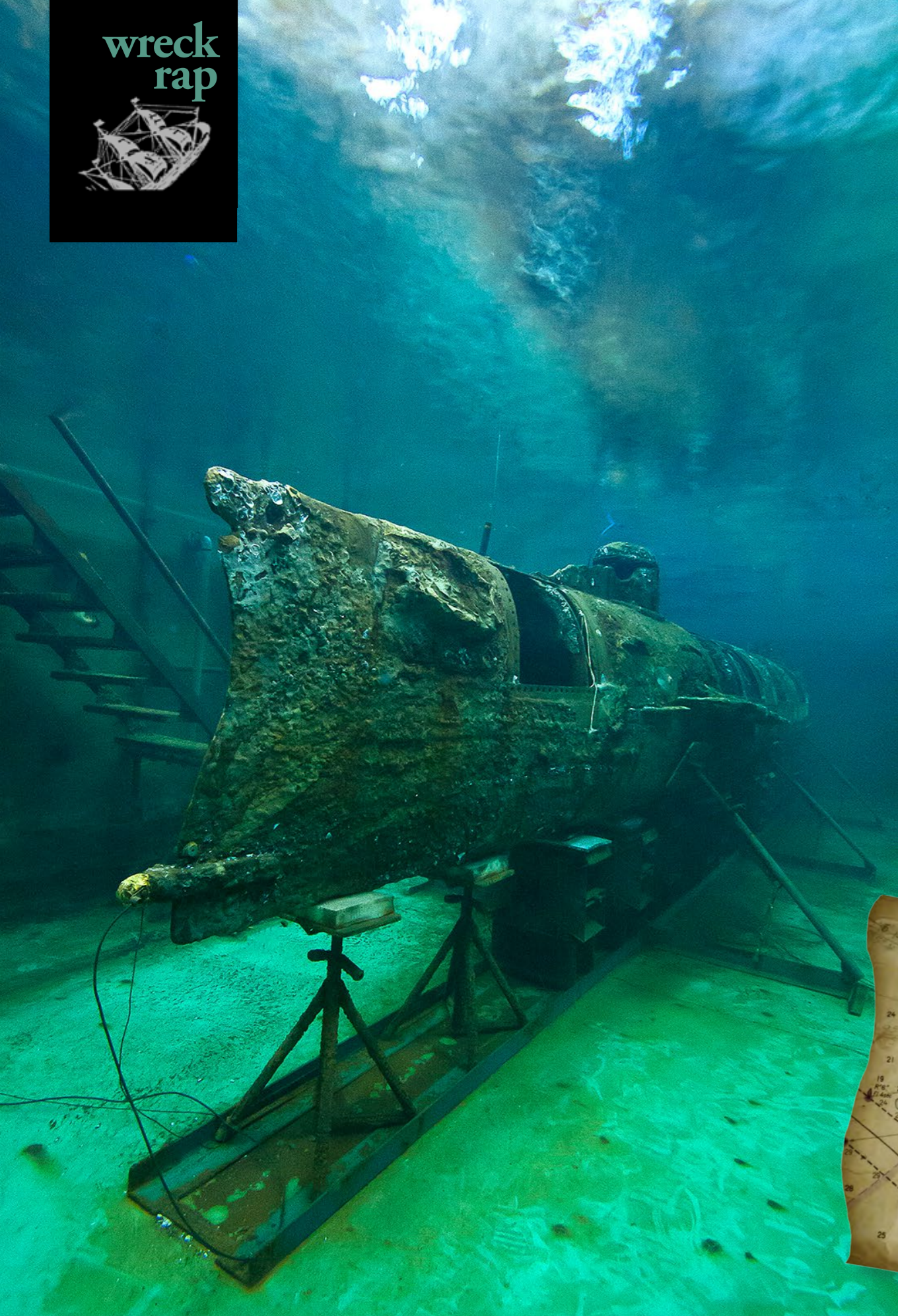
gist, E. Lee Spence, then just 22 years old, found the *Hunley*, after snagging a fish trap on it. Spence had not planned to dive that day, so he did not have any gear with him, but the captain did. Spence could not fit into the captain's wetsuit or fins, but scuba gear and a mask were all he really needed. He quickly stripped



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The Union Navy warship *Housatonic* was sunk by the *Hunley*.

Dr E Lee Spence discovered *Hunley* in 1970



Hunley undergoing conservation at the Warren Lasch Conservation Center in North Charleston

down to his underwear, donned the equipment and jumped into the bone-chilling, low-visibility water, following the trap line down into the murky depths. Minutes later, he emerged,

shouting to those on board, "I've found the *Hunley*!"

Knowing the importance of his find, he carefully plotted the location with amazing accuracy (this was before GPS was invented). Within days, a couple

of friends dove at the site, and soon afterward, he reported the location to the (then newly-formed) South Carolina Institute of Archaeology and Anthropology (SCIAA) and the National Park Service. Not after publicity, Spence did not alert the media until five years later, and

only in an effort to build up public pressure in support of it being preserved.

In 1978, thanks to Spence's discovery, the *Hunley* was placed on the US National Register of Historic Places. At the official request of Senator McConnell, chairman of the South Carolina Hunley Commission, Spence donated his legal rights to the wreck to the state of South Carolina in September 1995. It was an act which, Charles M. Condon, then Attorney General of the State of South Carolina, described as Spence's "generous and historic donation."

Since then, the submarine has become even more of a star. One reason it took so long to find the *Hunley* was because it lay offshore and east of the



Hunley on display at the Warren Lasch Conservation Center, North Charleston, South Carolina, USA

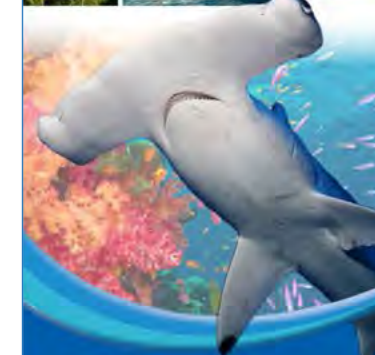
Spence's mapped location of *Hunley*



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What may be the most intriguing insight about the Hunley's story is the fact that even today, so little is actually known about what really happened to it.

Dr Spence (inset) on the day of the raising of the Hunley in 2000 (right). Photos courtesy of Sea Research Society



Housatonic wreck. This was an unlikely spot since historians and researchers had thought it, albeit erroneously, to be somewhere inshore and west of the *Housatonic*.

Excavation

In 1995, a SCIAA expedition, initiated and directed by Dr Mark M. Newell, and funded in part by novelist Clive Cussler, went to the site of Spence's 1970 discovery. Divers dug up enough of the wreck to photograph recognizable features and took the first photos to prove that it really was the *Hunley*. That was something Spence had been unable to do with the cameras available to him in 1970; and he had been prevented from doing so in the intervening years because digging it up would have required government approval, which Spence couldn't get. Newell, as a SCIAA archaeologist, didn't need such approval.

On 8 August 2000, the *Hunley* was raised with great anticipation and fanfare, to copious crowds and international media attention. I encourage you to see the *Hunley* for yourself, in all its glory, and to think about how it might have been for the crew on that fateful day in 1864.

Ongoing investigation

So much has already been published about its history, mission, discovery and recovery that I would heartily encourage the reader to study those subjects in depth, through the voluminous works by other authors. What may be the most intriguing insight about the *Hunley's* story is the fact that even today, so little is actually known about what really happened to it. It has been 151 years after the sinking of the *Housatonic*, and archaeologists and conservators have yet to arrive at a definitive answer about what had actually taken place on that day.

Technology has progressed significantly since recovery and conservation started 15 years ago. In various arenas, concurrent technological and multidisciplinary advances have allowed for subsequent advances in techniques used to interpret, record and study the *Hunley* data. Especially in the time of 3D computer imaging and laser-scanning technology, new ways of understanding the data open up compelling new theoretical possibilities.

Why didn't the *Hunley* make it home? Were the *Hunley's* crew knocked uncon-

scious after the impact of their torpedo with the *Housatonic*? Did the submarine take on water due to gunshots fired from its victim, or did it stay watertight for years after sinking? The possible answers to these and hundreds of related questions are fervently discussed in classrooms, books, coffee shops, newspaper articles, laboratories and the general blogosphere around the globe. Is our interest piqued? Yes, indeed it is.

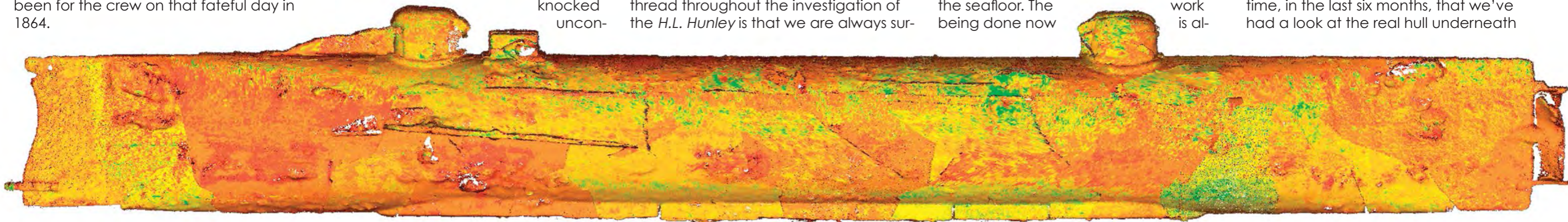
Surprises

Speaking on the subject of the ongoing investigation, archaeologist Michael Scafuri commented that "the common thread throughout the investigation of the *H.L. Hunley* is that we are always sur-

prised." For instance, before the excavation, it was generally assumed that the *Hunley* was buried relatively quickly after sinking and remained covered until 1995. But Scafuri noted that "it [the *Hunley*] had been exposed periodically," possibly after storms and hurricanes, since it sank about 28ft (8.5m) work being done now is al-

lowing interpretations of what happened that were unavailable until now.

The process of deconcretion involves the slow and arduous task of simultaneously documenting the details of progress as concreted material is removed from the surface of the submarine and its artifacts. Scafuri noted, "this is the first time, in the last six months, that we've had a look at the real hull underneath



Exterior scan of the *H.L. Hunley* submarine before excavation, courtesy of the Friends of the Hunley





“...The common thread throughout the investigation of the *HL Hunley* is that we are always surprised.”

— Archaeologist Michael Scafuri



Front and back of gold coin (left) recovered from the *Hunley* (above) on display at the Warren Lasch Conservation Center in North Charleston. The coin belonged to the *Hunley*'s captain, Lt. George Dixon, and had saved his life when it stopped a bullet that hit him during the Battle of Shiloh.

“...this concretion. This is the first time we've been able to examine the concretion and see how thick it is. What is its composition? Is it all corrosion product? Are there macrofaunal organisms that colonized the submarine when it sat offshore?”

With genuine archaeological flair, Scafuri added, “the biggest mistake in all of archaeology... in any investigative science... is to take your preconceived notions and look for evidence to support them.” When asked if any of his preconceived notions or ideas had

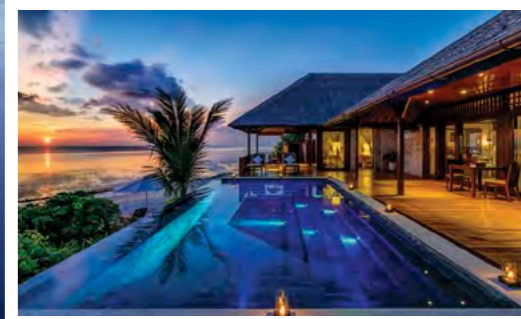
been “blown out of the water” by the ongoing research, he answered, “Almost every one.”

That promises a lot of stimulating discovery and adventure for the development of the *Hunley*'s story. I, for one, will keep reading. ■

Thanks to the Friends of the Hunley and Michael Scafuri. Please visit Hunley.org for tour information and to become a member or sponsor. You can read more about Dr E. Lee Spence and his many other discoveries at Shipwrecks.com and like him on Facebook at <https://www.facebook.com/shipwrecktreasure>.



Archeologist Maria Jacobson holds the gold coin just after excavating it



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Steve and Cindy Moore, April 2015



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Royal Australian Air Force (RAAF) Catalina flying boat

WWII Catalina found on Great Barrier Reef

A video released by the Royal Australian Air Force (RAAF) shows a newly found Second World War aircraft in the waters of Australia. The plane is a Catalina A24-25 flying boat from RAAF Number 11 Squadron, which went missing on 28 February 1943.

The wreckage was first discovered 56km south of Cairns, in 35m of water, by Cairns diver Kevin Coombs in 2013, but weather and planning challenges delayed the final dives to complete the investigation.

The A24-25 was part of a task force flying long-range missions against Japanese shipping and submarines during World War II. On 28 February 1943, Catalina A24-25 and its 11 aircrew were on a 17-hour mission to provide anti-submarine cover to a convoy

heading for Milne Bay in Papua New Guinea. The crew of the Catalina sent out a radio statement saying they needed to make an emergency landing. The aircraft crashed during the attempted landing and the 11 personnel on board were killed.

The Court of Inquiry recorded the plane crashed at sea while attempting to land after running out of fuel. There were no witnesses and no sightings of wreckage or crew during subsequent searches.

War grave

The RAAF will leave the aircraft where it was found as a mark of respect to the crew and the plane will be protected by a Maritime Cultural Heritage Special Management Area designation. ■



File photo of a Boeing B-17 'Flying Fortress'

WWII B-17 Flying Fortress bomber found off Sicily

The wreck of a Flying Fortress bomber shot down by German fighters during the Second World War was found at a depth of 75m (245ft).

The Flying Fortress took part in a raid on Palermo on 18 April 1943 when it was attacked by several German ME-110 fighters, which knocked out one of its engines. The aircraft, part of the 353rd Bomber Squadron of the American air force, crashed into the sea, with the loss of all nine crew members.

Months of detective work

The WWII bomber was found a few months ago by a group of Italian divers who are part of a project called "Shadows of the Deep", which aims to locate the wrecks of planes and boats off Sicily.

The discovery, helped by a sonar scan carried out by a diving unit of the Italian fire brigade, was the result of months of detective work, with historians and

amateur divers matching official war-time records with the accounts of elderly Sicilians who still remember the raid.

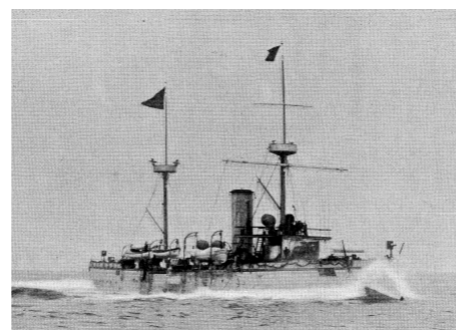
After identifying the aircraft's serial number, the diving team was able to trace US War Department records, which listed the crew members and an eyewitness account on the plane's demise:

"Lt Godwin's ship was attacked 20 miles from target by ME-110s and was shot down.

"There were no chutes seen to open and the gunners from the other planes were having a pretty busy time taking care of themselves," it said.

According to the report in the *Telegraph*, no human remains have been found yet inside the wreck. There are no plans to raise the wreck—it lies in deep water and is classified as a military war grave. ■

19th century Chinese cruiser *Zhiyuan* identified



The shipwreck, which was not discovered until 2013 and at first was code named "Dandong No.1", has now been tentatively identified as the cruiser *Zhiyuan*. It was sunk in 1894 during the largest naval engagement of the First Sino-Japanese War. According to China Radio International's English Service, over a hundred relics have been salvaged from the depths of the Yellow Sea, including canons, shells and other artillery. ■

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U-Boat Navigator Mission 2015:

HMHS Britannic

Text by Svetlana Murashkina
Photos by Sergey Bychkov and Svetlana Murashkina
Underwater photos by Eugene Tomashov

— In the Kea Channel, Greece

The Ageotec Perseo GTV ROV at HMHS *Britannic's* forecastle deck (previous page) and illuminates *Britannic* as it is now (right)

Through the centuries in Greece, Kea Island's renowned statue, the Lion of Kea (one cannot see him from the shore, but I know he is there), continues to smile and look askance upon human vanity—exactly the same way he did in 1916, when during World War I, hospital ships were hit by mines and tragically sank in the Kea Channel. These ships, now wrecks, include HMHS *Britannic* and SS *Burdigala*.



SERGEY BYCHKOV

Triton submarine being readied for launch with pilot Dmitry Tomashov and project photography director Sergey Machilsky



EUGENE TOMASHOV

It's July 2015, Greece. It's very hot outside. Television commentators from various countries are passionately informing humanity that Greece is ready to leave the European Union, and an inevitable collapse shadows the nation. Here, on Attica, there is still some tranquility and serenity to be found, as is usual for this historical region encompassing Athens. Maria, the taxi driver taking

me to the ferry in Lavrio, complains: "Business is very slow. But who said that life is easy?"

After an hour's journey on azure seas, I reach Kea Island and find everything there even more relaxed. Visitors are met with hugs and kisses, and friendly shouts, and as the cars disembarking from the ferry leave the parking lot, a tranquil atmosphere settles over the port.

U-Boat Navigator

The captain of the Russian-Ukrainian-Maltese crew, Olexandr Stasyukevych, welcomes me on board *U-Boat Navigator*, the research vessel of U-Boat Malta. The wrecks of HMHS *Britannic* and SS *Burdigala* are the subjects of research for the first stage of a joint expedition between the Center for Underwater Research of the Russian Geographical Society

and the company, U-Boat Malta. U-Boat Malta provides services to organizations in the fields of marine archaeology, scientific and historical research, as well as film. The company's playground is mainly the Mediterranean, but is not limited to this region. This time, it is the Aegean Sea.

U-Boat Navigator's captain, Stasyukevych, is a celebrity in the yacht-



CLOCKWISE FROM LEFT: Triton 3300/3 goes to the sea, secured by the tender; *U-Boat Navigator* at Kea Island; Works on board—ropes, winch, crew; The Russian geographic society crest on board *U-Boat Navigator*



SVETLANA MURASHKINA



SVETLANA MURASHKINA



SVETLANA MURASHKINA

ing world; besides being a successful racer and coach, he took part in an epic journey on board the yacht, *Scorpius*, in a "circulation of 33 seas"—bypassing both poles in one navigation. On the same crew of the *Scorpius* was, by the way, Sergey Bychkov, who is also a doctor aboard the *U-Boat Navigator*. All the *U-Boat Navigator*'s crew members—the boatswain, Sergey Zhdanovych; the chief engineer, Joseph Calleja;

the engineer, André Tanti; the electrician, Sergii Zakharov; the cook, Alexey Leonov; the deep divers Levan Margishvili and Andrey Likhanskiy—possess the absolute top, professional qualifications in their fields, and at the same time, do not shun any work onboard; this is the way things are done here. Everyone is a sailor, first of all.

Aboard the *U-Boat Navigator*, I was struck by the quantity of various equipment, packed

into every cubic meter of ship. There was a remotely operated vehicle (ROV)—an Ageotec Perseo GTV for visual and instrumental inspections—and the Triton 3300/3 submarine, able to work at 1,000 meters depth. There was also sonar equipment, winches, diving equipment, including a compressor and gas blender, and a full medical complex,

including a hyperbaric chamber—a dream dive boat for any technical diver.

Off to the sea we go! Here, for nearly 100 years, in direct

view of Kea Island's shore, in the channel between Kea and Makronisos, rests the legendary ship *Britannic*.

Triton 3300/3 being prepared by the tender (right); The Triton with its crew, submerging (below)



SVETLANA MURASHKINA



SERGEY BYCHKOV

Britannic

The British shipping company White Star Line's third and largest Olympic-class ocean liner, HMHS *Britannic* was the sister-ship of RMS *Titanic* and RMS *Olympic*. *Britannic* was supposed to enter service as the transatlantic passenger liner, RMS *Britannic*. The vessel was launched just before the beginning of WWI, however, she sat out of action at her builders in Belfast for several months before becoming a hospital ship in 1915. On the morning of 21 November 1916, *Britannic* hit an underwater mine off the Greek island of Kea in the Kea Channel, and sank 55 minutes later killing 30 of the 1,066 people on board.

There were 1,036 survivors pulled from the water onto lifeboats; after about an hour at 9:07 a.m., the *Britannic* sank. Even though *Britannic* was the biggest ship lost in WWI, it was not the most costly

in terms of deaths compared to the sinking of the *Titanic* or the *Lusitania*, or many of other vessels lost during WWI.

Divers often call this wreck



SVETLANA MURASHKINA

Deep diver Levan Margishvili cleaning *U-Boat Navigator's* windows at port of Korissia

the "Underwater Everest", stressing the unique features, dangers and complexity involved in diving the *Britannic*, which rests at a depth of 120m. Indeed, the number of people who have visited this magnificent ship underwater is less than the number of those who have gone to outer space. Diving *Britannic* is extremely difficult, demanding good preparation and technical diving knowledge as well as technical support. *U-Boat*

Navigator provides everything for this purpose: deep divers on staff, technical diving equipment, 100m operating diving bell with a hot water supply—so divers can be warm and comfortable during the five to six hours of decompression.

ROV and Triton submarine

But the most interesting features of this expedition are the primary "divers"—the ROV and the Triton submarine—as the main goal of the expedition is to get high-quality footage of HMHS *Britannic* and other deep wrecks for research purposes and for the series of

film documentaries entitled *Dark Waters*. Part one, entitled "Red Crosses on the Water: Hospital Ships of WWI", is dedicated to the 100-year anniversary of the sinking of HMHS *Britannic*.

The Triton submarine is used as a "housing" for the 6K RED camera, while also carrying a cameraman and a pilot. The pilot, Dmitry Tomashov, has spent over 40 hours on *Britannic*—an unprecedented record—and contributes his vast experience and invaluable knowledge on the subject to the expedition. The cameraman, Eugene Tomashov, has even more



The Ageotec
Perseo GTV
ROV on
Britannic

experience. Dima and Eugene, comprise a magnificent father-and-son team, operating seamlessly and understanding each other perfectly well.

Diving and filming

The ship is 260m long, with a maximum depth of 120m. The wreck is dived consistently, from bow to stern or from stern to bow, depending on the current. At least two to three shifts are necessary to cover the wreck, during which *U-Boat Navigator* moves its anchors, relocating the ROV. Eugene films



EUGENE TOMASHOV

Britannic's port anchor, still in its hawsepipe



EUGENE TOMASHOV

close-ups, highlighting details of the wreck. This year, during the third expedition season in a row, the team succeeded in shooting general views of the wreck in order to see the whole ship

at a glance. This imagery was made possible by special shooting technology, with the submarine and the ROV working together, to direct a large amount of light onto the subject. The director of photography of the project, Sergey Machilsky—well-respected in Russian cinematography—is an experienced professional and also a diver himself.

After several expedition seasons, the team has carried out about 50

hours of shooting *Britannic*, capturing several terabytes of footage. What is the reason for this? HMHS *Britannic* is a real movie star—nearly as famous as her sister-ship, *Titanic*. Eugene Tomashov, the expedition leader and project developer, is a professional deep-water diver, underwater operator and scriptwriter. He has investigated and filmed hundreds of wrecks, and he is very passionate about documenting underwater wrecks.

The *Britannic* wreck, like many deep wrecks, is disappearing over time. Water and marine organisms are doing their job and taking their toll on the ship's remains. In time, this gorgeous ship will turn into piles of dust. So, it is necessary to show *Britannic* as she is now, and once again, remember her legendary and tragic story. ■

SOURCE: [HTTPS://EN.WIKIPEDIA.ORG/WIKI/HMHS_BRITANNIC](https://en.wikipedia.org/wiki/HMHS_Britannic)

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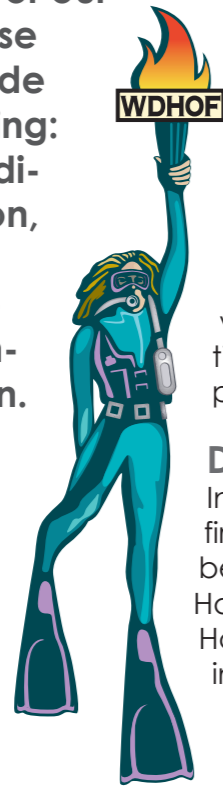


WDHOF announces new DAN / R.W. 'Bill' Hamilton Research Grant

Text and images by Rosemary E. Lunn

Women Divers Hall of Fame was founded in 1999 to recognise and raise awareness of elite leaders who have significantly contributed to exploring, greater understanding, safety and enjoyment of our underwater world. These endeavours span a wide variety of fields including: the arts, sciences, medicine, sports, exploration, archaeology, media, safety, education, service, business, environment and conservation.

Women Divers Hall of Fame members are nominated and selected on an annual basis every autumn, and inducted the following spring at the Beneath the Sea exposition in New York. To date, the membership comprises 168 noted women from 12 countries.



WOMEN DIVERS HALL OF FAME

The Women Divers Hall of Fame (WDHOF) has a secondary mission, that of developing and educating tomorrow's world-class diving leaders by providing educational, mentorship, financial and career opportunities to the diving community throughout the world. Each year, WDHOF fundraises to award 28 scholarships and training grants to individuals of all ages, particularly those who are preparing for professional careers that involve diving.

These scholarships aim to support tuition and fees, independent research, and/or internship programs at accredited universities and are offered in dive medicine, marine conservation, marine biology, underwater archaeology, marine education, journalism, graphic arts and photography.

Dr Bill Hamilton

In recent weeks, it has been confirmed that a new scholarship has been launched in honor of Dr 'Bill' Hamilton. For more than 40 years, Hamilton conducted research on diving physiology, including decompression modeling, mixed gasses and the treatment of injured divers.

Hamilton worked extensively with commercial diving companies, the partner

navies and the recreational training agencies in the development of mixed gas diving procedures. During his career, he authored numerous papers, reports, workshop proceedings, books and magazine articles.

Hamilton was instrumental in the development of technical diving. Without Hamilton's work on nitrox and trimix, decompression tables and procedures, free-swimming divers would have remained in the shallows.

New research

The Divers Alert Network has established an exciting and generous new US\$10,000 research grant to support new or continuing research in areas that were critically important to Hamilton. The grant is restricted for use to the following areas:

- Development of decompression procedure techniques for commercial, military, technical and/or recreational divers
- Development of new decompression models
- Probability of risk or probabilistic



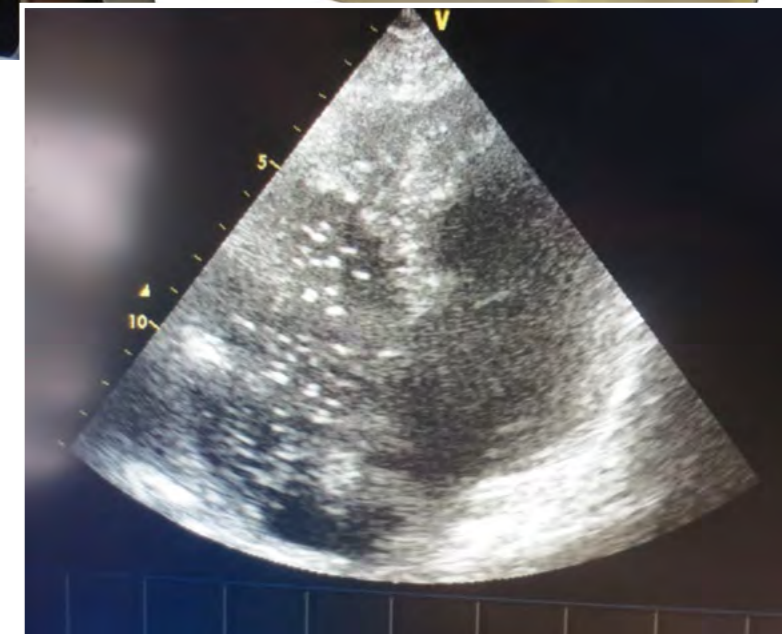
Dr Neal W. Pollock, DAN's Research Director, conducting decompression research. He is pictured here using two-dimensional ultrasound to look for bubbles in the heart (a measure of decompression stress).

- modelling
- Multi-gas dive simulation
- Dive computer procedure, protocol and testing
- Treatment of incomplete decompression and resulting incidents

Application

Applications will be reviewed by a panel of experts from Divers Alert Network and the Women Divers Hall of Fame. Full details of this DAN grant and other WDHOF scholarships can be found at www.wdhof.org/scholarships/scholarships.shtml.

The deadline for receipt of online submission applications is Friday 20th November 2015 (midnight EST). Applicants will be notified of award status by 1st February 2016. ■



Still image from the transthoracic echo imaging (TTE) scan of a subject's heart. You can clearly see bubbles resulting from decompression stress in the right heart (they look like bright white rice grains on the left side of the image). Blood in the right heart is sent to the lungs where bubbles can be filtered out of the circulation.

The Prince of Gases

Who was Dr R.W. 'Bill' Hamilton?

Text by Joel Silverstein

Born in Midland, Texas, Hamilton would always explore things on the edge of the envelope. He first expanded his youthful mind with liberal arts at the University of Texas, then went on to earn a master's degree in animal breeding at Texas A&M University. He finished up his formal education by earning his doctorate in physiology and biophysics at the University of Minnesota.

Along the way, Hamilton joined the US Air Force earning the rank of Major and served as a jet fighter pilot during the Korean War and again in Vietnam, where he earned the Distinguished Flying Cross, Air Medal and other decorations.

As a Life Support Officer, Hamilton helped solve equipment problems on unsuccessful bail-outs, which earned him a recommendation by the National Academy of Sciences to NASA as a Scientist Astronaut. Eventually, Bill left the Air Force with his wife and four children and headed to

Buffalo, New York, in 1964 where he met Heinz Schreiner and began his work in the undersea world.

A decade of exploration

The 1960s was a decade of change and exploration—some with art, music, politics and war protests—but for Hamilton, it was working as a scientist and director of a leading environmental physiology and diving research lab called Ocean Systems (a division of Union Carbide) based in Tarrytown, New York.

Hamilton and his staff conducted extensive research on the effects of gases both under increased pressure and in hyperbaric environments. This work led to the development of decompression modeling tools and operational procedures for divers,

astronauts, hyperbaric chambers, and tunnel and caisson workers.

One of the early projects, in which Hamilton was both the physiologist and test subject, led in 1965 to the first manned laboratory saturation "dive" to the continental shelf pressure of 200m (656ft, 12 atmospheres) of sea water. All of this was just the beginning.

During his time at Ocean Systems and after the death of his first wife, Beverly, in 1970, Hamilton met Kathryn Faulkner (aka "Ruby Lips") on an Eastern Airlines shuttle. That chance meeting turned into a 40-year marriage, which has created an international family of friends and colleagues.

Ruby played a pivotal role in Hamilton's life, becoming a mother to his children and then grandmother to their children. Not

satisfied to simply play a side role, however, Ruby also managed the business aspects of Hamilton Research, including finance, contracts, calendar, travel and social events, and served as Hamilton's sounding board for difficult decisions. It was rare that Hamilton would be at an event without her close by.

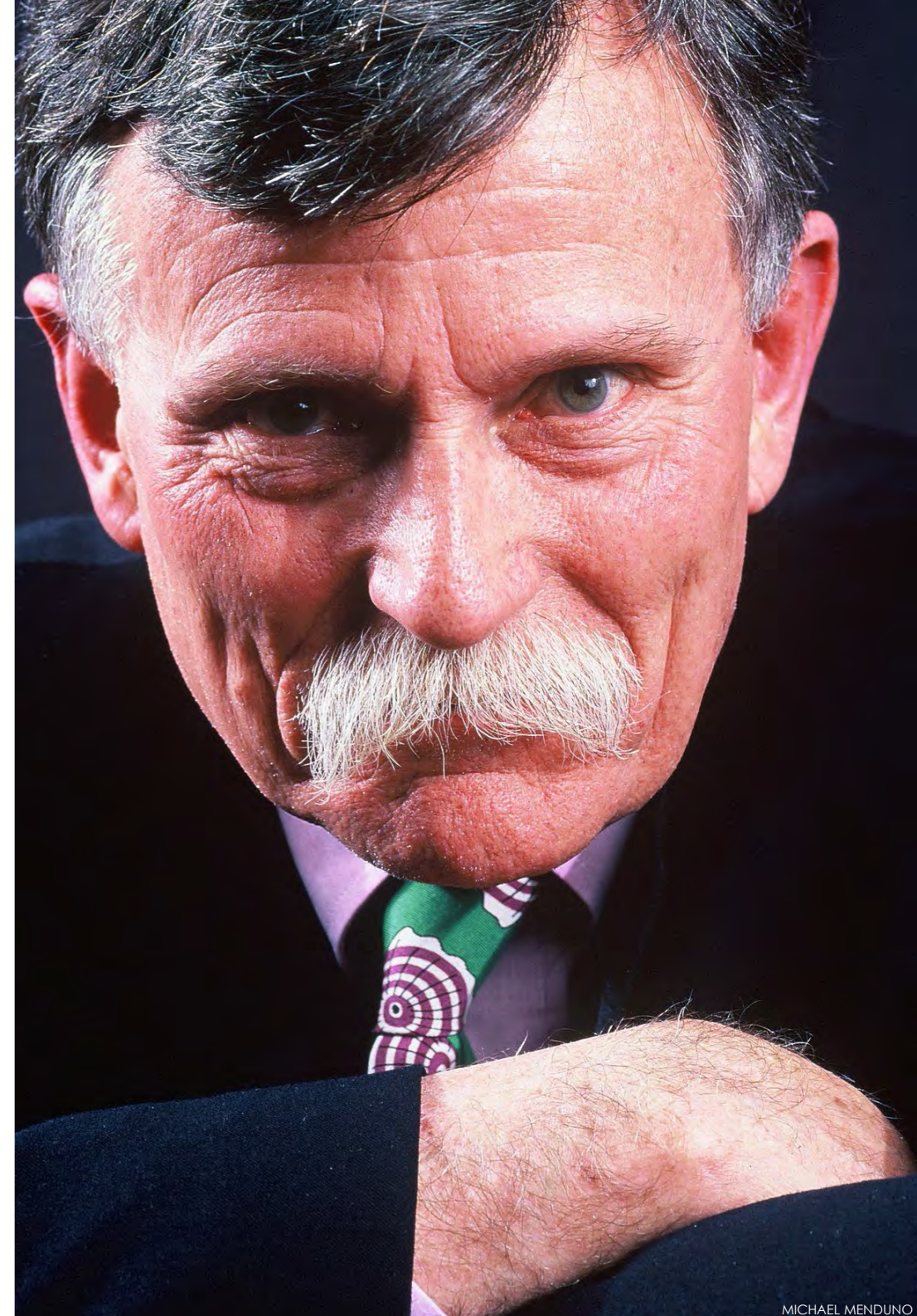
Setting up shop

By 1976, Hamilton took one of the biggest risks an academic could ever take—he set out to create his own physiology consulting firm, Hamilton Research, Ltd. Tucked away in a room in his house overlooking the Hudson River, Hamilton Research became the premier organization for decompression and hyperbaric research.

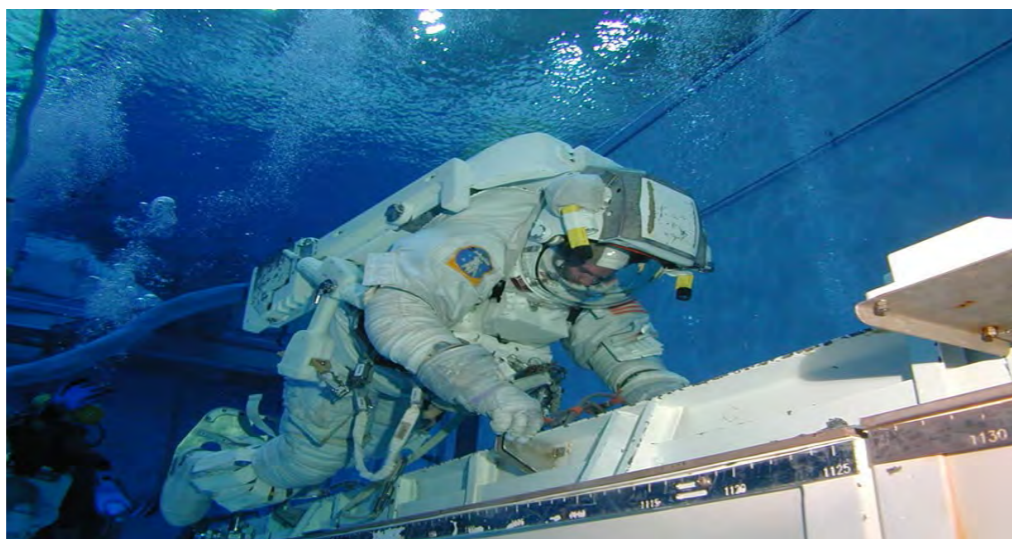
Hamilton was often sought for consultation and collaboration. He worked extensively with oil companies, the military and others in developing procedures and techniques to mitigate the effects of High Pressure Neurological Syndrome (HPNS) while compressing to depths of 300 to 600m (984 to 1,969ft).

Decompression procedures

The big project from Hamilton Research that has had an inestimable impact on decompression research was the development of



MICHAEL MENDUNO



the Diving Computational Analysis Program (DCAP). DCAP was co-developed with David J. Kenyon and is a comprehensive computer program that could analyze and develop decompression procedures and schedules for a wide variety of exposures to pressure, including submarine escape, space travel, deep commercial diving, caisson and tunnel work,

and free-swimming technical diving.

The program did nothing short of revolutionizing the way decompression analysis was done. Hamilton Research, armed with DCAP, began working with British, Swedish, Japanese, Finnish, Israeli, Italian and US navies; Canadian and German research centers; the Norwegian Underwater



Call It "High-Tech Diving", in the first issue, January, 1990



Institute; and countless other organizations around the world. In addition to DCAP, Hamilton was also the principal investigator and scientist in the creation of the NOAA Repex Oxygen Exposure table—the basis for most every oxygen exposure calculation method used today for saturation and repetitive exposures to oxygen in breathing mixtures. His work continued to evolve and he was consulted by attorneys and diving equipment companies on topics including dive computers, rebreathers and expert witness testimony. He was even consulted by food companies on packaging foods in pressurized environments. His reach was endless.

Entry into sport diving In the late 1980s, his love for the edge of the envelope came into view with extreme recreational divers. For decades, only commercial and military divers had access to mixed gases for diving operations. But now cave divers and wreck divers wanted to go deeper and farther than air would allow them to go safely. In an unprecedented move, Hamilton stepped out of his traditional role with commercial and military clients and stepped into the world of "sport divers."

He created a custom set of decompression tables for extreme cave dives into the Wakulla system for dives to 100m (328ft) on open circuit scuba, with man-

aged oxygen exposures and minimal nitrogen narcosis. The project was a success, and soon the "underground" was abuzz.

Under fire While some of his colleagues criticized him for these efforts, Hamilton believed that if he did not help these divers, they would do the dives anyway and possibly get hurt. His humanity was exemplified in his desire to help them and, as such, he opened up a whole new world of underwater exploration by the free-swimming un-tethered diver. This was the birth of "technical diving." News of Hamilton's tables got out, and practicing deep divers from all over the world began contacting him for help.

Along came Capt. Billy Deans from Key West, who had been doing deep dives for years but wanted a better and safer way to do it. He and Hamilton became fast friends and Hamilton helped Deans to create the first training program for open ocean trimix diving.

He was also a key contributor and advisor to *aquaCORPS Journal*, beginning with his seminal article, "Call It High-Tech Diving," in the first issue in January, 1990, which sought to explain the technological changes taking place in sport diving. This second part of an already accomplished career was shining brightly. Hamilton was on everyone's invite list for conferences and workshops all over the world. He was a principal contributor to the 1992 aquaCorps Nitrox Workshop in Houston, which helped make nitrox diving mainstream in the

The friendship further led in part to the creation of the Key West Consortium—a group of divers who hired Hamilton Research, Ltd., to create a universal set of trimix decompression tables that would be used for open-ocean dives in the 180-250 fsw range.

Trimix and tech This opened up access to wrecks all over the world. The success of these tables with thousands upon thousands of dives led to Hamilton creating trimix tables for NOAA, for use on the USS *Monitor* research projects.

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Hamilton was on everyone's invite list for conferences and workshops all over the world. He was a principal contributor to the 1992 aquaCorps Nitrox Workshop in Houston, which helped make nitrox diving mainstream in the

recreational diving world. Hamilton then went on to write nitrox training manuals and programs for many of the certification agencies, and was a major contributor to the original *NOAA Diving Manual*. He worked with many manufacturers on their dive computers and algorithms, and was a regular consultant to the US Navy on matters of decompression and decompression illness treatment.

Hamilton was generous with his time and advice, and he served by volunteering wherever he could. Oftentimes, this meant anything from repairing lights in his church to sitting on boards for the Divers Alert Network (DAN), the Undersea and Hyperbaric Medical Society (UHMS), the National Oceanic and Atmospheric Administration (NOAA), and the National Fire Protection Association (NFPA).

Hamilton volunteered to lead conferences as a keynote speaker as well as serving in the Air National Guard. He was never more than a phone call or email away to help those who needed it. That was his nature.

Over 100 honors Over the years, Hamilton was the recipient of more than a hundred

honors and awards from almost every diving and science organization. From keynote speaker to Diver-of-the-Year, someplace in the world, he and Ruby Lips would often be featured at the party.

Hamilton would often slip off for a little nap or find a laptop or a cocktail napkin, and have serious discussions with serious people about things that mattered, like life support.

Hamilton's accomplishments in life go deeper than the bottom of the sea and higher than Mount Everest. They delve into the hearts and minds of friends, family and colleagues. He instilled the desire to be better at what we do into each and every one of us.

His contributions to the world of diving are unmatched, and his forward thinking of how divers would survive underwater is arguably the basis for all extreme

exposure diving today. His *modus operandi* was to get the job done right and then have a good time with the people around him. Everybody he met, if only for a moment, was a better person for it. Hamilton's ability to examine and explore ways to make something or someone better was his way. A little nap along the way and he was recharged and ready to take on the next task. ■



Would you like to have Air or Nitrox? Bill Hamilton's work was instrumental in bringing Nitrox to recreational divers



Tobermory, Ontario gets new hyperbaric chamber

Fundraising in the local diving community and donations from area businesses and corporations have exceeded expectations, making it possible for the Tobermory Hyperbaric Facility on Bruce Peninsula in Ontario, Canada, to install a new hyperbaric chamber.

According to Dr George Harpur, the medical director of the hyperbaric facility, divers and other clinic patrons raised over CA\$80,000 in funds to add to \$200,000 in corporate donations. An additional \$170,000 in funding through charitable applications is being sought to complete the refurbishment.

The older vessel was used on several occasions over the past year to treat divers with decompression sickness as well as other patients needing treatment for wounds and other ailments. The new vessel is bigger and more accessible, allowing the medical staff to treat more patients and train more staff. ■

SOURCE: OWEN SOUND SUN TIMES, BAYSHORE BROADCASTING



NASA / WIKIMEDIA COMMONS / PUBLIC DOMAIN



Old Havana at night, Cuba

GABRIEL RODRÍGUEZ / WIKIMEDIA COMMONS / CC BY-SA 2.0

First direct flight from Washington DC lands in Havana

This fall saw the first direct flight from Washington DC land in Havana, as the United States and Cuba move forward in restoring airline service on a scheduled basis. It is a three-hour flight from Baltimore, just 38 miles north of the US capital. Jordan Levine, an American tourist, said he was looking forward to visiting Cuba, which has been off-limits to US citizens for so long.

"It is fantastic. We are so happy to see the Cuban culture, Cuban food, meet the Cuban people. It's an easy flight, three hours from Baltimore, and this is a first, so we are excited to see what we are going

to see tonight and tomorrow, and we'll leave Sunday," Levine told International Business Times upon arrival at Jose Marti International Airport.

Other passengers mentioned the convenience of the direct flight for Americans residing in the Northeast and especially Washington DC residents who previously had to change flights in Miami or New York.

US-Cuban talks

The flight followed two days of talks between US and Cuban authorities to restore regular airline service, with the aim of reaching a deal this

year, according to US officials. There are plans for the two sides to meet again, in Washington DC this time, before the end of the year said the official.

While general US tourism to Cuba is banned, according to the US trade embargo of Cuba, specially sanctioned travel is allowed, after US President Barack Obama relaxed restrictions, fostering a sharp rise of more than 60 percent in Americans travelling to the country. This year alone, over 106,000 US citizens arrived in Cuba as of September. ■

SOURCE: IBN

First airplane lands in remote island of Saint Helena

The first airplane to land in one of the world's most remote places, Saint Helena, located in the South Atlantic Ocean, has ended an era of mail received by ship. Landing in the British Overseas Territory, the twin-engine plane braved 2,000km over open ocean after taking off

from Johannesburg, South Africa, preceding the island's planned opening of the St Helena airport in February 2016.

The island to which Napoleon Bonaparte was exiled in 1815—so remote, even he could not escape—ranges only 17 by 10km in area, with a population of about 5,000. With stark geology described by Charles Darwin as a mass that "rises abruptly like a huge black castle from the ocean", historical tours of Bonaparte's tomb, and pollution-free

atmosphere offering crystal clear views of the stars, the island is likely to attract new visitors.

"The walking here provides some of the most starkly beautiful and spectacular landscapes," said Pamela Ward Pearce, member of the island's executive council.

And something that will stir many a diver's heart: it is possible to swim with whale sharks in the bay during certain months of the year. ■

SOURCE: THE GUARDIAN, WIKIPEDIA



• Raja Ampat

Komodo •

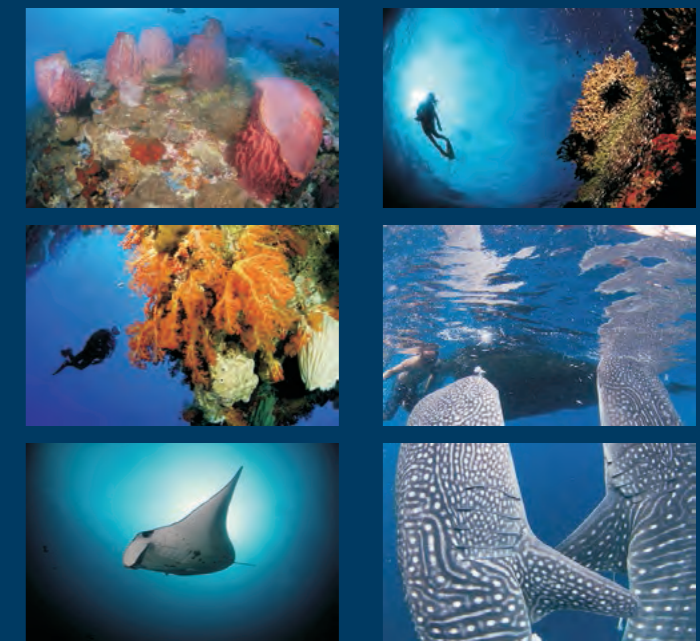


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Indian Ocean

The Maldives

Text and photos by Matthew Meier

— *The Southern Atolls*



Two blackfinned anemonefish in a red and green magnificent sea anemone
PREVIOUS PAGE: School of bluestreak fusilier fish swimming over the coral reef



Whale shark feeding on plankton in the lights behind the boat at night

The subtle knock on the door roused me from my slumber. It was 2 a.m. and the wake-up call could only mean one thing. A whale shark had finally appeared to feed on the large aggregation of plankton attracted to the light set out behind the boat. I scrambled out of bed and raced upstairs to get my camera.

For the next hour and a half, I snorkeled alongside the largest fish in the ocean, as it gulped down mouthfuls of seawater and krill, essentially ignoring my presence as it enjoyed a free midnight snack. Almost everyone had gone back to bed by the time I emerged from the

water. As if seemingly waiting for my departure, a second, smaller whale shark materialized to feed alongside the first. I watched them both from the surface, snapping a few more photos before calling it a night. It was truly a magical evening and well worth the lack of sleep.

Remote

Located on the Equator, 435 miles (700km) southwest of Sri Lanka, the island nation of the Maldives comprises 26 atolls surrounded by the Indian Ocean. Situated on the Laccadives-Chagos Ridge, a 1,243 mile (2,000km) submarine mountain chain created over 2,000 million years ago, the country is spread out over 56,000 sq mi (90,000 sq km) of ocean, though the land portion above water accounts for less than one percent of that area or 186 sq mi (300 sq km).



Blackspotted, or honeycomb, moray eel



A remote, deserted island (right) in the Indian Ocean, Mattidhoo Island, Huvadhu Atoll; Large aggregation of bluestripe snapper and striped large-eye breems (below); Fishing boats anchored in the harbor, Bodufinolhu Island, Laamu Atoll (lower right)



Maldives



Comprising beautiful stretches of coral, sand and palm trees, the islands themselves are surrounded by brilliantly clear, turquoise, warm water. The topography is exceedingly flat, with the highest point in the country being a mere

eight feet above sea level. Miles and miles of ocean often fill the space between islands, and it is not uncommon to entirely lose sight of land, as you explore this tropical paradise. There is so little land, spread out over such a large

area, that you will rarely share a dive site with other divers. Often, it feels as if you are on the only boat on an entire atoll.

Weather

The weather in the Maldives is greatly influenced by the Iruvai ("dry" northeast monsoon that typically blows mid-November to April) and the Hulhangu ("wet" southwest monsoon in May to October). Though air temperatures remain

fairly constant between 84-90°F (29-32°C) year-round and water temperatures fluctuate only slightly between 80-84°F (27-29°C), the monsoons affect the climate on land and in the sea.

With the start of the Iruvai,

underwater currents begin flowing from the northeast and visibility typically improves on the eastern edges of the atolls. Stronger currents and winds commonly define the Hulhangu, as the water flow shifts from the southwest, often bringing along with it larger algae

blooms, which can diminish visibility. The plus side of this is the increased food supply that often equates to intensified pelagic encounters.

Getting there

Getting to this remote destination can be a lengthy process.




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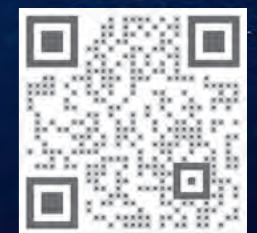
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CLOCKWISE FROM LEFT: Green sea turtle; Tightly packed aggregation of redfin anthias and golden sweeper fish; Bignose unicornfish and a school of redfin anthias swimming over a colony of black sun corals; Spotted eagle rays swimming in formation over hard coral reef

International travelers can stop in Singapore, Bangkok, Dubai or Kuala Lumpur, among others, before boarding a flight to Malé, the capital city of the Maldives.

Upon arrival, most divers walk straight out of the airport and onto a water taxi, which transports them directly to their land-based resort or liveaboard. It is quite possibly the only place I have visited where I did not set foot in a car and yet still traversed more than half of the country.

Diverse species

Whether it is swimming with whale sharks, playing with manta rays, interacting with sharks and huge schools of fish or exploring the incredible coral reefs, the Maldives has something for everyone. With one of the most diverse assortments of fish and coral species on the planet, the Maldives



are a bucket-list destination for most scuba divers, and rightly so. The hard corals alone are worth the trip. I have never seen such a wide variety of healthy—and massive—hard coral formations,

which in turn play host to an even greater array of colorful reef fish. There were damsels, fusiliers, chromis, butterflyfish, snappers, jacks, and endemic clownfish to name just a few. Did I forget



Maldives

Large number of plate corals (*Acropora sp.*) surround a coral bommie in shallow water

into a late morning dive amidst a light rain and small rollers. A short 45 minutes later, we surfaced in a near blinding down-pour with 3- to 5-foot waves crashing over our heads. The wind had switched direction and a storm blew in while we were underwater, causing the waves to crest in the channel. The experience reinforced the significance of staying with your buddy, having and—more importantly—knowing how to use your safety sausage, as well as coming to the surface with air in your tank. An equally fundamental lesson was hav-

ing and—again—knowing how to use a snorkel, staying calm and properly utilizing the Nautilus lifeline

to mention the turtles? I had lost count, there were so many turtles!

We had numerous encounters with huge Napoleon wrasse and swam alongside squadrons of eagle rays as they swayed in the current. Tucked into gaps in the reef were large schools of golden sweepers and glassfish, while hiding under the monstrous plate corals were colorful sweetlips. Large sea fans, dark green sun corals and colonies of black coral played host to aggregations of vibrant anthias fish. Beautiful honeycomb moray eels were found hiding amongst the coral reefs, along with sea stars, anemones, thorny oysters, shrimps, crabs and the occasional giant clam.

This level of diversity tends to make a photographer giddy, but also forces one to make hard lens

choices before each dive. If you are like me and shoot a housed DSLR, then you are limited to one lens for the entire dive and hope that the majority of subjects you encounter fit your selection.

Here is where having a seasoned divemaster can make or break the trip for a photographer. Happily, our guides had 15 and 18 years of diving experience in the Maldives, and they were able to suggest a suitable lens for nearly every dive site. Mother Nature does not always cooperate, so as with any dive trip, there were a few instances where I really wished I had made a different lens choice.

Safety measures

Speaking of Mother Nature, she provided a sobering reminder of the ocean's sheer power and the

need to be well-equipped and properly trained as a diver entering her waters. We had dropped



Marbled shrimp on reef

Maldives

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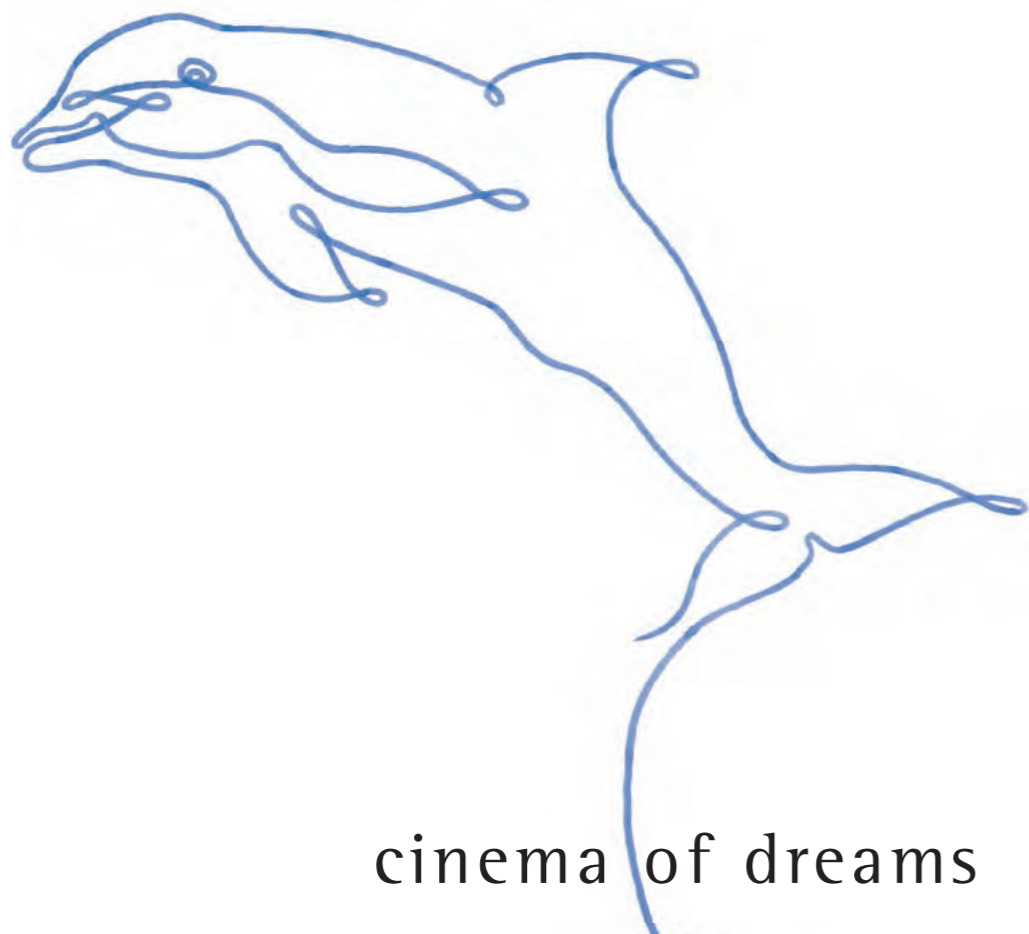


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Maldives



Large marbled ray swimming over the sandy bottom at night

system to locate divers. Happily, all divers were eventually recovered safely and the ordeal provided us a teachable moment to rethink our levels of preparedness.

Alimatha Jetty. One of my more exhilarating experiences on this trip was the night dive at Alimatha Jetty. Dropping into a swift current, we used reef hooks to anchor

ourselves to the patches of coral in the shallow lagoon and were soon surrounded by dozens of tawny nurse sharks and several large marble rays. The rays were foraging for food on the bottom, while blackjacks circled in a cooperative feeding behavior, waiting for the rays to scare up food out of the sand.

The nurse sharks alternated between cruising amongst us on the sandy bottom and schooling over our heads. We even had a few seemingly follow us back at the end of the dive to hang out at the surface in the lights behind the boat.

Most liveaboards touring the central atolls visit this dive site and there can be a lot of divers underwater at the same time. If possible, I would highly recommend beginning this dive a little before nightfall, thus avoiding much of the crowds.



Tawny nurse shark swimming near the water's surface behind the boat at night





CLOCKWISE FROM LOWER LEFT: Glassfish swimming above a red, white, black and orange thorny oyster; School of yellowback anthias swimming over staghorn corals; School of white-collar butterflyfish; School of bannerfish over hard coral reef

Southern Atolls

The Southern Atolls are only accessible a few months out of the year when the wind and wave

conditions allow for safe passage and the currents allow for safe diving. Typically, this is from January to March, though the past few years have seen favorable circumstances pushed farther back on the calendar due to changing weather patterns.

The word "atoll" is derived from the Maldivian word *atholhu*; and it comprises a ring-shaped bar-

rier reef, remnants from the sides of an extinct volcano. The reef protects a central lagoon, which is situated over the sunken caldera of the volcano. Atolls rely on coral growth, at a rate faster than the eroding volcano, to maintain their existence and are only found in tropical and sub-tropical oceans.

Only a few liveaboards visit the Southern Atolls, and Luxury Yachts Maldives was one of the first to make the journey in 1991. Back in the early days, airport access to the Southern Atolls was limited at best, so guests flew in and out of the capital city of Malé and then

took a 15-20 day round trip tour on the boat. Now, it is possible to get local flights straight to several of the Southern Atolls, making the logistics easier and the trips more varied.

Guests have the option to take one of the transit trips, visiting several of the atolls along the way or to fly into Huvadhoo (the second largest atoll in the world, by surface area), and spend their trip exploring the varied diving there. The transit trips are defined by high-energy dives in channels called a *kandu*, connecting the

lagoons to the open ocean.

These dives are typically done with an incoming tide so that the divers can ride the current into the lagoon after hooking in at the mouth of the channel to watch pelagics swimming in the blue. A reef hook is a must, as is an advanced dive certification,

given that the depths of most of these channels are 80 to 90ft (24 to 27m).

The Maldivians have names for their various reef structures, which are subsequently incorporated in the names of dive sites and this helps divers to visualize the underwater landscape even before





The romantic beauty of the islands draw many for weddings and honeymoons (right); MY *Duke of York* liveaboard dive boat and *dhoni* (below); Beach covered with plastic marine debris (lower right)

hitting the water. A deep-water pass or channel was defined previously as a *kandu*, and a *faru* is a circular reef within a channel that extends to the surface. An oblong or circular reef within an atoll whose top maxes out between 20-40ft (6-12m) below the surface is called a *thila*. A *giri* is similar to a *thila* but is a smaller reef that reaches to within 5-10ft (1-3m) of the surface.

Liveaboards in the Maldives operate differently than most other places around the globe. A separate boat called a *dhoni* is used as a diving platform to transport divers from the main yacht to the dive sites. These large, stable boats allow divers an easy giant-



without another living soul in sight. A scene seemingly plucked from the pages of a romance novel or the daydreams of a young girl's future honeymoon. It is no wonder so many couples choose to get married and/or honeymoon here. The beauty,

stride entry, have large rinse tanks for camera gear, provide ample shade and even have their own head.

All dive gear, tanks and weights are stowed on the *dhoni*, which is fully self-contained with air and nitrox compressors to fill tanks between dives. The full benefit of the *dhoni* is realized in the peace and quiet on the liveaboard from the lack of compressor noise.

Romantic beauty

The Maldives feature hundreds of deserted islands, looking like something straight off a postcard. One glance and it is easy to imagine walking hand-in-hand down a white sand beach with a loved one,

isolation and serenity of these islands are incredible.

Traveling by liveaboard, we passed untold numbers of these picturesque exotic islands and secluded sandbars. Occasionally stopping for a stroll on the beach, a relaxing snorkel in between dives or a lavish BBQ at the end of the day. The waters around these island oases are crystal clear and a magnificent shade of blue. As you come ashore, it is easy to imagine that you are the first humans to visit this tiny portion of our blue planet.

Sadly, even if you truly were the first person to set foot on that island, evidence of human existence would have



long preceded you ashore, in the form of marine debris and plastic trash. Most of the beaches I visited were littered with plastic water bottles, utensils, styrofoam

A remote, deserted island in the Indian Ocean, Mattidhoo Island, Huvadhu Atoll, Maldives



Gray reef sharks swimming in blue water amongst redtooth triggerfish (above and top right); A terminal phase, humpheaded wrasse swimming in blue water (right); Green sea turtle (left)

food containers and flip-flops. It was a somber reminder that our everyday decisions have a global effect on the planet.

Adventure

Diving in the Maldives is synonymous with currents and the varied reef structures provide for a multitude of dive profile options. For the adventurous type, diving at the kandu can provide an action-packed thrill ride and a fantastic show.

If done correctly, the divemaster

will position your water entry so that you drift with the current down to the mouth of the channel, where you will hook in, flying like a kite, as several varieties of reef sharks, large schools of fish, rays, Napoleon wrasse and even the occasional whale shark appear out in the blue. Negative buoyancy entries and the drag of a large camera housing can make this type of diving even more of an adventure. While navigating the Southern Atolls, you will experience one or two of these dives daily as part of your

three-dives-daily routine.

After unhooking from the mouth of the kandu, the current will sweep you into the channel where you will pass walls of coral formations along the edges and isolated reefs growing out of the sandy bottom. Here, you will pass smaller reef fish, eagle rays and lots of turtles.

Occasionally, it will be possible to swim into an eddy in the current, hide behind a large coral head or even rehook into the reef for a closer

view, but often, the current will be too strong and you will simply have to enjoy the ride as you watch the reef rush past. Farther into the channel as the current subsides, there will be more time to inspect the reef and its multitude of inhabitants, so long as you have sufficient air left in your tank.

Diving within the atoll and the protection of the outer reef usually provides for weaker currents and



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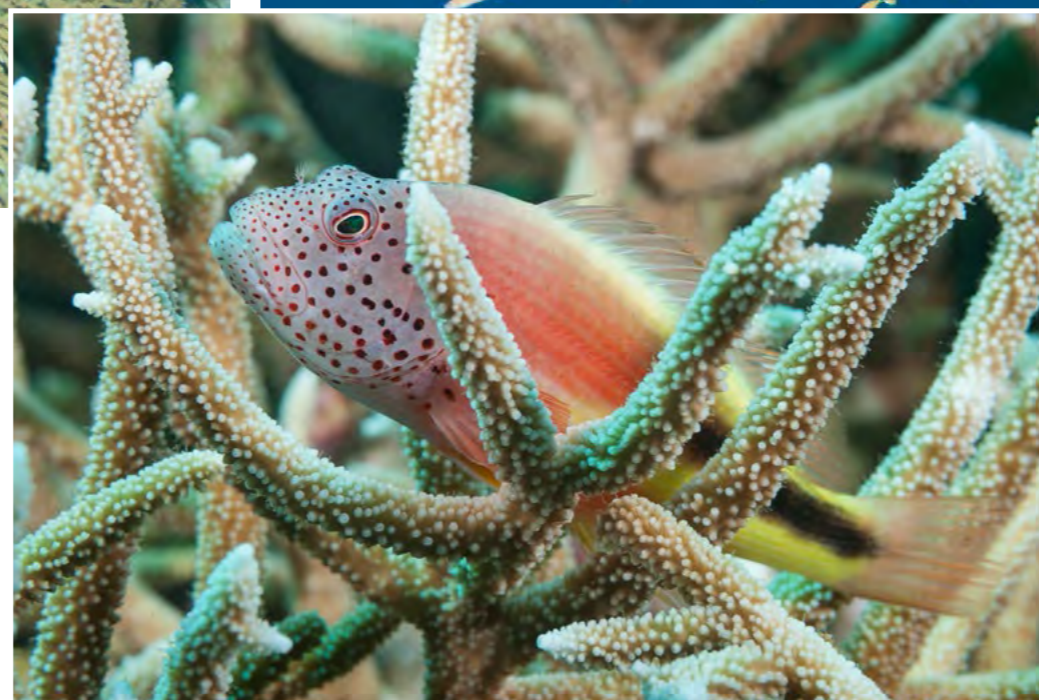


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Sun rays over stony and plate corals (above); Diver with an large, gorgonian sea fan and anthias (far right); Detail of yellow bubble coral (top inset)

easier dives. Astonishing coral formations comprising massive species of plate corals, staghorn corals and enormous coral domes create the backdrop, as you leisurely drift along, inspecting the incredible diversity living in and around these reefs.

Final thoughts

When you visit the Maldives,

bring along your sense of awe and wonder, be prepared for a little romance (whether real or otherwise), and don't forget your adventurous spirit. The beauty of this country, both above and below the water, will impress even the most seasoned traveler, but you may have to work a little harder to appreciate all she has to offer. ■

Freckled hawkfish on staghorn corals

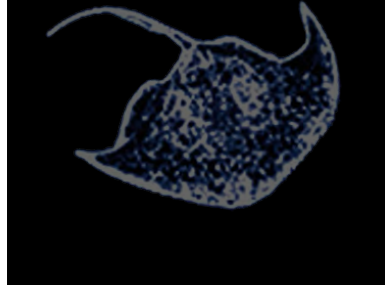
The author would like to thank Luxury Yacht Maldives (Luxuryyachtmaldives.com) for their incredible hospitality as a gracious host on this adventure. He would also like to thank Scubapro (Scubapro.com) and Blue Abyss Photo (Blueabyssphoto.com) for their

assistance with underwater photo and dive gear.

Matthew Meier is a professional underwater photographer and travel writer based in San Diego, California. To see more of his work and to order photo prints, please visit: Matthewmeierphoto.com.



fact file



The Maldives



SOURCES: US CIA WORLD FACTBOOK, XE.COM, VISITMALDIVES.COM

History The Maldives are believed to have been first inhabited over 2,500 years ago by settlers from India and Sri Lanka, though the ancient recorded history is incomplete and little archaeological evidence remains. The country is located along the main maritime trade routes and the strategic positioning is believed to have played a role in early colonization. For most of its history, the Maldives existed as an independent entity. There were brief periods of foreign control by the Dutch and the Portuguese, and in 1887, the Maldives became a British Protectorate. It remained under British control until it gained its independence in 1965. The first resort was opened in 1972, and today, the tourism industry is considered one of the best in the world. The Maldives is also

a world leader in promoting the protection of small countries and conserving the environment. Government: republic. Capital: Malé.

Geography The smallest of the Asian countries, the Maldives is located in the Indian Ocean south-southwest of Sri Lanka and India. The country consists of an archipelago of 1,190 coral islands clustered into 26 atolls, which are spread out over 90,000 square kilometers. Roughly 200 of islands are inhabited, with nearly 100 of them hosting tourist resorts. The highest point on the islands is only 2.4 m and thus the country is at risk of being swallowed up by rising sea levels due to global warming. Coastline: 644km.

Climate The climate in the Maldives is tropical and is greatly influenced by the Iruvai ("dry" northeast monsoon that typically blows mid-November to April) and the hulhangu ("wet" southwest monsoon in May to October). Air temperatures are fairly constant between 29-

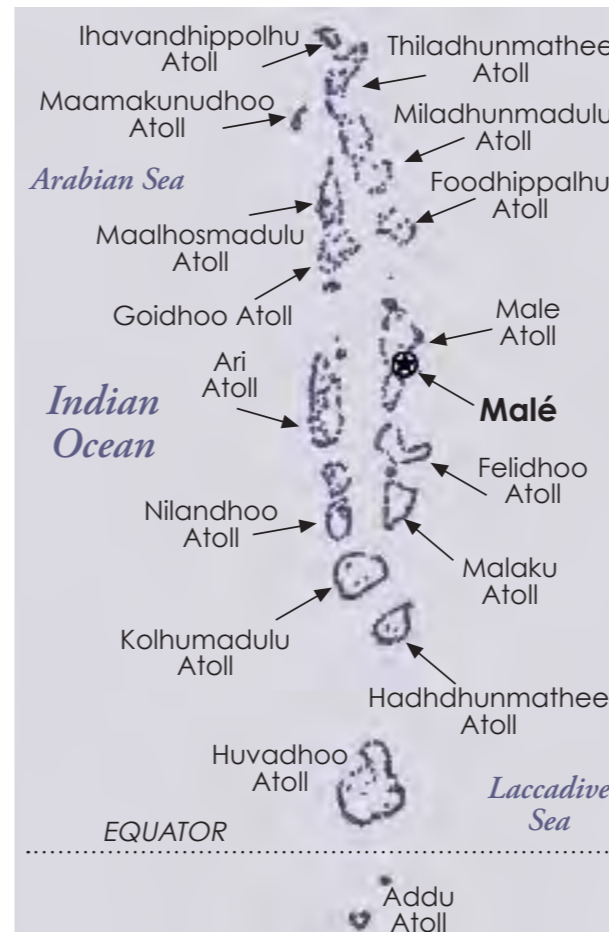
32°C (84-90°F) year-round and water temperatures fluctuate between 27-29°C (80-84°F). Steady sea breezes help offset the high humidity levels.

Economy Tourism accounts for nearly 30% of the Maldives GNP and is the largest economic sector. Fishing, which used to lead their economy, now comes in a distant second. Agriculture and Industry play a minor role but are limited by the lack of cultivable land and a shortage of local labor.

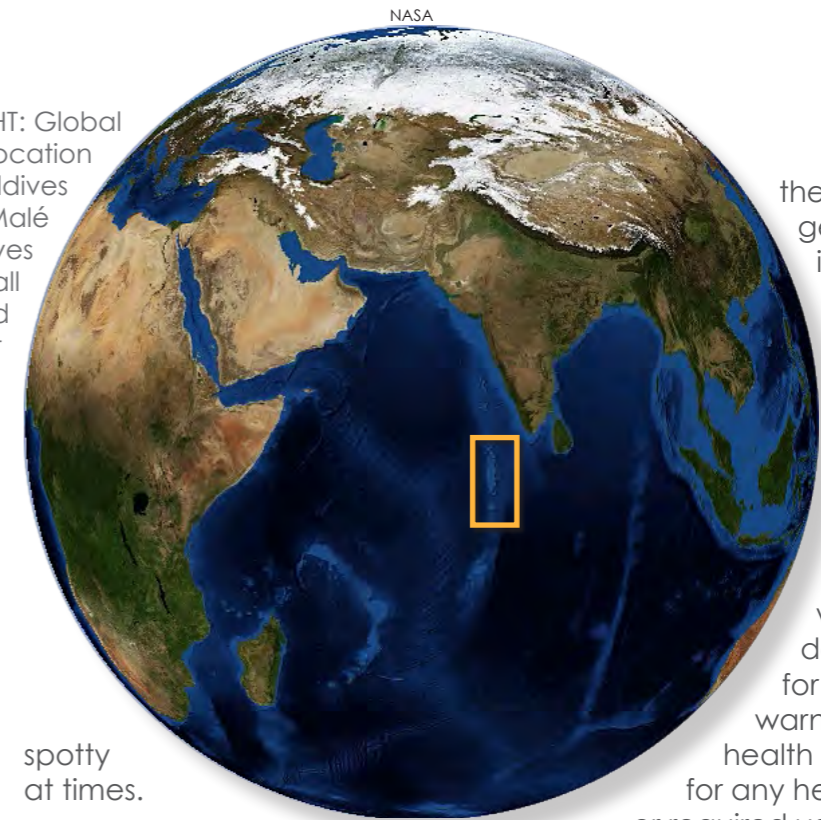
Environment Challenges include sea level rise due to global warming; depletion of freshwater aquifers, which is threatening water supplies; and bleaching of coral reef.

Population 393,595 (July 2014 est.) Primarily comprised of South Indians, Sinhalese and Arabs. The official religion is Sunni Muslim.

Language Dhivehi is the official language in the Maldives. It is a dialect of Sinhala and the script is derived from Arabic. English is spoken in Malé and at most resorts and tourist destinations.



RIGHT: Global map with location of the Maldives
BELOW: Location of Malé on map of the Maldives
LOWER LEFT: Three small gobies resting on a red cushion star



spotty at times.

Voltage

The voltage in the Maldives is 220/240 AC at 50 cycles and they utilize several socket types. An International multi-prong adaptor is recommended.

Cuisine

Traditional Maldivian cuisine is based on three main ingredients; fish, coconut and starches. Fish is found at nearly every meal in one form or another and is even used as a topping for pizza. Starches are comprised of rice, potatoes, taro, cassava and breadfruit. Coconut is eaten fresh or as coconut milk or oil in various dishes.

Tipping

A service charge is added to most everything in the Maldives, so tipping is not required. However, tipping is expected on liveaboard dive boats and at most tourist resorts. Each establishment will have their own guidelines and recommendations.

Driving

The islands only have 88 km of total roadways, most of which reside in the capital of Malé. Boats and small planes are

the only way to get around the islands and atolls of the Maldives.

Health & Safety

Before you travel to the Maldives, please check with your state department for any travel warnings and your health department for any health advisories or required vaccinations.

Decompression Chambers

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Kandoludhoo Island Resort, Kandoludhoo Divers Rescue tel: + 960 773 485

Kuramathi Resort, Kuramathi Medical center hotline: +960 777 3485

Travel/Visa

The Ibrahim Nasir International Airport is located adjacent to the capital of Malé and is the only International airport in the Maldives. Flights from a variety of airlines connect directly to Malé via Singapore, Bangkok, Dubai, Kuala Lumpur, among others. A passport is required for entry and a free 30-day visa is granted on arrival. Customs checks are extremely strict and the import of alcohol, meat and pork products, drugs, pornographic material and underwater fishing spear guns is prohibited.

Websites

Maldives Tourism
www.visitmaldives.com/en



The Philippines
**Southern
Cebu**

Text and photos
by Andrey Bizyukin





Diver with golden sergeants on soft coral at reef wall off southern Cebu (left); Picturesque view from the resort (above). PREVIOUS PAGE: Ornate ghost pipefish



Diver in swim-through on reef off southern Cebu

Cebu Island is one of over seven thousand islands located in the Philippines. It may be best known as the place where the early 16th century Portuguese explorer Ferdinand Magellan met his unfortunate end. There is a 20-meter tall monument at Punta Engaño on Cebu erected in honor of the native chieftain, Lapu Lapu, who in the 1521 Battle of Mactan, proved victorious over Spanish forces led by Magellan. Among divers, though, Cebu is more commonly known for its wide variety of dive sites.

Our party of divers departing from Moscow got discount tickets and authorization for additional luggage for dive

gear, plus an extra 10kg per person, after just showing our driver's licenses to Cathay Pacific Airlines. It is a very pleasant airline with which to travel, especially when one flies to the other end of the world—to the Philippines—where our party planned to dive at the southern end of Cebu Island. Nine hours took us to Hong Kong, and it was two-and-a-half hours before we landed in Cebu International Airport. It was a peaceful flight in a large and comfortable Boeing airplane.

From the airport in Cebu, we traveled to the very southern tip of the island, to a dive center and resort called Easy Diving. It took four-and-a-half hours racing through the narrow roads of the island to get there. Every minute was a hair-raising thrill-ride in a self-assembled microcar, quite an original and unique mode of public transportation. We finally arrived at a paradise awaiting us on a rocky shore leading to a turquoise-colored sea.



Locals use a covered motorcycle with sidecar



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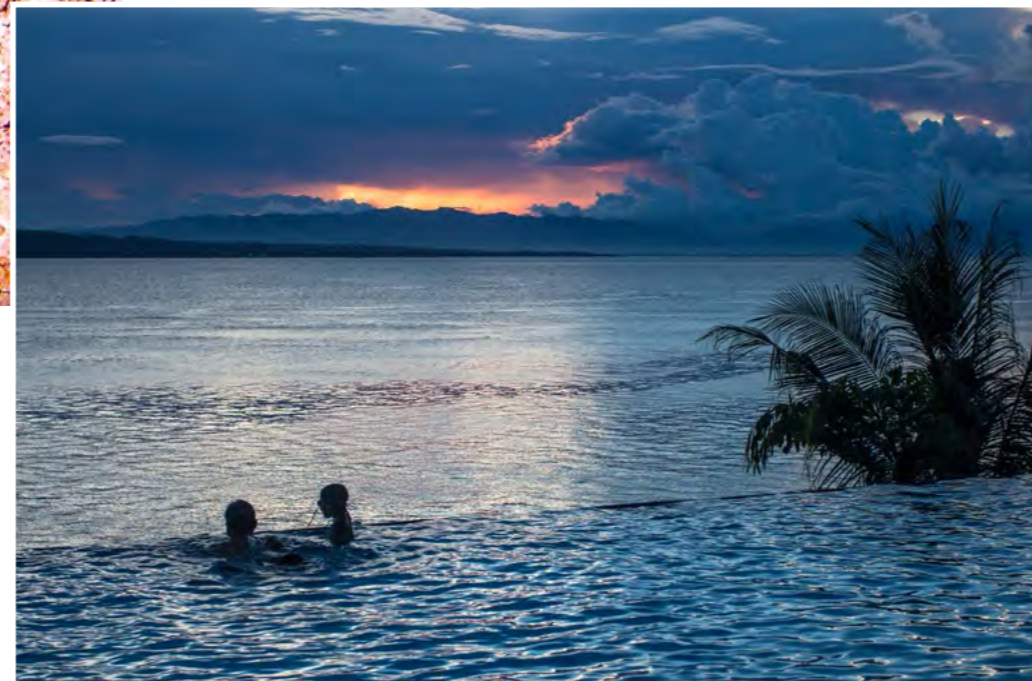
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A timeran called a "banka" serves as a stable dive boat (above); Romantic sunset swim in the pool at the resort (left); There are caves to explore in the reefs off Cebu (top left)

elers have come to expect.

The cuisine at the resort varied in selection, with meals to impress even the most discerning gourmet palettes. There was a huge selection of drinks at the bar, which was staffed with helpful, ever-courteous, smiling staff, ready to fulfill customers' wishes.

In addition, it was exactly here where the resort sits in a strait between the islands of Cebu and Negros, where the sea was most calm and quiet, having the lowest chance of hurricanes. There was a charming house reef and quick access to seven well-known dive sites, allowing divers to dive here all year round. Virchaux had a sufficient amount of rental equipment, so if one has a strong desire to avoid extra luggage fees on airlines, one could easily rent dive equipment at the resort. That is Easy Diving—a small, cozy resort, with a solid four-star rating, serving a maximum of 20 divers.

Raphael Virchaux, the owner of the dive center, came to meet us in person. He is a PADI Course Director, technical diver, and a big fan of diving in Cebu—a man with a passion for the Philippines. Virchaux was born in Antibes in southern France, where the World Festival of Underwater Images was initially established (continuing now in Marseille). Apparently, the Cap d'Antibes on the peninsula of Antibes has a magical place in the history of diving and is a center for international diving culture.

Originally from Switzerland, Virchaux decided to trade the snowy peaks and mountain lakes of his homeland for the wonderful climate, warm seas, magical sunrises and sunsets of the Philippine Sea, so similar to the French Riviera. After finishing medical school, he decided to become a

diver. Twelve years ago, he came to the Philippines, and built the dive resort, Easy Diving. The site of the resort was not chosen by chance. It sits on a picturesque rocky terrace above the sea, with a romantic view of the ocean strait, bordered by the peaceful, soothing, distant misty mountains of a neighboring island. Indeed, in his home garden filled with fruit trees, he has built a pool with Roman-style columns, which fits

well in such an idyllic landscape.

It was so good to relax in the evening after a hot day of diving and swim in the cool outdoor pool, enjoying fresh mango juice and sunset views over the bay, dreaming about the next Philippine adventure. It was a real stroke of diver's luck to find this resort comprised of five comfortable bungalows with two rooms each, marble floors, wide personal balconies and all the amenities Western trav-



Merchant preparing local produce



Cebu

Clown anemonefish in anemone (left); Frogfish (below) and blue ribbon eel (bottom right) at house reef



The house reef

The dive center is just a two-minute walk from the hotel and the seashore. I did not even have to touch my equipment there, because the dive center staff—branded in Easy Diving t-shirts—were so efficient, promptly loading all our dive equipment onto the dive boat. The boat was called a "banka"—a spacious, comfortable trimaran that was very stable on the waves.

The dive boat moored very close to the hotel and we were ready to go diving only ten minutes later. Our dive guides looked very experienced.

There was a typical Philippines briefing before the dive—very relaxed, nearly Russian in style. With no austere regulations, no discussion of possible problems, the dive guide shook his head, and told us not to forget to control the air flow rate on the pressure gauge. That was it. At first, I was a little surprised by the relaxed approach, but later I realized that it came naturally, taking into account the innate characteristics of

the Philippine Sea.

We got in the water and followed the guides. The underwater slope of the island that gently descended into the depths was overgrown with corals. The water temperature was 29°C and visibility was about 10m, which was considered a bit low for this area, but as a site for macro photography, we were satisfied. A local guide pointed out to us a frogfish, blue and yellow dwarf moray eels, sea anemones with "Nemo"-like clownfish, starfish, worms and nudibranchs.

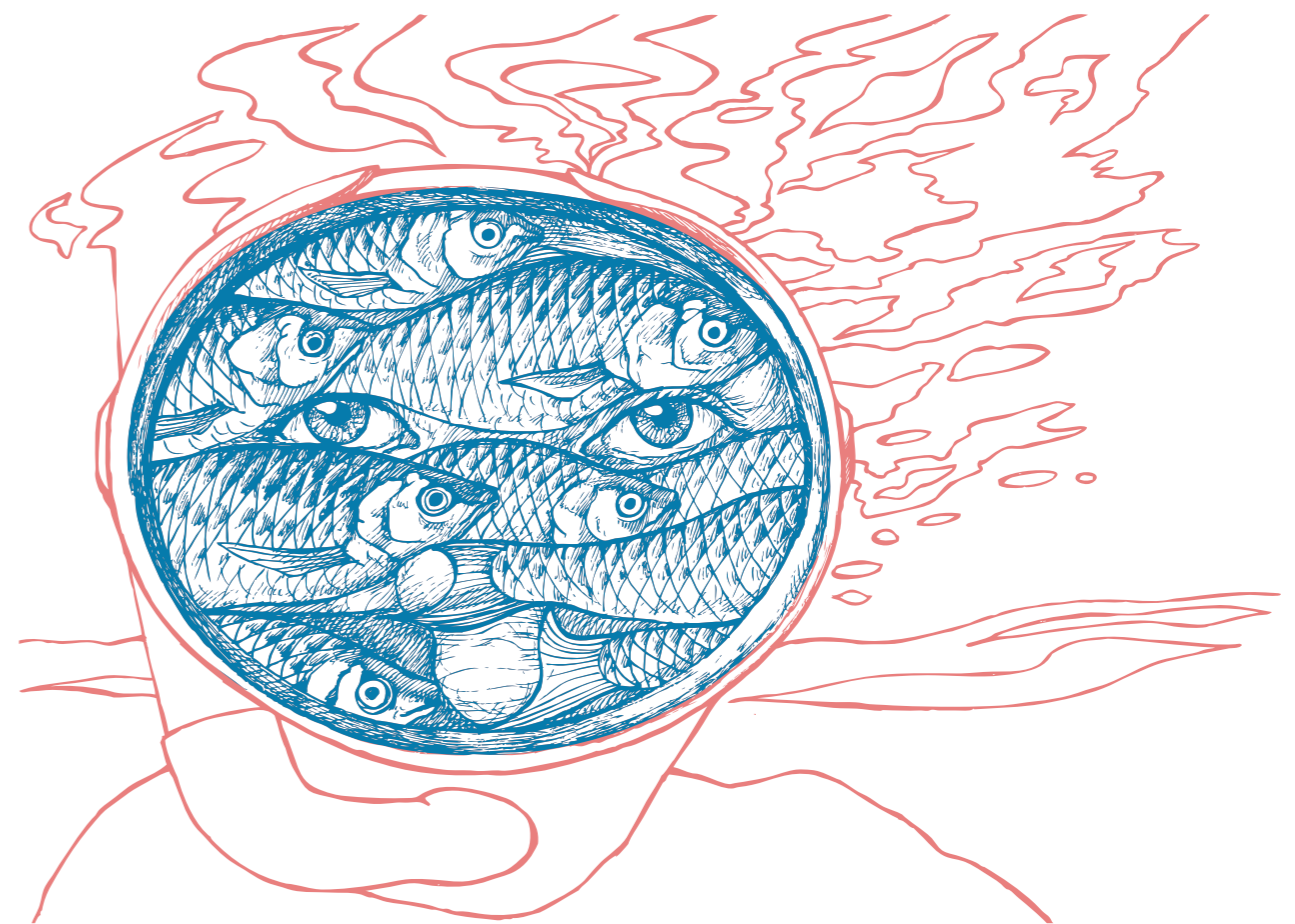
There was no current and the maximum depth of the dive did not exceed 20m, so we were happy to spend time taking photographs of the tiny creatures and the diverse inhabitants of the Philippine Sea. For the underwater photographer, especially macro enthusiasts, the two dives in the house reef at Easy Diving flew by very quickly. There was plenty to see and to photograph.



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Divers with feeding whale sharks at the town of Oslob

Whale sharks at Oslob

A traditional highlight of the south of Cebu Island is diving with whale sharks. Diving with these gentle giants is organized very professionally, but a bit like a circus attraction. Sailing to Oslob town took about an hour-and-a-half on our banca (dive boat). At the location, there was a feeding station for the whale sharks. The site bordered the seashore and was cordoned off by a rope with buoys. Inside this area, in small boats, were floating station employees—the breadwinners of shark diving. They fed shrimp to the whale sharks. This feeding practice has gotten these marine giants so well house-trained that they

intently followed the boats and constantly opened up their mouths for the tourists, waiting to feast on the next portion of the goodies.

Our party went ashore to buy tickets and permission to dive with the whale sharks. We listened to instructions given during the ten-minute briefing concerning safety and the specific behaviors of these huge animals. After the meeting, two specially certified local dive guides followed us into the water just inside a fenced area and gave us the opportunity to spend about 30 minutes taking pictures of the giant sharks. Officially, we were not permitted to approach the sharks closer

than four meters. We were also not allowed to use flash, torches or lights that might scare the animals.

On this day, six to eight huge whale sharks were feeding in this little area of the sea surrounded by small floating boats and an audience of about 50 people at the surface wearing masks and snorkels as well as around 20 divers with cameras, vigorously scouring the water, hoping to capture another underwater masterpiece in pixels. The water around us was literally seething with bubbles, fins and sharks flying past, with huge mouthfuls of shrimp. At first, photographic passions ran high—everyone tried as much as possible to



Diver with large barrel sponge (above) and coral overhang (top right); *Ardeaddoris egretta* nudibranch (right inset)

get close to a shark, without breaking the rules of diving. After 45 minutes, I took my finger off the shutter of my camera and realized suddenly that I could watch these whale sharks scurrying in front of me, behind me, to the side, above and below me. It truly was a whale shark underwater circus here, in the south of Cebu.

Sumilon Island

Sumilon Island is located in a protected marine area a few miles from the dive

resort. Here, one can find dense coral gardens on a reef plateau at eight to 10m depths, vertical rock walls with large coral fans, lots of fish, large sponges and countless underwater caves and grottos. Divers can do a couple of dives per day, traveling along the rock walls in different parts of the island, depending on the time of day and direction of tidal currents.

We started the dive from a shallow reef slope, with water

temperature at 30°C, then slid down to a rocky drop-off and maneuvered into a depth of 30m, drifting in the weak current and looking for interesting marine life. It seemed that our dive guides were asleep, or lazy, just swimming next to us like rice-gorged, relaxed islanders. Such an approach

Cebu

Who we are?

- Scuba Museum
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- 3D Animation Zone
- UW Photo Gallery
- Best Design Award
- Marine Movie Festival
- Technical Diving Seminar
- Kids Zone



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Commensal shrimp on anemone (left); Diver at swim-through in reef off southern Cebu (lower left)



was clearly not alright with me. I signaled one of them over, requiring his attention and the pointing out of new subjects. He seemed shaken and showed me an interesting coral fan, surrounded by lovely yellow fish. I used it as a model, taking pictures and immediately afterwards, on the viewscreen of the camera, I showed him the image that was captured. He loved it! He seemed to wake up and was transformed instantly! Now he was an underwater hound, rushing in all directions, scanning the slope in search of new subjects.

Such is the power of art! No longer just a staff member going along for the ride, the dive guide became an avid accomplice in the process of capturing compelling underwater images.

There were also caves that were interesting—places where big fish hid—and at times, it seemed that from the caves' deep shadows, the voices of pirate treasure seekers could be heard. So I never deny myself the pleasure of inspecting every interesting underwater cave I find. We photographed the coral, scattering fish, and explored all the caves.

Our dive boat drifted with us, down with the current. When we reached a wall of the reef skirting the island, and swam off to the right, a strong current took us away from the reef. We fought the current, to no avail. The 5m safety stop would have to be taken in the water column, rapidly carrying us away to a wide strait between the islands of Cebu and Sumilon. It's



Surface marker buoy helps dive boat locate divers caught in current.

Oval-spot butterflyfish and blue-green chromis on hard coral head (left)

Cebu



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Diver with scorpionfish on reef (left); Hot volcanic bubbles rise from reef (above) at Apo Island; Hinge-beak shrimp (right); Green sea turtle (top right)

times like these when it's very handy to send up a surface marker buoy during the decompression stop, which allowed the dive boat to find us and come pick us up out of the strong current.

Apo Island

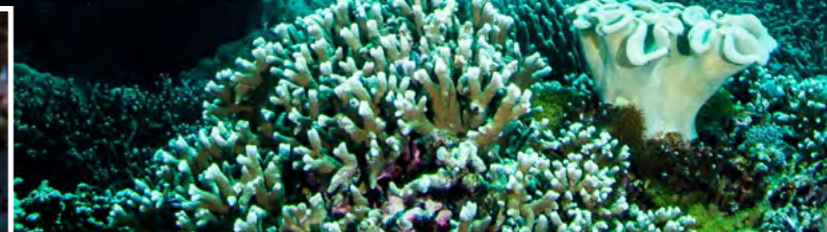
Apo Island is a small island known for its clear waters, brilliant corals and sea turtles. To get there, we had to spend three-and-a-half hours in a continuous race on the sea, along the southern coast of the island of Negros and beyond. We went out on the sea at the rising of the sun in order to have the opportunity and time to do at least three dives. Breakfast and lunch boxes came along with us for the long sea voyage. During the long journey to the dive site, I sat down next to our dive guides and had a confidential, friendly talk "about life." I told them about Russia, and I listened to them talk about the Philippines. For the photographer, it is always important to be

in close contact with and gain the trust of the locals. Only then do they happily disclose the underwater treasures only the locals know about, and they begin to show you the true beauty and value of the nature of the Philippines. And this offers a real chance to make good pictures.

Apo Island is located in a protected area, so we again had to pay for permission to go diving in the area to see the underwater world of the island. The dive started on a shallow coral reef lit by bright Philippine sunshine. There were literally volumes of marine life and healthy corals to delight the eye. Here, one could find vibrant and interesting coral life, fish that did not scare easy, gobies, scorpionfish, striped poisonous sea snakes, huge well-fed nudibranchs, and shrimp. It was here that one of the best locations for diving with and



photographing large sea turtles could be found. We did the first two dives of the day here, observing sea turtles and exploring sea caves. Then we took an excursion to the beach, to get acquainted with the local flavor of the island. There seemed to be more than 200 residents living on the island. The third dive was planned for the western part of the island, at a depth of about 20m on a sandy bottom out to an area with hot volcanic bubbles, which was



Jawfish on sea bottom



CLOCKWISE FROM LEFT: Cuttlefish; Wonder octopus; Pair of robust ghost pipefish; Frogfish; Dragonet

like an underwater whirlpool—evidence of the ancient volcanic origins of Apo Island.

Apo Island is a unique place. I strongly recommend this dive site for divers of different levels of training and, of course, every underwater photographer going to the

Philippines.

A strong headwind stretched out the duration of our trip back to the dive center—to four hours—so it was quite dark by the time we got back to the resort.

Dauin

On the morning of our last day in our far-too-short stay on Cebu, we were invited to go to the legendary dive site of Dauin. It is the place where countless photographs, which grace the covers of leading dive magazines around the world, were taken. Dauin is one of the best dive sites for underwater macro photography, located on the coast of Negros Island.

On first impression, it is quite an unremarkable stretch of sea. The beach town of Dauin is encircled by a rope with buoys. Our dive boat was moored near these buoys. We, of course, had to pay for permission to dive here. We went down into the water, where visibility was 25m and water temperature was 30°C. We settled on the sandy bottom, and then swam along a slope to a depth of 20 to 25m. At first glance, I thought: “What is there to see? Just a sandy bot-



Banded sea krait is a venomous sea snake



Halimeda crab (*Huenia heraldica*) is a decorator crab that attaches live fronds of Halimeda algae to its shell for camouflage (PROJECTNOAH.ORG).

tom?" But when our dive guides drew our attention and began to show with their pointers the tiny, absolutely fantastic miniature creatures seeming to come from another parallel world to our own—thriving, running and jumping on this magical sand—we understood that we had hit the jackpot on the Klondike. And here began a photographic Rock 'n' Roll of creatures such as a green crab, which looks like a leaf with legs; fish with a flag or a horn on the nose; colorful pipefish; shrimp; gobies and more.

Two dives here flew by in one breath, it seemed, and my finger was constantly on the trigger of the camera. The emotion, enthusiasm and nitrogen saturation signal on my dive computer went through the roof. Dauin is interna-

tionally recognized as a macro classic.

However, the time quickly approached when we had to stop diving. It was time to return topside, because tomorrow, we had to catch a plane.

Waterfall of Cebu

While our dive gear was drying, we ordered a taxi to go see the nearby waterfalls and enjoy the local natural (not only underwater) attractions of southern Cebu. In only a quick half-hour drive, we found ourselves at a local fresh-water resort. Adults and children came here to this shady valley to enjoy a refreshing, cool swim and be invigorated by the energy of the falling waters, cascading from a great height. Waterfalls have always attracted people. There is



Yellow shrimp goby

Banded boxer shrimp (above); Porcelain crab and anemonefish on anemone (top left); Durban hinge-beak shrimp (top right)





something about them that embodies spirituality and magic. For us, it was an escape from the Philippine heat and it seemed that one could enjoy watching the water falling from the cliffs endlessly.

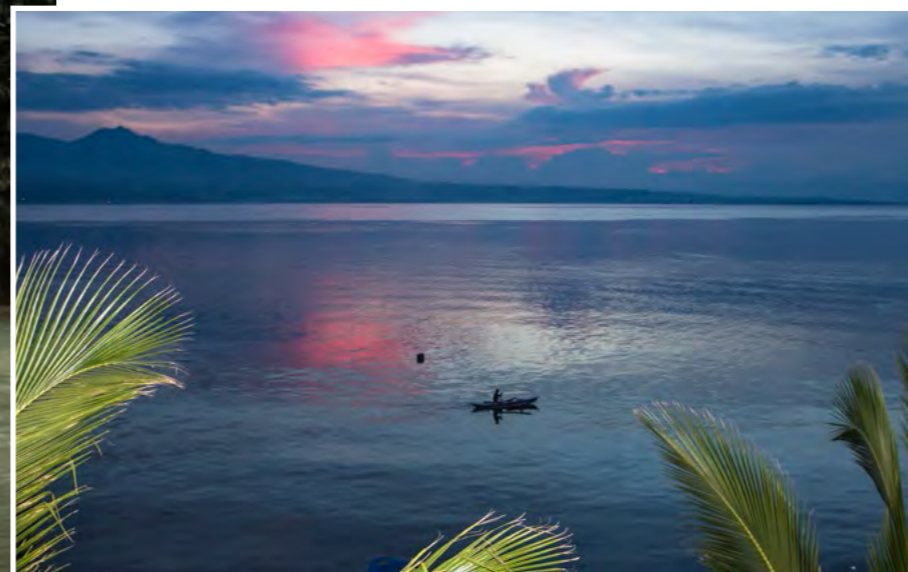
Raphael Virchaux told us that Easy Diving resort initially focused on German and European divers. However, after the international economic crisis struck, Europeans were traveling much less, and the resort's main guests were divers of various nationalities,

including more and more of our Russian compatriots. "How do you like Russian divers?" I asked Virchaux. "I like their enthusiasm for the underwater world, their friendly spirit and traditions of behavior, which are similar to Filipinos," he said. "They love to laugh, like a friendly hug and kiss. They seem like very positive people and are good divers."

Five days of diving in the south of Cebu passed in an instant. I have fond memories from the trip as well

as uniquely bright colorful pictures, celebrating the Philippine sun and turquoise sea. The people are friendly and open, always smiling, and I cherished the opportunity to enjoy and photograph the unique wonders of the underwater world of the Philippines. ■

SOURCES:
[HTTPS://EN.WIKIPEDIA.ORG/WIKI/FERDINAND_MAGELLAN](https://en.wikipedia.org/wiki/Ferdinand_Magellan)
[HTTPS://EN.WIKIPEDIA.ORG/WIKI/LAPU-LAPU_SHRINE](https://en.wikipedia.org/wiki/Lapu-Lapu_Shrine)
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Sunset over the waters of southern Cebu



Bamboo forest on Cebu (above); Rocky landscape of Cebu's southern coast (top right)

Locals and visitors alike enjoy the cooling effect of the waterfalls of Cebu

fact file



The Philippines



SOURCES: US CIA WORLD FACTBOOK,
US DEPT OF STATE, DIVEPHILIPPINES.COM

History During the 16th century, the Philippine Islands became a Spanish colony; In 1898, they were ceded to the United States following the Spanish-American War. The Philippines became a self-governing commonwealth in 1935 under elected President Manuel Quezon who had to prepare the country for independence after a ten-year transition. The islands fell under Japanese occupation in 1942 during WWII. U.S. and Filipino forces fought together to regain control from 1944-45. Philippine independence was declared on 4 July 1946. A widespread rebellion of the people forced President Ferdinand Marcos into exile after 21 years of rule in 1986 when Corazon

Aquino was installed as president. During her presidency, there were several coup attempts, which affected political stability and economic development. In 1992, Fidel Ramos was elected president who enjoyed a presidency marked by greater stability and progress on economic reforms. The United States closed its last military bases on the islands in 1992. President Joseph Estrada, elected in 1998, was impeached on corruption charges and was succeeded by his vice-president, Gloria Macapagal-Arroyo who was elected to a six-year term in May 2004. The country was one of the few relatively unaffected by the 2008 global financial crisis. Benigno Aquino III was elected president in May 2010.

Armed insurgencies and separatists in the south continue to be threats. Government: Republic. Capital: Manila

Geography The country is comprised of an archipelago located in Southeastern Asia, east of Vietnam between the Philippine Sea and the South China Sea. Its terrain is mostly mountainous with narrow to

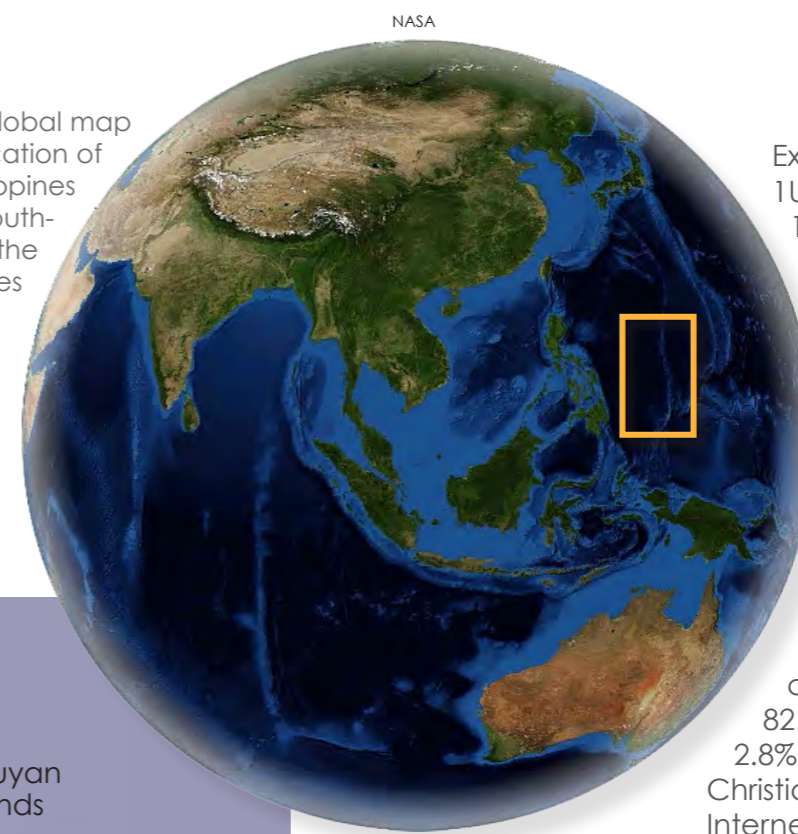
vast coastal lowlands; Coastline: 36,289 km; Elevation: lowest point: Philippine Sea 0m; highest point: Mount Apo 2,954m.

Economy The nation's economy fared better than most after the global economic and financial downturns because of several factors: less exposure to affected international securities, decreased dependence on exports, recovery of domestic consumption, large payments from several million overseas Filipino workers, and a fast growing business outsourcing industry. As a result, the Philippines has gained several upgrades in its sovereign debt credit rating, making financing its deficits with domestic and international markets easier. While current administration have increased social spending and infrastructure programs, long-term challenges still remain in battling poverty, unemployment or underemployment, governance



Green sea turtle on reef off southern Cebu

RIGHT: Global map with location of the Philippines
BELOW: Location of southern Cebu on map of the Philippines



Exchange rates:
1USD=46.80PHP;
1EUR=52.27PHP;
1GBP=71.33PHP;
1AUD=32.93PHP;
1SGD=32.83PHP

Population

107,668,231 (July 2014 est.) Ethnic groups: Tagalog 28.1%, Cebuano 13.1%, Ilocano 9%, Bisaya/Binisaya 7.6%, Hiligaynon Ilonggo 7.5%, Bicol 6%, Waray 3.4% (2000 census) Religions: Catholic 82.9%, Muslim 5%, Evangelical 2.8%, Iglesia ni Kristo 2.3%, other Christian 4.5% (2000 census) Internet users: 8.278 million (2009)

Language Filipino and English

Security Please consult your state department for the latest information. In the past year, there have been reports of activities against foreigners by terrorist or insurgent groups based in the area of Mindanao Island, the Sulu Archipelago and the southern Sulu Sea.

Health Please consult your health department for the latest information. There is a high degree of risk for food or waterborne diseases such as bacterial diarrhea, hepatitis A, and typhoid fever; vectorborne diseases such as dengue fever and malaria; and water contact disease such as leptospirosis (2013)

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reform and improving the judicial system, infrastructure, regulatory predictability, and attracting greater local and foreign investment by increasing ease in doing business in the country.

Climate Tropical marine. The north-east monsoon occurs November to April, the southwest monsoon occurs May to October.

Environmental issues Challenges include soil erosion, uncontrolled deforestation, water and air pollution in major urban areas as well as coral reef degradation and increasing pollution of coastal mangrove swamps.

Currency Philippine peso (PHP).



South Africa's

Sardine Run

— *Wild Nature at Port St. John*

Text and photos by Gregory Lecoer



Sardine Run



Picturesque view over the Umzimvubu River at Port St. Johns (far left); Gannet seabirds (left) and diving for sardines from 30 to 40m high (below); Spotter on dive boat looking for activity that indicates a bait ball is nearby (lower left)

PREVIOUS PAGE: Fur seal and bait ball of sardines during Sardine Run

From a point on the horizon, frantic sounds of gannet birds became louder and their dives from the air seemed to accelerate as they shot straight down, piercing the surface of the sea. Before our party of divers got into the water, I could not imagine the incredible spectacle that would be found under the surface.

The ocean was full of energy. We were escorted by hundreds of dolphins; foam at the surface revealed several fins among the frenzy of birds. All the region's predators seemed to have gotten the same invitation to join the party. A signal from the spotters announced that a bait ball of sardines had been sighted. At full throttle, our dive boat headed towards

the vortex of seabirds in the air, the adrenaline rush grabbing all of us aboard the zodiac. The hunt was on!

Mass migration

During the winter months in South Africa, a natural phenomenon known as the Sardine Run takes place every year between the months of May and July. It is just as exciting and spectacular as the wildebeest migrations in the Masai Mara and the Serengeti plains. Millions of sardines off the coast of South Africa follow and benefit from the nutrients in the cold water currents moving up the African coast, taking the fish from their natural habitat in Cape Agulhas to the southern part of KwaZulu Natal, along the Wild Coast of the country.

The mass formed by the migration of millions



of sardines can stretch over several kilometers and be observed from space. It is an event that draws many predators.

Thanks to its underwater topography, Port St. Johns is a mecca for migrating sardines.





Bottlenose dolphins seen at the surface and common dolphins feeding on sardines (right)

As the continental shelf is narrow here, deep waters are close to the shore, so the schools of migrating sardines become concentrated as they near the coast.

Opportunists

Whether friends or enemies, all predators here combine to form a single army, together hunting the small sardines, leading to the greatest "show" on earth. But this show depends on many ingredients. Evolving along the rocky sandstone coast, cold water currents and thermoclines, with water temperatures between 14° and 20°C are imperative to ensure the presence of the sardines.

The hunt begins with common dolphins that have developed special hunting techniques using their sonar skills and bubble streams to locate and isolate a ball of sardines in the outgoing tide.

The ball of sardines, called a "bait

ball", are preyed upon by seabirds like albatrosses, terns, cormorants, but the crazy gannet is the king of group. With remarkable eyesight, the gannets follow the dolphins before diving in a free-fall from 30 to 40 meters high, piercing the surface of the water head first at a speed of 80km/h, immersing themselves as deep as 15 meters to get their fill of sardines before reaching the surface.

Other opportunistic predators attracted by the agitation can appear, including hundreds of sharks, tunas, sailfishes, sea lions and sometimes Bryde's whales—all are drawn to the feast. Orcas also can show up in an attempt to snatch a dolphin.

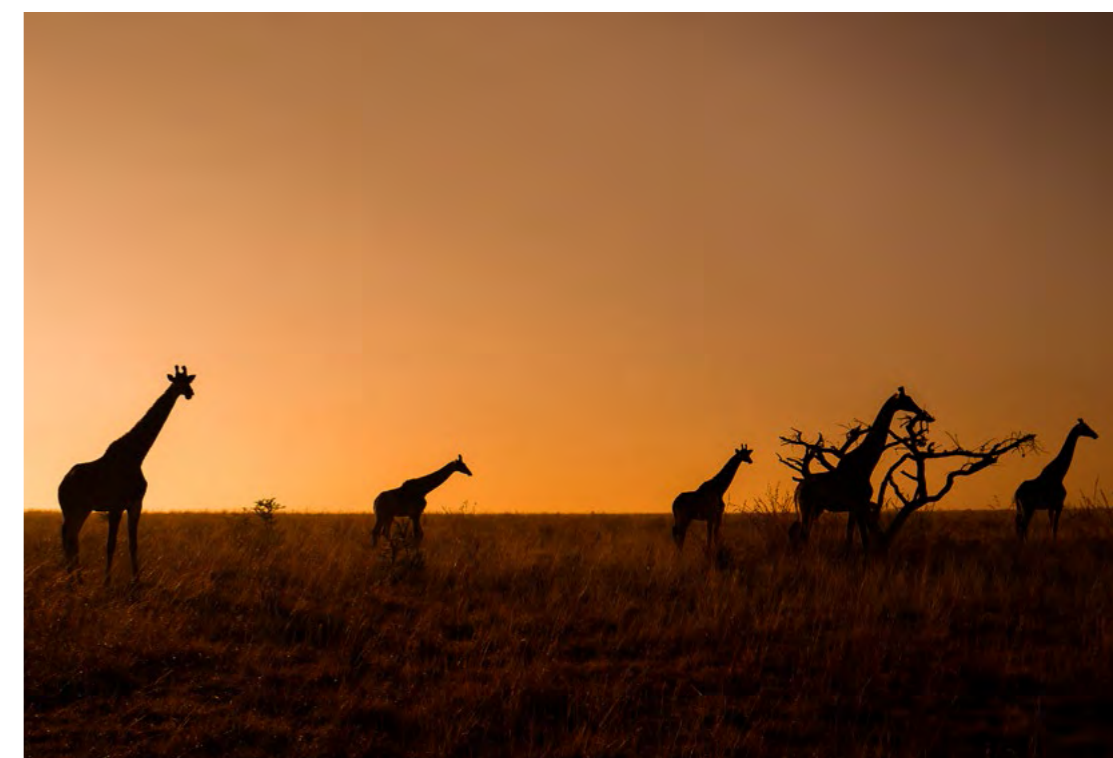
Challenging nature

The Sardine Run was made world-renown by the BBC's television documentary series, "Oceans." Now divers from around the world come to South African waters wanting to experience the same fabulous event seen on the



Large pod of bottlenose dolphins tracking bait ball of sardines during Sardin Run





CLOCKWISE FROM LEFT: Encounter with locals on a country road; Picturesque view of the Wild Coast; Elephant herd at a watering hole and giraffes on a grass plain in the early morning at Nambiti Reserve; Vervet monkey

years, divers can have a 90-minute ringside seat to the magic show; in other years, sardines are hardly found, if at all. Remember, it took several

years for the BBC production to acquire just a few minutes of incredible footage, showing the event. That said, this region of the world still attracts exceptional biomass, and the possibility of capturing the spectacular scenery and wildlife of the Wild Coast pushes underwater photographers to try their luck.

In addition to the sardine migration along the wild coast, there is also, during this time of year, the migration of humpback whales, heading to the warm waters of the Indian Ocean to give birth. Keep in mind that it is a lottery—divers who come here will always hope that chance is on their side and try to win the jackpot!

Getting there

After arriving on the tarmac at Durban's international airport, it took six hours to drive to the village of Port St. Johns, located in the estuary of the Umzimvubu River. The Wild Coast is one of the most spectacular tourist destinations in the world, with its pristine beaches, beautiful waterfalls, lush

forested landscapes and cultural diversity. Due to its remoteness and prior inaccessibility, this area has long been unknown to the outside world.

Port St. Johns is located on the wild coast, a coastline of about 270 km long, with some of the most beautiful scenery in the country. It lies at the mouth of the Umzimvubu River, a river that flows through an impressive gorge known as the "Gates of St. John" in an estuary situated on the Indian Ocean. Offshore Africa is the only operator in residence

that has all the logistics, expertise and experience to successfully conduct dives for the Sardine Run.

From the river, our party of

divers embarked on a zodiac with skipper Rob Nettleton and dive guide Debbie Smith. Nettleton is passionate about diving in South Africa, having crisscrossed and

film. But very few of them come back from this dive destination with full memory cards and still-dreamy eyes. Because the Sardine Run depends on so many factors that, if not all present, frustration can become a big part of the adventure.

Each year is very different from the next on the Wild Coast. Some



THIS PAGE: Bottlenose and common dolphins hunt and gannets dive for sardines

dived the South African waters from an early age. Besides being an excellent skipper, he knows the area and is unbeatable in his knowledge of the local flora and fauna. An undeniable asset to any dive group, Nettleton can read and anticipate the behavior of predators and put divers in the best spots to observe the wildlife and the action.

We traveled down the river to get to the surf crashing on the beach. The first challenge was to cross the breaking waves. Only a few South African skippers are able to read these waves to spot an aperture and get out to open sea.

We had our feet secured in the straps of the zodiac, and we clung to the handrail of the boat. The departure is on! We crossed the violent waves before making a final push to get out of the surf zone.

Wildlife

Barely recovered from our emotions after the crossing, we focused on the marine

life. After a few minutes of searching, we saw hundreds, even thousands of common dolphins spread over the water.

The blue sky was filled with gannet birds flying over the area and occasionally diving here and there to steal some fish. Excitement took over the boat, but Nettleton remained unmoved and said that we needed to concentrate our energies on finding more consistent action of wildlife—not ephemeral action, which he called “popcorn”.

After only a few minutes spent on the waters of Port St. Johns, we were in the presence of thousands of dolphins and birds. With steep cliffs and steep rocks, seen from the sea, the landscape offered a sumptuous surrounding.

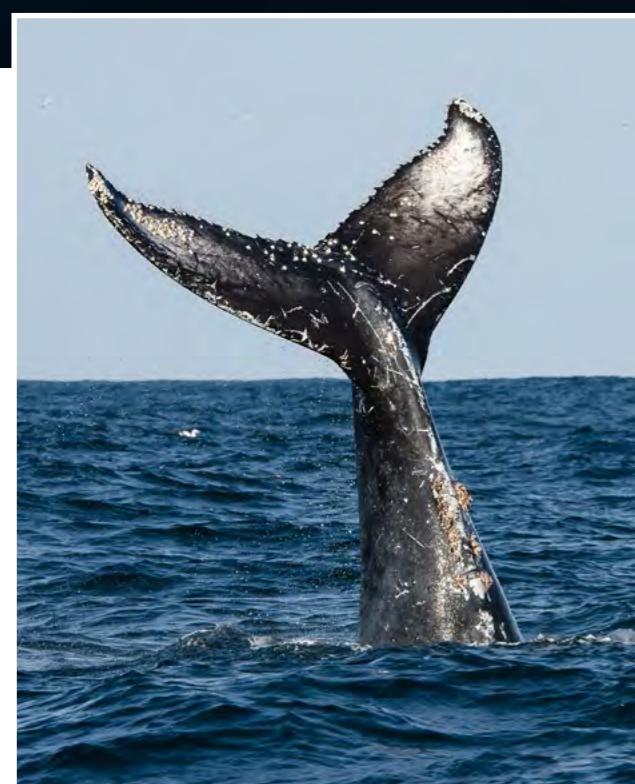
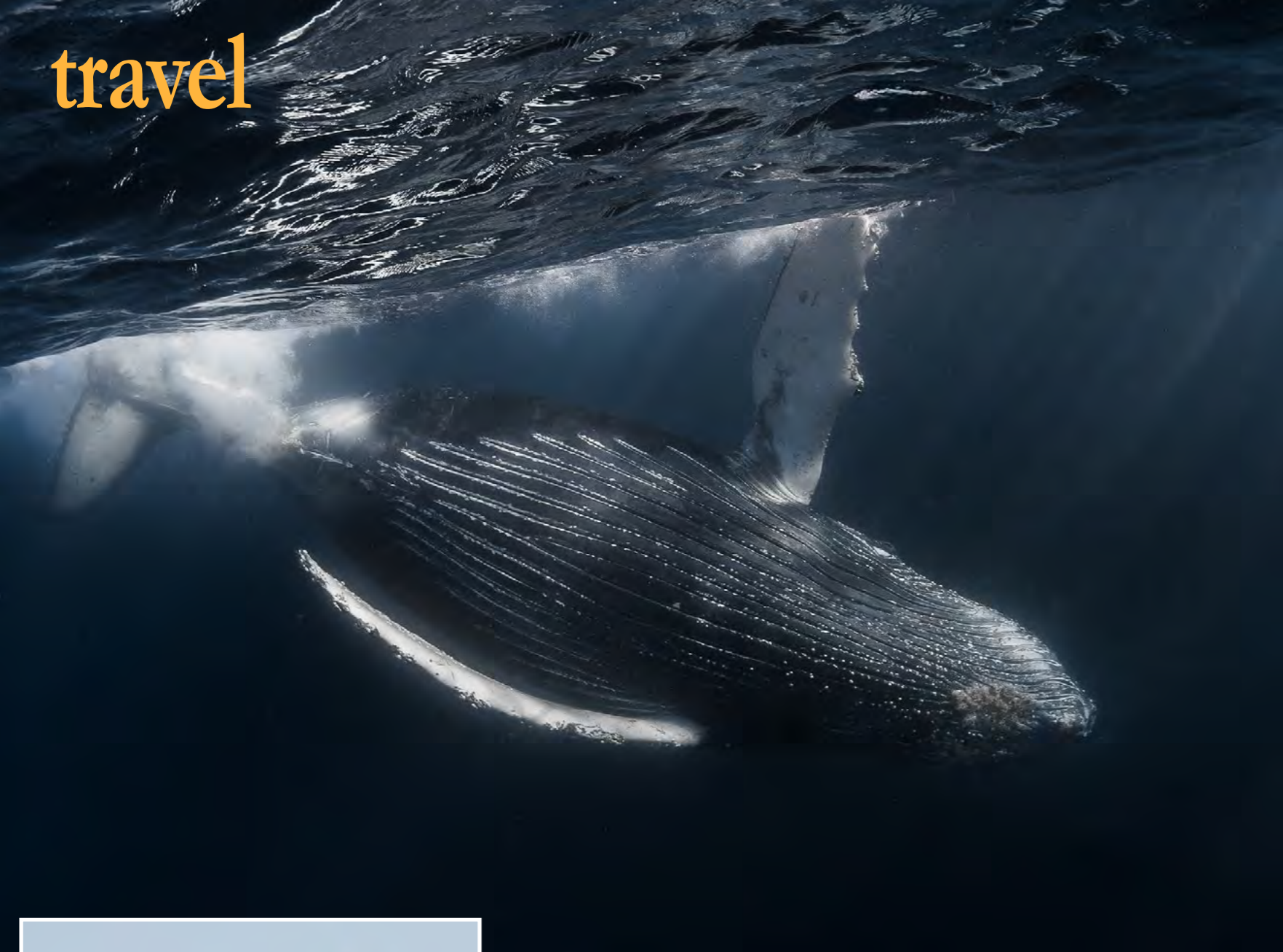
We followed the direction of the birds and dolphins with the help of a small plane, which spotted the most suitable areas of



action. We went to an area where few birds fell from the sky, but it was still brief action or what Nettleton called “popcorn”.

The first challenge of the dive boat is to get across the violent surf





It looked like all the ingredients were here: the water was cold, the sardines were there, with predators on the look out. As we watched, the predators worked together and created a consistent bait ball. While waiting, we all pictured in our heads, the perfect bait ball, harassed by predators. With all this life around us, our imaginations ran wild.

Surprises

After a while, doubt started creeping in, when suddenly, a huge spout of water followed by a giant tail was spotted. It was a humpback whale! The whale was not here for sardines, though; she was on her way to warmer waters where she would

give birth to a calf and wean her offspring. She disappeared after surprising us with a hefty breach, lifting her 40-ton body out of the water!

The show was surreal, but Nettleton spotted some new activity of gannet birds. We left the whale and set a course offshore. The closer we got to the action, the more the bird activity seemed to increase. We saw a lot of dolphins were in the area, too.

It was literally raining hundreds of birds, and dolphins were breaking the surface of the water. With the engine turned off, and we drifted in the direction of the seething broth in the ocean created by the hunt.

We were waiting for the signal to

THIS PAGE: Encounter with a breaching humpback whale migrating to warmer waters in the Indian Ocean



Sardine Run



do our back-flip into the water when Nettleton asked us to take off our scuba gear. The water was green, full of nutrients, with visibility less than five meters—it was too dangerous to jump into the water with so many predators.

So while frustration filled us on the boat, the show on the surface was just fantastic to watch. We consoled ourselves by observing the aerial show and cementing in memory the hunting scene from the boat.

Back on land, we mulled over our luck. Navigating the sea, with all its marine life, is simply unique. Diving amidst sardines

is the cherry on the cake, as there are many beautiful things to discover on the Wild Coast.

Another chance

Our following days at sea were met with lowered expectations. The perfect sardine ball in blue water, like the one in the BBC documentary, does not happen every day. Nettleton proposed that we took advantage of every possible opportunity to find the wildlife action.

A storm was announced, which was a good sign, as the winds and currents tend to clarify the water, and predators,

fond of turbulent waters, tend to come to the table. Back at sea, we observed that the area of action had moved and all of the marine life was in the south. Visibility was also improved in places, while some areas remained milky.

Although there was a high concentration of birds and dolphins, the sardines moved quickly and “popcorn” activity was present everywhere. The visibility was good, so Nettleton suggested we try to intercept the path of the Sardine Run. After watching the carousel of birds, Nettleton read and anticipated the trajectory. Equipped with minimal gear—

THIS PAGE: Gannet birds and common dolphins feeding on sardines; Bottlenose dolphin (above)



Common dolphin under sardine bait ball



THIS PAGE: Dramatic view underwater of the hunt, with diving gannets and swooping dolphins

... fins, masks and snorkels—we jumped into the water.

Dolphins were the first things we observed, followed by several explosions announcing the arrival of diving birds. Curious and opportunistic dusky sharks and oceanic blacktip sharks passed right underneath our dive group.

We remained in this spot near the surface for a moment when our dive guide Debby brought our attention to a small bait ball forming around us. Dolphins also spotted the bait ball and patrolled around us.

The predators launched their assault, and dolphins rushed in to the sardines right before our eyes. Like lightning, crazy gan-

net birds pierced the surface, ending up about ten meters deep, and then began a disorderly swim to catch several fishes in the same dive. The assault was stealthy, and the little bait ball burst apart, only to reunite under our fins.

We took the opportunity to quickly put on our scuba gear so we could dive with the sardines. The dolphins and the gannets were exciting to watch. The dolphins' attacks were accompanied by rattling and the gannets' attacks were announced by the impacts of the birds perforating the surface. Sharks prowled just below and made occasional intrusions into the bait ball.





An added bonus

Back on board, everyone was ecstatic and all our eyes sparkled when Nettleton asked us to prepare for another dive, as another vortex of birds had recently arisen near our boat. The magnitude and impact of sea birds at the same place suggested that the sardine bait ball had reassembled. With our air tanks empty, we just jumped in the water with snorkels.

In a frenzied state, birds were diving from all sides. Common dolphins, large dolphins, tunas, sharks and one fur seal were decimating a new bait ball. We

invited ourselves to the show, keeping our distance, as the attacks were dazzling and unpredictable, and visibility was rather average. After several minutes of chaos, sardines and their predators were gone. It was time to leave the water and return to the mainland.

For several days, we spent eight hours at sea looking for anything that was hunting. Like many opportunistic predators in this region, we took every opportunity to throw ourselves in the water. In between dives, on the boat, we visited the "cooler box" (or icebox) which had delicious

homemade food, or we spent time watching humpback whales, which gave us a show every day.

Topside excursions

Visitors in the area can enjoy a hike to Eagle Nest for a panoramic view of Port St Johns, a trip to one of the cultural villages of KwaZulu Natal, a visit to the waterfalls of Magwa Falls and Fraser Falls or a cruise along the Umzimvubu River to explore its nature and ecology. There are also opportunities for horseback riding, kayaking and fishing.



Common dolphins; Blacktip sharks patrol over a bait ball (top right); Fur seal hunts sardines (top left)





View of the estuary at Port St. Johns (above); Water buffalo at watering hole in Nambiti Reserve (top left)



Elephant at watering hole in Nambiti Reserve

And what would a trip to South Africa be without visiting the animals in the different reserves on the African savanna? One such reserve is Nambiti where a French couple has settled and now welcomes visitors to their beautiful lodge, "Esiweni". Lions, cheetahs elephants, buffaloes, giraffes, rhinos and all the game of the savanna are observed during the safari here, ensuring an exceptional stay.

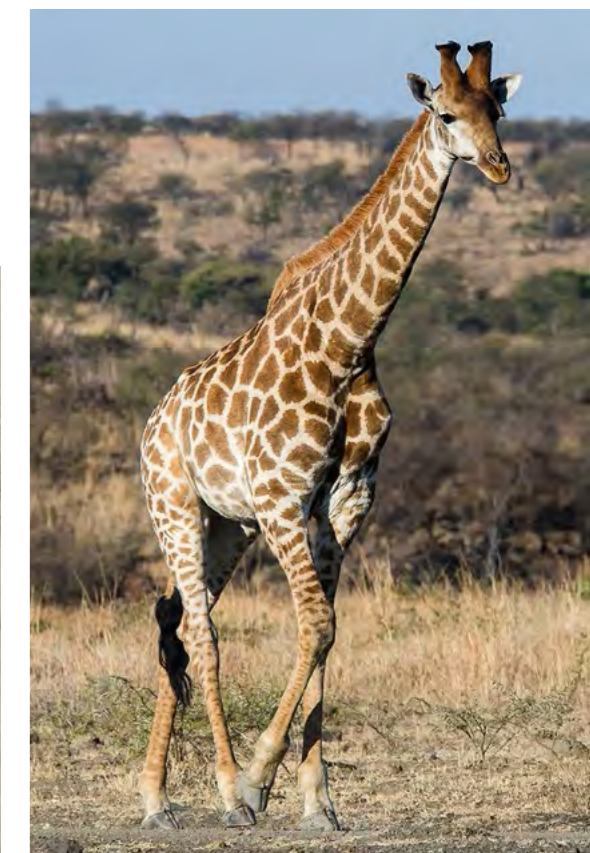
The Wild Coast has many treasures for lovers of authentic experiences in nature and certainly seduces those who take the time to discover it. Visitors who remain long enough may be lucky to get the right number of dives in to experience the action around a sardine bait ball, like the one in the BBC documentary. Reserved for experienced divers, diving in these places is not guaranteed, not easy, and can be frustrating. But this part of the world deserves the

journey for its abundance of life and its magnificent landscapes. ■

The author's thanks go to Rob and Debbie of Offshore Africa (Offshore-portsjohns.com), Allen Walker (Allen-walkerphotography.com), Kathryn and John of the Outspan Inn (OutspanInn.co.za), Henriette and Michael of Jungle Monkey Backpackers (Junglemonkey.co.za), Sophie and Ludo of Esiweni Lodge (Esiwenilodge.com), Aqua Lung (Aqualung.com/fr) and Nauticam (Nauticamfr.com).

Gregory Lecoeur is an internationally published underwater photographer and dive writer based in France. As photo pro, he will be leading a Sardine Run safari in June 2016. Email greglecoeur@hotmail.com for more information or visit: Greglecoeur.com.

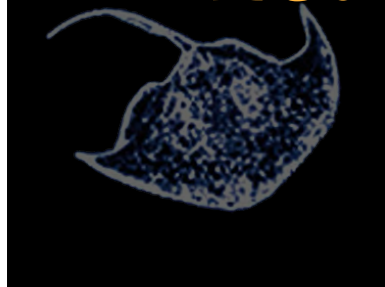
SOURCES:
[HTTPS://EN.WIKIPEDIA.ORG/WIKI/PORT_ST._JOHNS](https://en.wikipedia.org/wiki/Port_St._Johns)
[HTTP://WWW.PLACES.CO.ZA/ACCOMMODATION/OUTSPAN-INN-BED-BREAKFAST.HTML](http://www.places.co.za/accommodation/outspan-inn-bed-breakfast.html)



THIS PAGE: Zebra, giraffe, lions and cheetahs are found roaming the bush of Nambiti Reserve



fact file



South Africa



SOURCES: US CIA WORLD FACTBOOK, US DEPT OF STATE, DIVEPHILIPPINES.COM

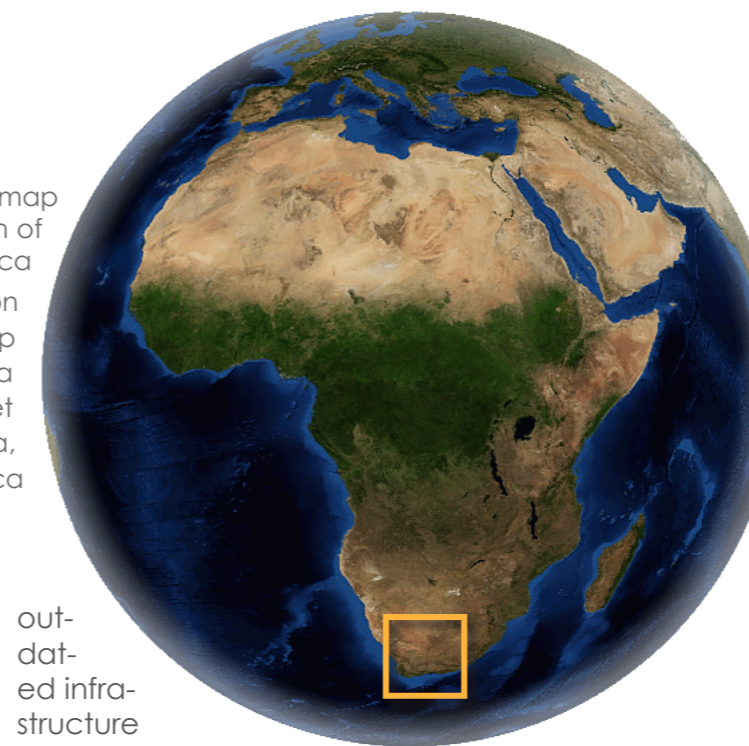
History In 1652, Dutch traders landed at the southern tip of modern day South Africa and founding the city of Cape Town, establishing a resupply station on the spice route between the Netherlands and the East. In 1806, many Dutch settlers (the Boers) travelled north to establish their own republics after the British seized the area of the Cape of Good Hope. In 1867 and 1886, the discovery of diamonds and gold encouraged wealth and immigration. This intensified the subjugation of the indigenous population. The years 1899-1902 saw the British defeat the Boers resistance during the Boer War; but, the British and the Afrikaners, as the Boers became known, governed together

under the Union of South Africa. The National Party was voted into power in 1948 and instituted a policy of apartheid—the separate development of the races. In 1994, the first multi-racial elections saw the end of apartheid and brought in black majority rule. Government: republic. Capital: Pretoria.

Geography Southern Africa, is located at the southern tip of the continent of Africa. The country of Lesotho is completely surrounded by South Africa, which also almost completely surrounds Swaziland. Coastline: 2,798 km. Terrain: vast interior plateau surrounded by rugged hills and a thin coastal plain. Lowest point: Atlantic

Ocean 0 m. Highest point: Njesuthi 3,408 m. Natural hazards: extended droughts. Environmental issues: extensive water conservation and control measures are required due to the lack of important arterial rivers or lakes; water usage increases outpace supply; agricultural runoff and urban discharge cause pollution of rivers; acid rain due to air pollution; soil erosion; desertification. South Africa is party to: Antarctic-Environmental Protocol, Antarctic-Marine Living Resources, Antarctic Seals, Antarctic Treaty, Biodiversity, Climate Change, Climate Change-Kyoto Protocol, Desertification, Endangered Species, Hazardous Wastes, Law of the Sea, Marine Dumping, Marine Life Conservation, Ozone Layer Protection, Ship Pollution, Wetlands, Whaling.

Economy A middle-income, emerging market with a large supply of natural resources, South Africa has well-developed financial, legal, communications, energy, and transport sectors. Its stock exchange is the 17th largest in the world. Its modern infrastructure supports an efficient distribution of goods to major cities throughout the region. Since 2004, growth has been strong, as South Africa reaps the benefits of macroeconomic stability and a boom in global commodities. However, there is still high unemployment and an



RIGHT: Global map with location of South Africa

FAR RIGHT: Location of Durban on map of South Africa

LOWER LEFT: Sunset over the savanna, South Africa



out-dated infrastructure limits growth. The country began to experience an electricity crisis at the end of 2007, due to supply problems of the state power supplier Eskom plagued with aged plants. It necessitated "load-shedding" cuts to businesses and residents in the major urban areas. Remnants of the apartheid period include daunting economic problems, especially poverty, no economic empowerment among disadvantaged groups, and public transportation shortages. The economic policy of the country is fiscally conservative but pragmatic. It focuses on controlling inflation, sustaining a budget surplus, and—as a means in increasing job growth and household income—employing state-owned enterprises to provide basic services to low-income areas. Natural resources: gold, chromium, antimony, coal, iron ore, manganese, nickel, phosphates, tin, uranium, gem diamonds, platinum, copper, vanadium, salt, natural gas. Agriculture: corn, wheat, sugarcane, fruits, vegetables; beef, poultry, mutton, wool, dairy products. Industries: mining (South Africa is the world's largest producer of gold, platinum, chromium), automobile

assembly, metalworking, machinery, textiles, iron and steel, chemicals, fertilizer, foodstuffs, commercial ship repair.

Climate South Africa is mostly semiarid with sunny days and cool nights. There are subtropical areas along the east coast.

Population 43,786,115 (July 2008 est.) This figure factors in the effects and mortality rate of AIDS which is ravaging the country's population. Ethnic groups: black African 79%, white 9.6%, mixed 8.9%, Indian/Asian 2.5% (2001 census). Religions Zion Christian 11.1%, Pentecostal/Charismatic 8.2%, Catholic 7.1%, Methodist 6.8%, Dutch Reformed 6.7%, Anglican 3.8%, Muslim 1.5%, other Christian 36% (2001 census), Internet users: 5.1 million (2005).

Currency rand (ZAR). Exchange rates: 1EUR=11.39ZAR, 1USD=7.60ZAR, 1GBP=14.27ZAR, 1AUD=6.67ZAR, SGD=5.44ZAR

Language IsiZulu 23.8%, IsiXhosa 17.6%, Afrikaans 13.3%, Sepedi

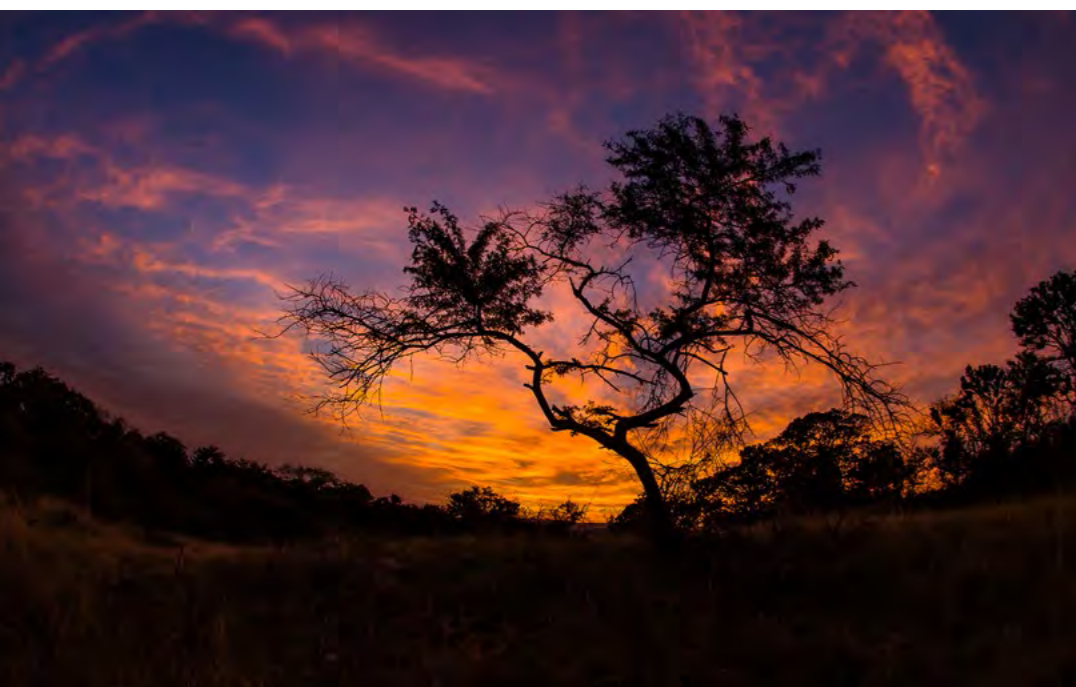
9.4%, English 8.2%, Setswana 8.2%, Sesotho 7.9%, Xitsonga 4.4%, other languages: 7.2% (2001 census).

Health There is an intermediate degree of risk for food or water-borne diseases such as bacterial diarrhea, hepatitis A, and typhoid fever. Vectorborne diseases include Crimean Congo hemorrhagic fever and malaria. Water contact diseases include schistosomiasis (2008).

Decompression Chambers CAPE TOWN: National Hyberbarics Klienmont Hospital, Cape Town 24-Hour Hotline: Tel. 021-671-8655

DURBAN: St. Augustine's Hyperbaric Medicine Centre Hyperbaric and Woundcare Unit St. Augustine's Hospital 24-Hour Hotline: Tel. 031-268-5000 www.sahmc.co.za

Web sites South Africa Tourism www.southafrica.net





Vercors Caves

—*Diving the Karst Systems of Southeastern France*

Text and photos by Claudia Weber-Gebert



The cliffs at Presles in the Vercors mountain range of southeastern France (left)

PREVIOUS PAGE: William Thumy of Dive Xtrême in Isère, France, leads cave diving trips in the Vercors

declared a natural reserve. As for flora and fauna, one will find alpine plants and animals that are eradicated elsewhere in Europe.

The plateaus and valleys provide habitat for eagles, various birds of prey and vultures, alpine ibex and marmots. More recently, lynx and wolves have also been resettled here.

Alpine plants such as edelweiss, gentian and carline

The karst area of the Vercors mountain range is located in the foothills of the French Alps, bordered on the east by Grenoble and on the west by Valence in the Rhone Valley.

It is an insider's tip that found this location where tourism has grown very slowly. There is barely any industry, and there are no congested roads, no large concrete tourist centers and just one small supermarket. Quiet and contemplative, the area is characterized by traditional crafts, agriculture and tourism. The region is frequented by scientists and mountaineers, hikers, base jumpers, speleologists, bat researchers and cave divers.

The access road to the area penetrates the narrow gorges, where the restricted road was partially carved out of the rock to form tunnels. Coming from the south via the little village of Die, the road serpentine up the slopes of the plateau. Only size-restricted vehicles are authorized to use this road. Tourists in buses are therefore excluded.

The Vercors, divided into two parts by the canyon of the river, La Bourne, comprises an area of approximately 1,350 sq km: the north, which has opened up and been developed for tourism, offers all kinds of sporting activities; and the south, which is still wild and pristine.

Flora and fauna

In the early '70s, Vercors was



The winding, serpentine road from the town of Die ascends the high plateaus of the Vercors



Parts of the narrow, restricted road up to the Vercors high plateau is cut out of the rock. Due to low overhead, vehicles over 2.5m are not permitted





thistle occur there, but a special feature are the 60 species of orchids, of which the well-known lady slipper's orchid is only one.

The Vercors boasts some 2,000m mountains, of which Mont Aiguille at 2,086m is not the highest, but probably the best known, as it was the cradle of Alpinism. It was in this region that alpine mountaineering was "invented" in the beginning of the 15th century by Charles VIII. At that time, the mountain was conquered by ropes, hooks and ladders. Even today, many hikers and climbers come to the region, which by its status as a nature park, still shows a reasonably intact natural mountain landscape.

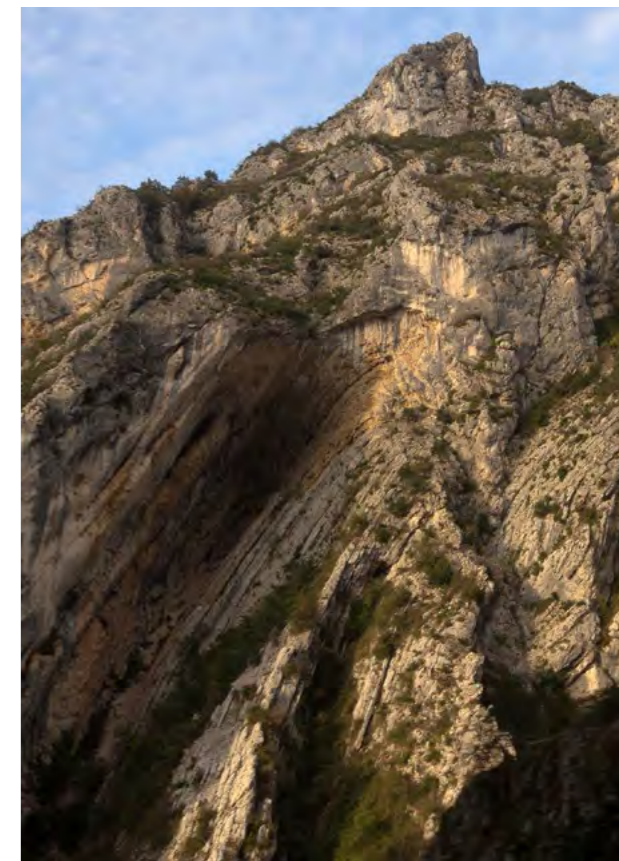
Caves

Particularly impressive in this region is the karst system with its natural attractions: the numerous stalactite caves with their bizarre structures of calcium

deposits. Five caves have so far been made accessible to visitors: Grotte de Choranche, Grotte de Thais, Grotte de la Luire, Cuves de Sassenage and Scialet de Draye Blanche

So, how did the karst area in the Vercors and these stalactite formations develop? In the Mesozoic Age—about 250 million years ago when this area was still below sea level—reef limestone was formed and layers of marine deposits were created. This included snails, mussels and other marine life (now visible everywhere as fossils in the different rock layers).

In the Tertiary period, about 65.2 million years ago, rises and folds through tectonic plate processes were produced by the pressure of the African plate on the Central Europe plate. Today, we can see the effects of these processes evidenced in the more than 300m steep cliffs and drop-offs of the plateaus.



Folds in the earth created in the Tertiary era

THIS PAGE: Scenes from the Choranche Cave in the Vercors mountain range of southeastern France



Vercors

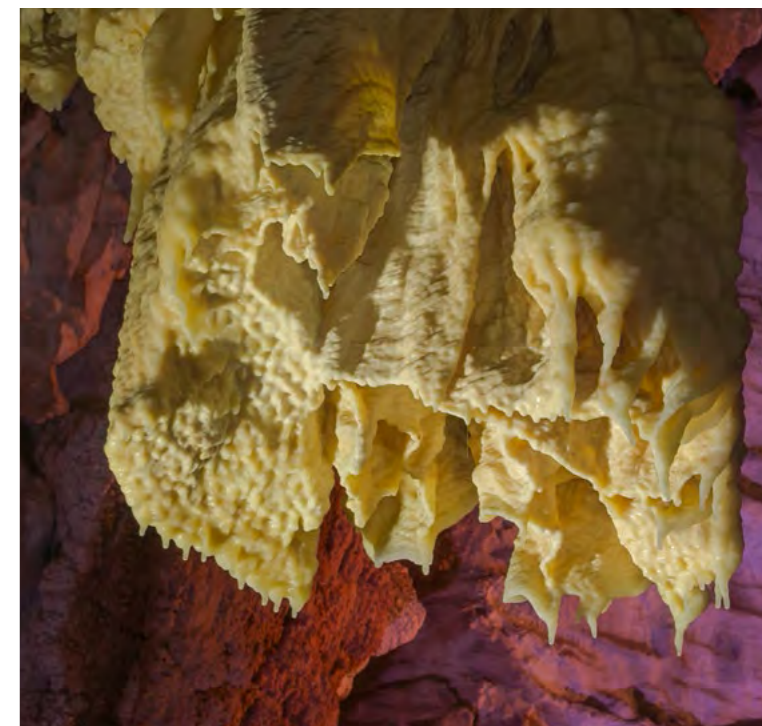


Rainwater, seeping through the plateaus, has carved out the wonderful formations in the caves. In a nutshell, this process can be explained as follows: Carbonated calcium is released from the limestone, caused by carbonic acid in the water, and corrosion takes place. Deeply penetrating water leads to leaching of dissolved calcium carbonate, thereby forming large cavities in which water collects and flows.

At the same time, a reverse process takes place. The lime-saturated solution dripping down from the cave ceiling leaves deposits on cave ceilings and floors, which form into stalactites and stalagmites after millions of years. The calcareous water forms gutters when flowing on the ground, some of them also have bizarre shapes. These wonderful and unique formations attract many visitors.

It is crystal clear and filtered—of the highest water quality.

The cave of Choranche was discovered in 1871, when during a drought, the inhabitants of Choranche were searching for the source of the Gournier River. Water came out of a gap in the rock. After having cleared away loose scree, the inhabitants found a narrow corridor that ended in a large hall with a subterranean sea. The two underground rivers, Coufin and Chevaline, flowed together here. During the drought, there was access to this hall. Only 20 years later, the pioneer and speleologist Oscar Descombaz (circa 1866-1914) explored the caves of



Choranche—after the water level had dropped again in another period of drought.

Today, about 100,000 people per year visit the cave of Choranche and explore the natural wonders

Choranche Cave

As can be clearly seen on the 3D model in front of the cave of Choranche, the water runs off and only gets out above the ground when it strikes a waterproof barrier. Until then, the water flows predominantly vertically through a 300 to 500m thick limestone layer.



THIS PAGE: Limestone formations in Choranche Cave lit by LED display include fistula hanging from the ceiling (above) and stalactites and stalagmites that have merged to form pillars (top right); Over long periods of time, various cave structures are formed by water dripping down through the rock and leaving calcite deposits (right)





Bournillon Cave entrance (above and right); 320m waterfall at Bournillon Cave; Gours, or rimstone dams of calcite, are formations found in Choranche Cave (left)

Choranche are the numerous thin fistula that hang from the ceiling like straws, growing only approximately 5cm over 100 years. These fistula resulted from the constant flow of water in the grotto, as the water descended slowly, but continuously in these tubes. The longest of these fistulas has a length of 3.2m.

Stalactites and stalagmites in this cave are of different sizes and lengths, and some have grown together over millions of years into large columns.

In the "cathedral" of the cave system—an impressive space around 50 by 80m in size—there are numerous terraced formations cascading down like stairs. These are round gours, or rimstone dams (cave formations of calcite), into which water drips steadily from the

ceiling. The water then accumulates in underground lakes, which flow out through these gours—a bizarre world is formed.

Bournillon Cave

The Grotte de la Luire at 45km is the longest cave system of the Vercors. During wet seasons, the level may rise up to 450m in this transitional system. It drains into the Grotte de Bournillon, an impressive cave near Châtelus with a ceiling height of 140m. The size of the cave opening is very impressive, especially the pink rocks of the vaulted ceiling that forms the largest cave in Europe.

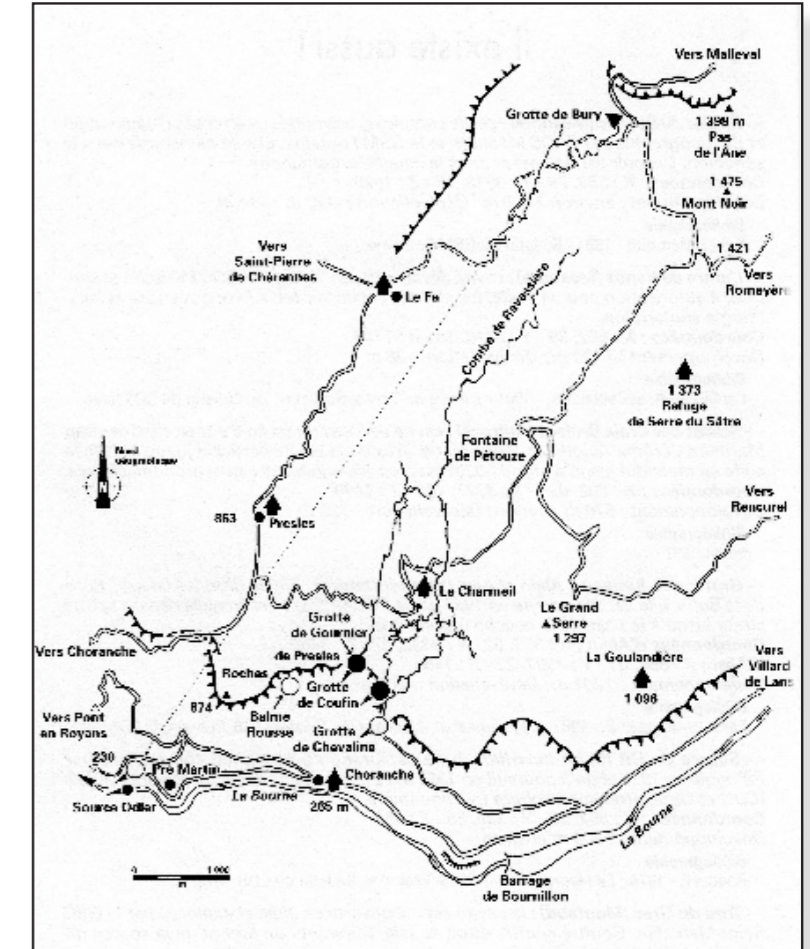
Nearby, the largest waterfall in Europe, at 320m in height, can be seen.

on paved paths and under the supervision of the cave guides. The part opened for tourism is well-lit and spec-

tafully staged, since 2013, with modern LED technology. The peculiarity of the Grotte de



Fistula cave formations hang from the ceiling in Choranche Cave (left); Detail of stalactite (lower left) in Choranche Cave, created by water deposits of calcite over time



Map of Choranche Cave



Civilization has taken advantage of the huge volume of water passing over the great height of the cliffs here, with a power plant generating electricity. Further down the valley, the water is dammed again, and the resulting reservoir serves as a water supply for the region.

Unique species

In the part of the Bournillon cave that is not accessible to the public, speleologists have found eyeless and non-pigmented crabs, catfish and other species. As eyes and pigmentation are not useful in a dark environment like a cave, creatures have evolved other sensors

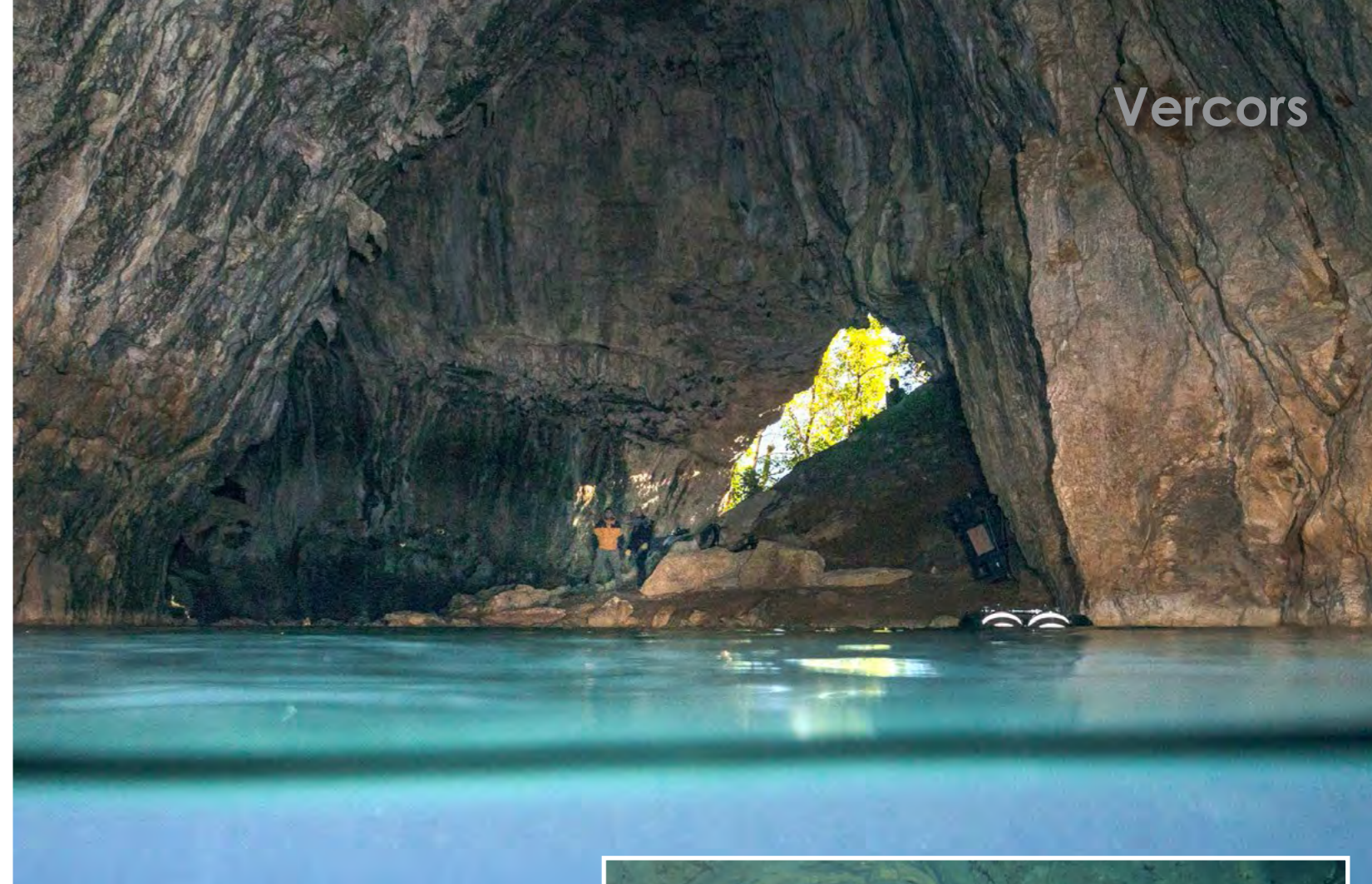
such as antenna or whisker-like barbels to scan the environment, and thus to “see” in the dark.

The animal most associated with caves, the olm (proteus) or aquatic salamander, is found in Choranche only sporadically in underground pools, as it is endemic only in the caves of the Balkans in what is now Slovenia. In other regions, these creatures are not to be found, unless they are exhibited in aquariums. The pigmentless species is about 35cm and eyeless and can live up to 60 years. At birth, its eyes are present, but they wither away rather quickly and are no longer recognizable later in the animal's life.



Olm or proteus, an eyeless aquatic salamander, is found in Choranche Cave

Here, water rushes down from the semi-circular cliffs of the Cirque du Bournillon and then merges with the water from the cave river.



THIS PAGE: Scenes from cave diving in Gournier Cave; "Medusa" jellyfish-like stalactite formation in Gournier Cave (right)

The space over the water surface in the numerous caves is almost exclusively settled by bats, of which there exist about 30 species in the Vercors—an ideal retreat for light-shy animals. There are regular guided tours for tourists and school groups to see these species under the guidance of skilled specialists.

A recently discovered endemic insect in the caves of the Vercors is a species of longhorn beetle. However, there is still not much published about it.

Caving

Where the cave stops for day visitors, begins the domain of speleologists, archaeologists and researchers. In the Choranche Cave, which has been studied the most extensively so far, a transitional system of 33km in length has been explored. Scientists can penetrate this system

within six to eight hours.

The only access is through the so-called "siphon", a sump in an underwater part of the cave of the Choranche. Passages, corridors and tunnels lead to differently-sized cavities with pockets of air on different levels. The exploration is still ongoing and will enhance the knowledge of this system. Any further exploration attempts are recorded and documented on maps. However, access is limited to 10 to 20 times per year, even for the French Federation of Speleology, in order to keep the cave system in its natural, pristine state.

Diving

Where water, rivers and lakes are present, one can, of course, go diving. One, who has found his niche in the large number of diving centers in France, is a native of the Vercors—

William Thumy (www.vercors-plongee.com). Since his youth, he has had a passion for cave diving in the caves and the crystal clear rivers of the Vercors. His diving center, Dive Xtreme, specializes in conducting dives in the caves, grottos and rivers as well as ice diving, with different levels of difficulty. Even with the scientific explorations in the various caves, he is often involved and is knowledgeable about the latest state-of-the-art technology employed on these expeditions.

Gournier Cave

In the cave of Gournier, which is not far from the cave of Choranche, you can dive autonomously. Here, however, the equipment must be carried to the cave entrance. The water is consistently cold, about 8 to 10°C and crystal clear. A drysuit is highly recommended, but not nec-





Waterfall near Gournier Cave (left); In Gournier Cave, a diver explores gutters (above), which drained water, that were formed millions of years ago when the water level was lower; Fallen stalactite underwater in Gournier Cave (right)

essary. Experience in night diving and good buoyancy control are clear advantages here.

In this huge cave where the water is 3 to 5m deep, you can see stalagmites on the floor, and there are stalactites hanging from the ceiling of the cave. The walls have structures of calcium deposits that are common for caves—a sign that the water level must

have been much higher even over long periods. One particular feature is the “Medusa” on the wall, a stalactite formation that has a jellyfish shape and is a real eye-catcher.

At the rear end of the cave, where the underground river enters, the cave becomes more and more narrow and the ceiling becomes increasingly flatter.

There is a slight current towards the cave exit. On the back wall, you can see a sort of gutter and sinter pools through which the water drained in earlier periods.

Normally, the water is crystal clear, if sediment has not been stirred up by some divers previously. However, with the constant light flow of incoming water, the suspended particles are transported towards the cave exit, and after a short time, the visibility is good again.

Not to be underestimated are the lighting conditions in the cave, which are comparable to a night dive. Although light is incident from the cave entrance and the walls are bright, the light is swallowed by the huge size of the cave of Gournier and in the water no light remains. Good torches are recommended!

Exploration findings

The Gournier is considered to have the most beautiful underground river in the world. Its course can be tracked up to 15km. Time and again, galleries open along its course, with waterfalls and pools connected by gours and gutters. With ropes, ladders and hooks, scientists have now penetrated deeper and deeper. Some videos about their expeditions in this cave can be seen on YouTube on the Internet.

Barnabé Fourgous, a French scientist, has found the fossilized skeleton of a bear that was extinct more than 30,000 years ago. Due to the conditions in the cave, the skeleton is very well-preserved.

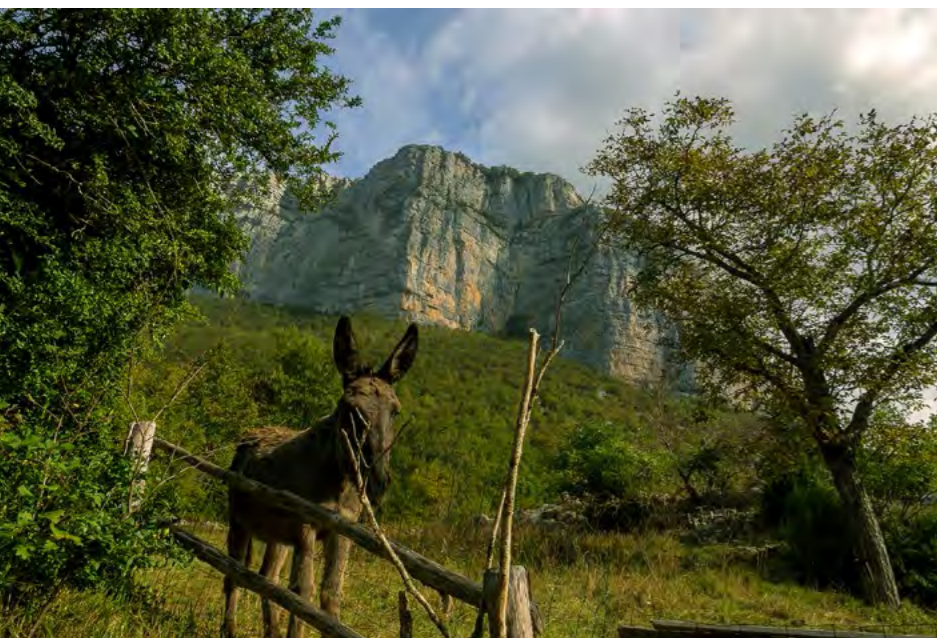
In some parts of the cave sys-

tem, one can also find evidence of prehistoric people. More specifically, it is only by diving into the water-bearing passages themselves that these findings can be made. To do so, one must have

previous experience in cave diving and the appropriate training. Not everyone is allowed to dive in these areas, and only under leadership. Here again, William Thumy is the right partner for divers who

Vercors





want to undertake this adventure.

From narrow, water-filled tunnels to spacious rooms with airy chambers, the cavities are always connected by underground rivers and tunnels. Few fearless explorers can dive this unique wonderland and admire the bizarre limestone structures underwater. Technical equipment is required. One should always ask in advance, what requirements are imposed.

Based on the section of the Grotte de Thais (established by Yves Billaud)

one can clearly see the difficulties in extreme cave diving: the way is long and partially narrow and the return trip must be counted in. As the previously explored part of the cave has a difference in altitude of about 90m, an advanced decompression procedure is

required.

Most of the time, only scientists are found studying, exploring, documenting and going even deeper into the various caves. All scientific studies are coordinated by EDYTEM (Environnements, Dynamiques et Territoires de la Montagne, or Environment, Dynamics and Territories of the Mountain), an association of the CNRS (Centre National de la Recherche Scientifique or National Center for Scientific Research) and the

University of Savoie, consisting of speleologists, archeologists, geologists and geographers.

People of the Vercors

Artifacts and human remains from prehistoric ages document the fact that the region has been inhabited by human beings for a long time. The caves offered protection against the cold and water was available in abundance. There were also animals such as deer and ibex, which could be hunted. Marmots served as a source of fat and furs. However, proof of real settlement was found rather in the deeper parts of the Vercors.

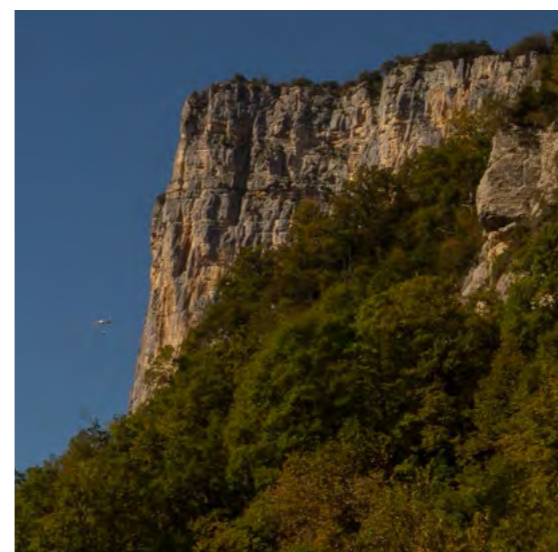
During the Second World War, the Vercors served as a refuge for the people from the Resistance. Some medieval castles have been irrevocably destroyed during that period.

Today's villages in the Vercors have a more rural character, with no big supermarkets but lots of small shops where one can buy specialties of the region such as goat cheese, dairy products, walnut products and handicrafts. Hotels are reasonable in price, small and personal, and accommodations can also be found on many iso-

lated, outlying farms.

Even today you can find evidence, like in Pont-en-Royans, that civilization has come to terms with water and taken advantage of this resource. The tiny village of Pont-en-Royans was one of the first places in France that had its own power supply. Until the '60s, parts for electric installations were produced in this village. In the Museum of Water, you can have a look at the entire history concerning water in this region. ■

Claudia Weber-Gebert is a cave diver, underwater photographer and dive writer based in Germany.



Pont-en-Royans (above) is a town located at the gates of Vercors Regional Natural Park (top panorama); BASE jumper (left) and donkey on farm (far left) near the cliffs at Presles in the Vercors mountains of southeastern France

POINT & CLICK
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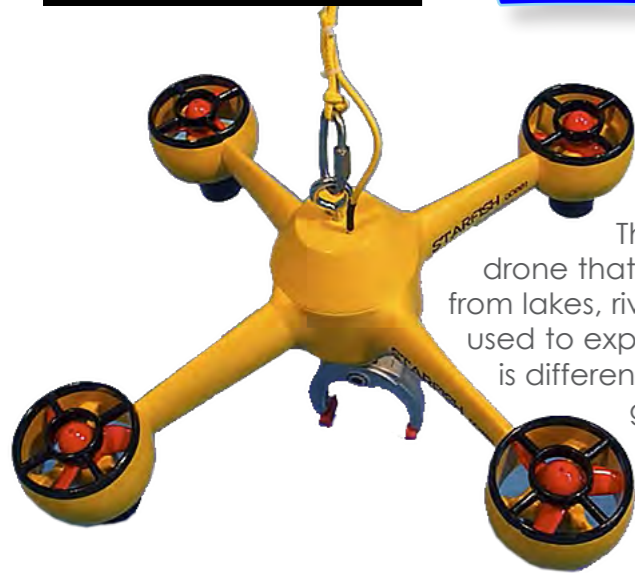


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Edited by
Rosemary 'Roz' E. Lunn

Equipment



Find your stuff

The Starfish is an underwater tethered robot drone that can search, grapple and retrieve objects from lakes, rivers and the ocean floor. It can also be used to explore a wreck or dive site. Starfish's design is different in that it has a strong umbilical and grapple capacity. It is possible to retrieve heavy items weighing up to 227kg (500lbs) from up to 91m (300ft) below the surface by pulling or winching up the umbilical attached to the Starfish body. Starfish could also be used to

save lives. The standard grapple on Starfish has been designed with the correct spacing to hold a human arm or wrist, thus facilitating a potential rescue of someone underwater.

Quadradiver Robot



Find your buddy

The German made 'Buddy Watcher' is a wrist or upper arm mounted system that uses ultrasound technology to produce a vibrating and visual signal in a second unit. The manufacturer states that the working range between a pair of units is approximately 20m (65ft). Each green and black plastic unit has two large buttons and a panel of LED lights. (The buttons look chunky enough that even a 5mm wet glove would be able to operate this unit). One button sets-up and pairs the devices, whilst the second button 'calls' your buddy.

Meanwhile the receiving device vibrates

and the red LED's light up. This is a far more discrete and direct way of alerting your buddy than using a horn or rattle. The unit is powered by two rechargeable batteries, which are sealed within the unit. They are charged via a USB connector. The Buddy Watcher has a useful depth rating of 40m (131ft) **Buddy-watcher.com**



OrcaTorch

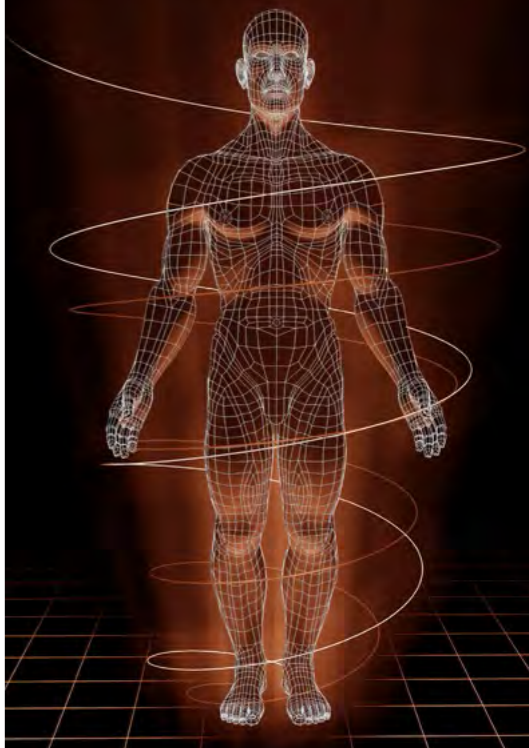
A new canister lighting system has been launched specifically for the underwater videography and photography market. The OrcaTorch D600V light head has four USA CREE XM-L2(U3) neutral white LEDs. These produce a super wide 120° beam with natural color rendition or 500K color temperature and a maximum output of 2,700 Lumens for 70 minutes. (The low power burn-time is 11 hours). The aircraft-grade high strength aluminium battery canister comprises two 26650 Li-ion rechargeable batteries. OrcaTorch has designed this hard-anodized canister to be detachable from the light head to make it easier to travel with. **OrcaTorch.com**

No name... yet

Deep 6 Gear will be unveiling its debut equipment collection at this year's DEMA Show. The range includes a rather eye-catching high performance regulator that is yet to be named. The first stage is a balanced diaphragm, therefore it will give the diver a consistent breathe, regardless of depth or pressure. Deep 6 Gear has stated this reg will come with an environmental cold water kit as standard, and have five low-pressure and two high-pressure ports. These will be placed to provide optimal routing for sidemount, twinset, stage and, of course, single tank diving. The first stage is finished with a coat of PVD, or physical vapor deposition, thus making it more resistant to chips and scratches when compared to the standard chrome finish used on some regulators. The pneumatically balanced adjustable second stage has been fitted with a Turbine Poppet (patent pending) and a pre-dive/dive knob. Deep 6 Gear has advised that the (patent pending) silicone hose will be fitted with marine grade 316 stainless steel fittings. Apparently, this hose is lighter than a rubber version and heavier than a braided nylon hose. Does this make it the Goldilocks of diving hoses? **Deep6gear.com**



BIOMAP



Bespoke drysuits

Fourth Element has just announced that it has brought the process of creating a bespoke drysuit into the 21st century, with the launch of their BIOMAP system—a brand new service that produces a custom-made drysuit. Just imagine: You don a set of base layers before stepping into a booth, and in less than five minutes, you are scanned from head to toe.

The resulting accurate measurements are then used to create a unique pattern for your new drysuit, or confidently tell you what size drysuit you need. Bye-bye guesswork. No more tape measures. Just

an accurate, fast scanning process that is truly personal. What is even cooler is that once this scan has been done, a pattern for your specific suit could begin cutting almost immediately. With

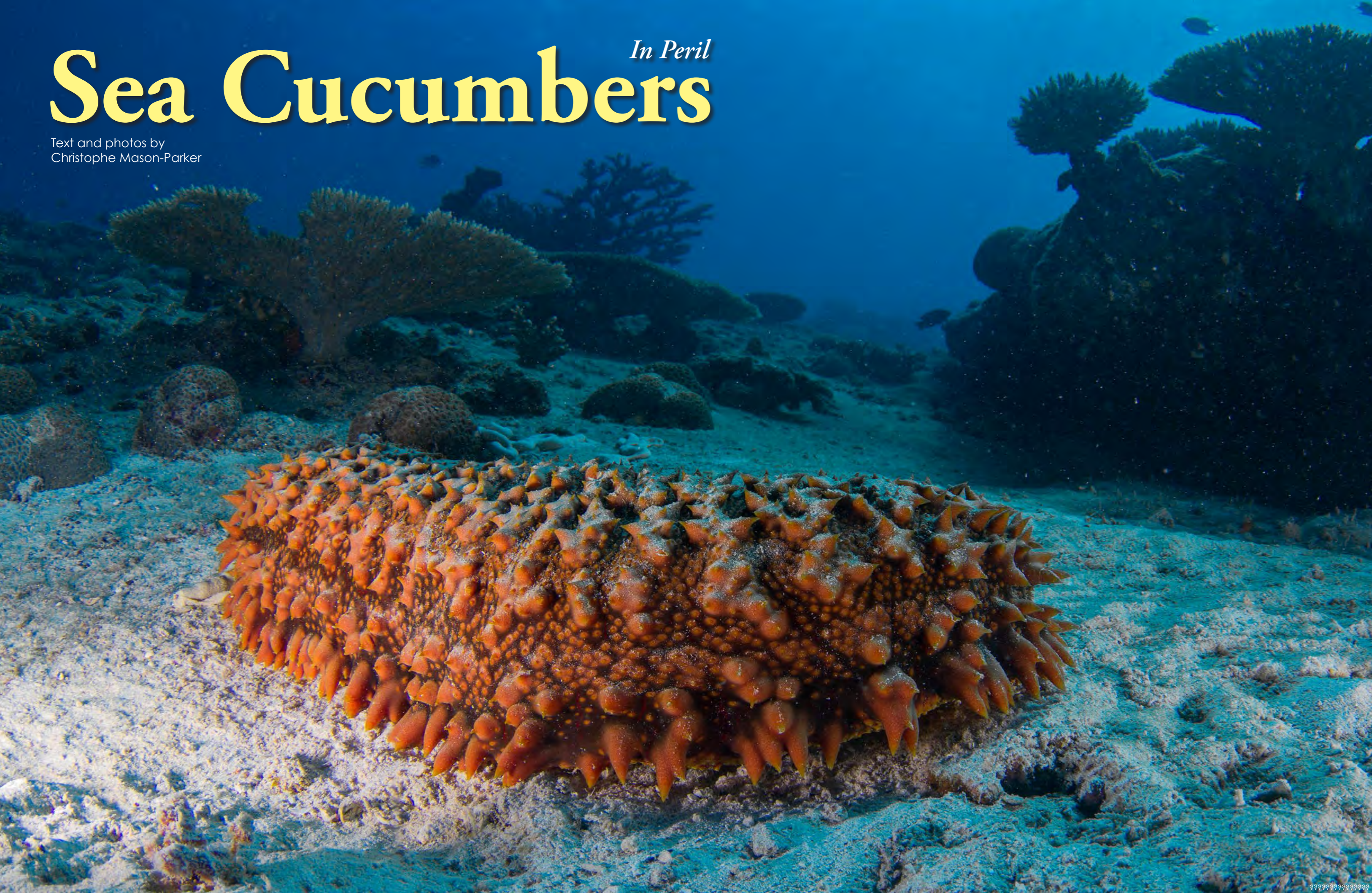
your new bundle of joy (a Fourth Element drysuit designed to fit you perfectly) landing on your doorstep just a few weeks later.

FourthElement.com



Sea Cucumbers *In Peril*

Text and photos by
Christophe Mason-Parker



In the late afternoon, sea cucumbers display spawning behaviour.

PREVIOUS PAGE; An adult prickly redfish on the reef

Sea cucumbers are a group of marine species belonging to the Class *Holothuroidea*. They are characterised by fleshy, elongated bodies, covered in numerous projections known as papillae. When disturbed, many species eject an effluvium of sticky, white threads designed to distract predators, and if removed from the marine environment, they quickly become foul smelling—not your ideal culinary ingredient, one might think. Yet the market for sea cucumber is booming, so much so that several species have seen significant population crashes.

As with many marine species, it is the Asian market that is driving the trade, with Hong Kong and China the main hubs. Sea cucumbers have traditionally been harvested throughout their

range and have long been considered a delicacy in numerous countries. However, in recent years the rise of an affluent middle class in China has led to a surge in demand, in part due to the animals' popularity as a food source, but also as a result

of its association with male virility in Chinese folk medicine. As local populations of target animals have collapsed, fisheries have switched to exploit further species, leaving large areas of seabed depleted with little possibility of replenishment.

Processed food

Both fresh and dried varieties are used in cooking, but the animals require a great deal of preparation before they are ready for consumption. As with shark fin, the final product has minimal taste and the process

often requires the animal to be cooked in broths to add flavour. A wide variety of sea cucumber species are harvested globally, with a high proportion of these destined to be dried for export as a culinary ingredient. The product is known as *bêche-de-mer* in

While underwater macro photographers will no doubt testify to the numerous photographic opportunities that an abundance of symbiotic creatures provide, invertebrates will always lose out to charismatic megafauna as far as the general public is concerned, and sea cucumbers are never going to be high on anyone's list of conservation priorities. This does not mean that they are any less deserved of our or the media's attention.





French, hoi sam in Chinese and trepang in Indonesian.

Meeting demand

As populations collapse in Asia, middlemen have begun targeting locations further afield. In Southeast Asia where sea cucumber harvesting is most intensive, fishermen often glean cucumbers from shallow reef flats. However, overexploitation has had significant impacts on local populations and many shallow water species have suffered localised extinctions.

While in some parts of the world sea cucumber harvesting is carried out with traditional scuba gear, there remains a number of countries where fishermen use a method known as 'hookah'. The system involves divers breathing compressed air, delivered to them



through extensive tubes connected to the surface.

The 'hookah' system allows divers to access depths of up to 100m for over 30 minutes at a time. This method of fishing is not

without risk and accidents are all too common. Equipment failure is a constant threat and the divers

Dried sea cucumbers for sale in an Asian market store; A customer browses the shelves of a dried seafood shop in Hong Kong's Sheung Wan district (far left)

must be wary of kinks or holes in the tubes delivering their air, or worse,

a malfunction of the compressor. Decompression sickness is a genuine hazard as divers remain at depth for too long, and often fishing expeditions are miles away from adequate medical assistance.

The demand for sea cucumber shows no sign of abating, while stocks of most species continue to decline. In an attempt to tackle the issue, attention has now turned to sea cucumber aquaculture. While there has been moderate



Dried sea cucumbers on sale with other marine products

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- 6 ADEX UNDERWATER FASHION Photo of the Year

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- Matthew Smith (Australia)
- Pasquale Vassallo (Italy)
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A juvenile prickly redfish with elongated papillae (left); An emperor shrimp on the surface of a Stichopus sea cucumber (right); Commensal crabs are often found living in association with several sea cucumber species (below)

lae on the dorsal surface, which are far more pronounced than in adults of the species.

Pearsonothuria graeffei, known as the flowerfish, or blackspotted sea cucumber, is cream coloured with numerous dark blotches and small black spots, and the animal's mouth is circled by two dozen black tentacles. Juveniles of the species bear no resemblance to the adults and are instead blue with black lines and yellow papillae. The colouration is believed to be a defensive strategy with the young sea cucumber imitating the appearance of a toxic nudibranch.



Sea Cucumber

success with a handful of species, there remain a number of impediments to achieving large scale production in sea cucumber aquaculture.

For many locations throughout Southeast Asia, if there is to be any prospect of replenishing sea cucumber populations, and maintaining sustainable fisheries, then extensive management plans need to be adopted.

Biology

For divers, sea cucumbers are often ignored. To underwater photographers, they are perhaps not the most photogenic of subjects, yet they are fascinating creatures that deserve our attention.

Symbiotic relationships. Several species of sea cucumber live in a symbiotic relationship with other marine organisms. The commensal crab *Lissocarcinus orbicularis*

is often found associated with the sea cucumbers *Holothuria atra* and *Actinopyga obesa*, while the emperor shrimp (*Perclimenes imperator*) is another well-known symbiont, and is frequently found living with several sea cucumber species. Meanwhile, the Carapidae family, more commonly known as pearl fish, are famously renowned for inhabiting the sea cucumber's anal opening where they feed upon the animal's gonads.

Juvenile forms. Juvenile sea cucumbers are particularly interesting not least because they are rarely encountered. Certain species, however, have striking juvenile forms that differ greatly from the adult animal. The prickly redfish (*Thelenota ananas*) is a commercially important species, which is harvested for bêche-de-mer throughout its range. Juveniles exhibit elongated papil-



Reproduction. Sea cucumbers display little sexual dimorphism, though the sexes tend to be independent. Reproductive behaviour can often be observed in the late afternoon when both male and females are positioned upright on the substrate. The animals proceed to sway back and forth as gametes are released into the water column as part of the spawning process.

Reef cleaners. Holothurians are detritivores, and play a crucial role in nutrient recycling, feeding



The flowerfish has two dozen oral feeding tentacles (left);
The juvenile flowerfish resembles a toxic nudibranch (below)



Sea Cucumber

many localities they have all but disappeared. While we remain insouciant, the trade will no doubt continue at unsustainable levels, and it is likely that we will fail to understand the true value of these remarkable creatures until it is too late. ■

Christophe Mason-Parker is a marine conservationist and underwater photographer based in the Seychelles. In 2015, he published his first book, Underwater Guide to Seychelles. For more information, visit: Archipelagoimages.net.

on organic matter on the seabed. Many species ingest sand from the substrate, removing edible particles before ejecting the sand, while others utilise oral tentacles to remove plankton from the water column.

In the tropics, they regulate coral reef health by removing organic matter from the ecosystem. The process of harvesting large numbers of sea cucumber from shallow waters could potentially have lasting consequences on the entire marine food web.

In recent years, it has even been suggested that sea cucumbers play a role in mitigating the impacts of ocean acidification on coral reefs through the production of cal-

cium carbonate. The marine environment is a complex, interconnected system that is currently facing unprecedented anthropogenic pressures, coral reefs in particular are on the front line, and it is possible that sea cucumbers and other marine invertebrates may be critical in helping to build reef resilience.

Unsung heros

Despite their varied forms and interesting behaviour, for the majority of recreational divers the sea cucumbers are an undervalued group of marine animals. While underwater macro photographers will no doubt testify to the numerous photographic opportunities

that an abundance of symbiotic creatures provide, invertebrates will always lose out to charismatic megafauna as far as the general public is concerned, and sea cucumbers are never going to be high on anyone's list of conservation priorities. This does not mean that they are any less deserved of our or the media's attention.

As divers, we have a unique opportunity to champion the cause of the sea cucumber and highlight their importance as integral parts of a healthy marine ecosystem. For the commercially sought after species, the pressure being placed upon them by overharvesting is causing a decline in numbers throughout their range and in



Sea cucumbers are important for healthy reefs, but overharvesting is causing a decline in their numbers



opinion



It's Not Always About the Cards

Text by Simon Pridmore

Diver training agencies are in the business of selling scuba classes and would like you to believe that the only way to develop your knowledge and skills is to sign up for one of their vast array of courses. While time spent with an instructor is indeed a very good way to improve your technique, you do have other options, a number of which I was reminded of recently.

The other week, I joined a dive live-aboard charter and two of the fellow guests were very new divers, with four and 24 lifetime dives, respectively. We were in Raja Ampat, where the diving is fabulous, the corals are lush and the fish life as plentiful as it is anywhere in the world. It is also a patch of ocean where currents can be intense and a number of the best dive sites can be tricky if the conditions are not perfect, which is rarely the case. Raja Ampat is not a place for beginners.

The liveaboard usually attracts

experienced divers, and there are no instructors on board, only dive guides whose job it is to make sure the divers get the best possible dive at each site by leading them along the optimum route and spotting marine life as they go along.

One of the dive guides was placed in charge of the two new divers and, as soon as he saw on the checkout dive on day one how new they really were, he made it his mission to do his utmost to teach them how to be better divers.

Over the week, I watched him teach them how to weight themselves correctly, how to descend properly, how to ascend and do a safety stop, and how to raise a surface marker buoy from their safety stop to show the tender boat where they were. He showed them how to swim more efficiently against a current and how to use a reef hook to stay in place when a current is running. He instructed them on how to swim horizontally using a variety of fin kicks and how to remain motionless in the water to observe marine life up close and take pictures of it. (Of course, despite

their lack of experience the divers both had cameras!) On deep dives, he reminded them to concentrate, not get distracted and monitor their computers more frequently, and he briefed them and guided them on their first night dive, which they loved!

By the end of the trip, the two divers were transformed. They were comfortably accomplishing dives in a high current that even veteran divers were shying away from. They were working together as a team

and becoming less dependent on the guide with every dive.

Did they receive a dive card at the end of the week? No! Did they become better divers?

Unquestionably! Did the guide feel a sense of considerable pride in what he had achieved? Absolutely! Will the new divers recommend the guide and his operation to friends and the dive community at large? Every time!

This was a perfect example of how excellent diver training does not always need to be about handing out reading material, completing quizzes and card collecting.

The success of the week, of course,

Excellent diver training does not always need to be about handing out reading material, completing quizzes and card collecting.

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MATTHEW MEIER

was not solely down to the efforts of the dive guide. It was also due considerably to the students' willingness to learn. While you are fun-diving with professionals, do not be afraid to seek advice on equipment, technique or how to manage certain diving environments. You just have to pick the right moment when they are not busy with other things and ask.

Most will be willing to help and will often be very pleased you asked. It is much better to have divers in your charge who confess they do not know something and want to learn, than to deal with folk who are unwilling to admit ignorance, pretend to know everything and then get themselves into difficulty.

Staying dive fit

Living in Bali, where there are as many yoga studios as there are dive shops, I have a number of friends who practice yoga under the tutelage of an instructor, sometimes several times a week. The instructor takes the students through the exercises, positions and skills, demonstrating how they should be performed, gently advising them with suggestions and praising them fulsomely when progress is made. The classes keep the students active, enthusiastic and yoga fit.

This is a training concept that could easily be imported into the world of scuba diving. Regular confined water scuba circuit practices for divers would improve their

skills immensely as well as keep them in tune and dive fit between trips. Instructors would also gain from the regular work and derive important job satisfaction from building a group of highly capable divers.

Like yoga classes, there would not be any cards handed out, (although, if you need such things, you might be able to get an attendance certificate for your "Me" wall!) Assuming a sufficient number of divers signed up and turned up regularly, sessions could be priced about the same as yoga class-

Regular confined water scuba circuit practices for divers would improve their skills immensely as well as keep them in tune and dive fit between trips.

es, with the group sharing the cost of the pool booking and the instructor's time.

Keeping dive fit is important. No matter how experienced we are, most of us will become better divers during a dive vacation and, by the end of it, swimming on scuba is as natural as walking. Within a few months, however, highly-polished

instincts become dulled, finely-tuned skills go off key, and by the time we come to the next dive trip, we find we have to climb the learning curve again. It is no coincidence that, wherever people dive, the largest number of accidents take place at the beginning of the season.

Dive clubs

Traditionally, dive clubs have taken on the job of keeping us training and dive fit between trips, and I was reminded of this when I was asked to give a talk at a dive club in Singapore last month. Weekday evening meetings at

the club and organised weekend dives allow experienced divers and instructors to mingle and dive with newer folk on an informal and social basis, with everyone benefitting from the consequent exchange of information and advice.

To find a dive club in your town, ask around. Enterprising urban dive shops often establish clubs to keep local divers active and involved in the sport. If you can't find a club, then think about establishing one of your own and recruiting some like-minded, locally-based divers to join you.

If you need a further incentive to take the initiative, you might be interested to hear that, as well as enabling you to keep your skills sharp, expanding your knowledge through association with other divers, and enjoying social opportunities with like-minded folk, a dive club also gives you substantial buying power. Resorts and liveboards will often offer advantageous deals for group bookings, with discounts and free spaces. So, as well as all the above, you can get cheaper dive holidays too! ■

Simon Pridmore has been part of the scuba diving scene in Asia, Europe and the USA (well, Guam) for the past 20 years or so. He is the bestselling author of Scuba Confidential: An Insider's Guide to Becoming a Better Diver and has just published a new book entitled Scuba Professional: Insights into Scuba Diver Training and Operations. Both are available from Amazon in a variety of formats.

Cards

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Jarrold Jablonski, President of Global Underwater Explorers collects coral samples for researchers at the University of the Algarve, Portugal. Project Baseline divers like Jablonski volunteer their advanced diving skills such as increased bottom time and precise control of their buoyancy and trim to assist researchers as they continue to learn more about deep water coral communities.

Text by Vanessa Belz, Program Manager, and Dr Todd Kincaid, Director of Project Baseline
Photos courtesy of Pilar Barrera, Andreas Hagberg, Jarrold Jablonski and Global Underwater Explorers

Project Baseline works by organizing and mobilizing a global network of highly skilled and passionate divers to create a lasting visual legacy of underwater environmental conditions one photo and one video at a time. Their images, descriptions and data are moved into an online database designed to render their observations accessible to the world. Their images create a baseline for environmental quality. When stitched together, those images create a time lapse revealing how that quality is changing.



GLOBAL UNDERWATER EXPLORERS

The underwater world is elusive. In a statement of stunning over-simplification, its inaccessible reaches are a great source of both mystery and inspiration.

Consider the whole of things, living and inanimate, that inhabit

the vast five oceans and smaller seas. Ponder the lakes that take up an entire horizon line or span barely more than a few swimming pools, or the rivers that mingle and intertwine as spider webs across land masses, their sources

reaching high into mountain ranges or present at unremarkable lake outlets.

Then there are the springs and swallets—portals to underground rivers that flow out of sight and continuously fill underground

aquifers where balanced “water budgets” allow. Many flooded cave passages along with the rest of these underwater environments remain unexplored with reaches unknown.

Water is pure energy moving

on top of, across and through our planet as raindrops, waves, rivers and currents—evaporating, condensing and falling back to the Earth's surface. It is in motion, constantly in flux, shape-shifting and responding to the queues it

Conserving the Underwater World

Project Baseline

— Through Citizen Science and Reporting





Mission divers from Project Baseline assist Dr Joshua Voss from Harbor Branch Oceanographic Institute with researching the sea floor at 298ft about 7 miles offshore from Fort Pierce, Florida, USA. On the last day of operations the team discovered large areas of Stichopathes coral, or whip coral. Researchers have identified this as an important habitat species (left)

connected by a highway running straight through it, which means that more people can easily reach this once seldom-visited territory. Scientists who study the near-shore coast in the Keys no longer consider the underwater ecosystem a scientifically defined coral reef. Today, less than five percent of the coral reef is alive in the Keys. The once wild and dynamic underwater ecosystem cannot survive the increased nitrogen and phosphorous loads coming from land-based sources. Reefs are covered by a smothering mono-culture of algae and sponges.

Defining what is pristine
And what of water's response to a stage that has been set for



Project Baseline

Dr Todd Kincaid, Director of Project Baseline, (right) collects a sample from the Hollywood sewage outfall located less than one mile offshore of Hollywood, Florida, USA. Project Baseline divers advance algal bloom research being performed throughout southeast Florida by the Harbor Branch Oceanographic Institute.

GLOBAL UNDERWATER EXPLORERS

GLOBAL UNDERWATER EXPLORERS

takes from its surroundings near and far. It is under the influence of paleoclimatic and anthropogenic factors persisting year in and year out.

Progress and pollution

In the western United States, Lake Tahoe absorbs most of the nitrogen now present in levels damaging to its long-term health, from the air. Exhaust from the automobiles of some 55,000 residents and an estimated four million visitors

annually are often trapped in the mountain basin where the lake sits. The gas settles on the surface and leeches its way into the chemical composition of those internationally famous clear waters.

In the Florida Keys, the archipelago that was once a series of discrete islands is now



PILAR BARRERA

The *Baseline Explorer* is a privately owned exploration and research vessel dedicated to supporting and expanding the Project Baseline mission. The 146ft vessel boasts 24 berths and deck space for two, manned submersibles, a hyperbaric chamber, gas compressor and two tenders.

lasting health? In a study published last year in *Nature*, scientists collectively identified five key features of successful Marine Protected Areas (MPAs.) It was reported that MPAs with all five features showed a 224 percent increase in fish biomass; over an 800 percent increase in large fish, grouper, and jack biomass; and a nearly 2,000 percent increase in shark biomass. A remarkable and potentially lasting

rebound of underwater conditions.

But how do we know where normal or pristine ecological health begins? When or where do we start to observe and measure changes? Is a 224 percent increase in fish biomass truly a remarkable increase, or are we just revisiting the historical norm for which we have no record?

To what environmental state, exactly, will the residents and visitors in the Florida Keys decide to restore their coastal waters? The one that was present before the first US Navy settlement was established in 1822? Or perhaps to the one existing just before the island-linking highway was completed in 1938, which helped pave the way for around four million annual visitors in 2014? As

a newcomer to the Keys, do we begin now and congratulate ourselves on preserving a largely dead coral reef from an even further state of decline?

Establishing baselines

The starting point, or "baseline", for environmental norms underwater are in many places elusive. Our planet's wet, saturated and uninhabitable landscape is so challenging for humans to access, so expensive, so potentially life-threatening and so remote, that much of the baseline data required to inform the public about a historically "pristine", or at least sustainable environmental condition, is simply not available.

A lack of cultural and institutional knowledge about what an underwater environment originally



Global Underwater Explorer divers Todd Kincaid, Robert Carmichael and Doug Mudry perform a reconnaissance of a Project Baseline study area near Bimini, Bahamas

looked like leads to a misinformed public on a global scale.

Dr Daniel Pauly, Principal Investigator of the Sea Around Us Project, spent time observing fisherman in Ghana whose survival depended on catching tilapia averaging 20cm in length in the early 1970s. Just one generation later, fisherman were still subsisting on the same fishery, but with tilapia sizes averaging just 5cm. As a result, the fishermen's quality of life has not been substantially diminished, but a father's fishing experience is not the same as his son's or daughter's. Pauley brings this research to life in a simple but sweeping statement: "So nothing has changed and yet everything has changed."

Documenting change

How do we share what our common experiences and interactions with the underwater world are like as the years go by? Do we write in our journals? Save samples of fish bones and preserved coral tucked into glass cases? Do we take pictures and post them to Facebook? Do we meticulously record every detail and plot growth and con-

tractions on a graph and file our findings in a report? Do we sit down and tell our grandchildren how things used to be, faulty, subjective memories and all?

Project Baseline is the first volunteer, citizen science organization dedicated to addressing the phenomenon of "shifting baselines", in the field of conservation psychology referred to as environmental generational amnesia, in underwater environments on a global scale. It is an endeavor to connect people with the alarming changes that are occurring in our underwater world, from mountain lakes to ocean reefs and all waters in between. The documentation initiative aims to provide the people who can see these places and these changes, often certified scuba divers, with an effective voice to promote and support much needed and forever sustained conservation.

When volunteer divers are coupled with scientists and resource managers struggling to understand and protect the ecosystems where communities of divers are present, the collective effort becomes greater than the sum of its parts.



JARROD JABLONSKI



PILAR BARRERA

The Baseline Explorer transports her crew, divers and all the equipment required to complete remote operations at sea to the next mission location in the Atlantic Ocean

Project Baseline's goals are simple:

- Build a platform to permanently record diver observations through image media and numeric data;
- Encourage volunteer divers to direct some of their endless energies toward perpetually populating that platform;
- Then use their images and data to foster environmental baselines in every type of underwater environment across the globe.

Action

As of July 2015, Project Baseline has 64 active projects spanning 28 countries. In most cases, what began as the interest and effort of a single person or very small

group has grown into small communities of similarly skilled and passionate divers that work together on a regular basis to document their sites and stations. Teams are supported by Project Baseline staff to establish a Permanent Positive Presence focused on specific water bodies and the specific challenges that confront them.

In several cases, their persistent efforts expand into productive relationships with other entities: universities, conservation organizations, and even local businesses, that have an interest in understanding and protecting the water bodies in which our teams are working.

Teams and training

Project Baseline is the central conserva-

tion initiative of a Florida-based nonprofit organization called Global Underwater Explorers (GUE). Founded in 1999 by two avid cave divers and explorers, Jarrod Jablonksi and Todd Kincaid, who remain dedicated to mission-focused, team-based diver training. It was through the training component of this mission that the founders have been able to establish and sustain lasting partnerships with groups of like-minded, equally capable, and identically trained and equipped teams of explorers across the world.

Through those partnerships, GUE teams have explored all manners of environments from underwater caves to ship wrecks, from high mountain lakes to reefs and vertical walls across the globe. The organization has trained over 10,000

Looking forward

The underwater world is changing. It is degrading in very many places, yet the causes of that degradation and the consequences to the associated ecosystems go largely or even entirely unseen. In most of those places, there exists no baseline for what is pristine or even what is tolerable.

Until such baselines can be established, there can be little hope that effective local and focused conservation measures can be enacted.

Beyond those imperiled areas, there remain, however, astoundingly beautiful and thriving ecosystems in our marine and freshwater bodies that are also largely or entirely unseen, at least at the level needed to establish baselines.

At its heart, Project Baseline is a great experiment that tests the significance and role of the common but passionate citizen in the growing global struggle to protect the vast and vulnerable life beneath the waves. Project Baseline is a global community of highly skilled and passionate volunteer divers, research vessel and submersibles, and collaborations that endeavor to rectify this problem.

The program's mission is therefore ambitious yet stunningly simple: to effect positive change within the world's aquatic environments measurable in terms of improvement within our lifetimes and to establish the permanent positive presence across the globe that will be needed to sustain those improvements. ■

For more information, please visit: Projectbaseline.org.

Global Underwater Explorers founder, Jarrod Jablonski, pushes through the Stargate Cave in Andros, Bahamas, on a 2014 mission to collect conductivity, temperature and depth (CTD) data in support of Project Baseline

divers over the past 15 years and is composed of some of the best-trained, most capable, safest, and most dedicated divers on the planet.

Exploration

Repeatedly drawing from its global network of divers, Project

Baseline creates teams for numerous exploration efforts in all manners of environments.

In 2014, Project Baseline added a new and powerful dimension to its mission through the acquisition of a capable research vessel, the *Baseline Explorer*, and two observation submersibles, *Nemo* and

Nomad. Specifically, the goals of the *Baseline Explorer* is to take Project Baseline to critical places not accessible by our shore-based teams and to leverage the combination of the ship, subs and divers to establish and sustain productive collaborations with scientific institutions that will foster

improved understanding of our underwater world and the much needed conservation of its fragile ecosystems.

Its ongoing mission will focus on documenting and establishing protections for shallow and mesophotic coral reefs offshore of Florida, the Bahamas, in the Gulf

of Mexico and in the Northern Caribbean Sea. Future goals focus on replicating the *Baseline Explorer* platform and mission in every ocean and making Project Baseline a significant contributor to the global efforts aimed at marine conservation.

ANDREAS HAGBERG



Edited by
Catherine
GS Lim



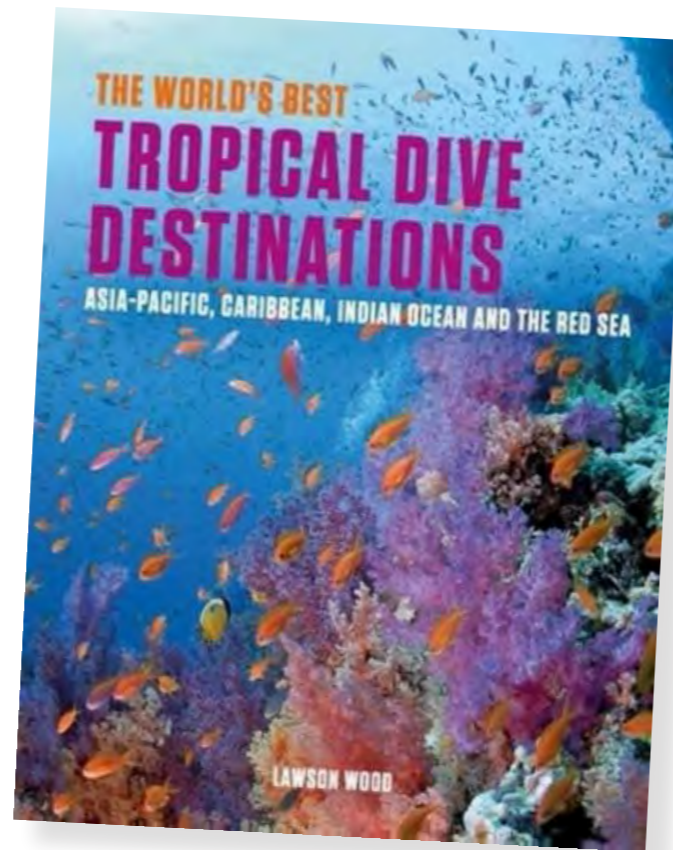
Shark Tales

Shark Bytes: Tales of Diving with the Bizarre and the Beautiful, by John Bantin.

This book contains accounts of author John Bantin's

personal experiences when diving with sharks around the world. Accompanied by more than 80 breath-taking photos, these encounters are captivating, inspiring and sometimes shocking. Readers get a glimpse into what it feels like to swim amongst these beautiful and bizarre animals, from the great white shark to the small blacktip reef shark.

Paperback: 224 pages
Publisher: Fernhurst Books Ltd.
Date: 15 Sept. 2015
ISBN-10: 1909911453
ISBN-13: 978-1909911451

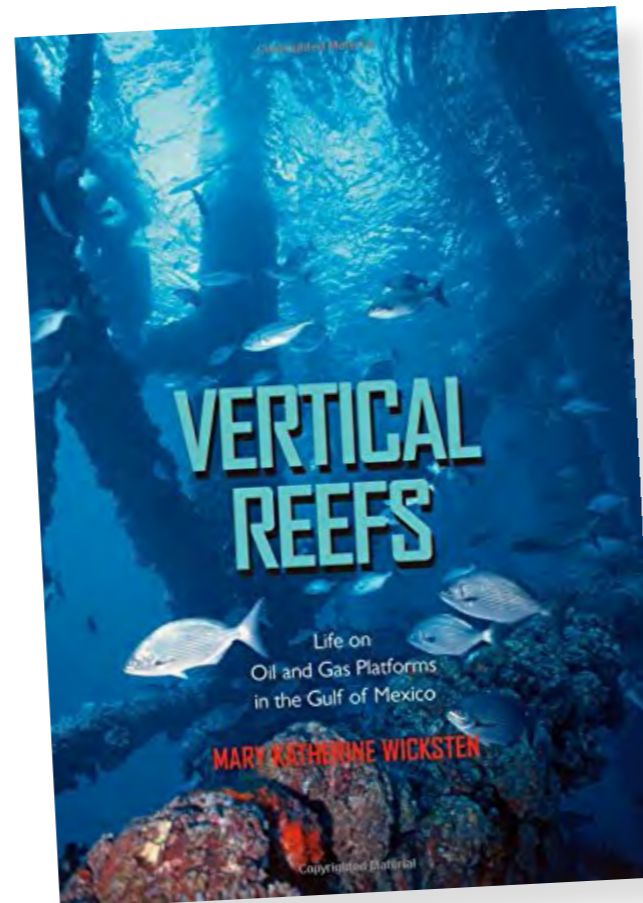


Tropical Diving

The World's Best Tropical Dive Destinations, by Lawson Wood.

This illustrated reference showcases the top tropical dive destinations in the tropics. Covering exotic destinations in the Caribbean Sea, Bermuda, the Red Sea, the Indian Ocean, the Indo-Pacific and the Pacific Ocean, the book is your springboard to your next dive holiday in the tropics. Each dive site profile features a detailed regional site map, travel advisory as well as the type of dive to be experienced at that specific location.

Paperback: 208 pages
Publisher: John Beaufoy Publishing Ltd
Date: 1 Oct. 2015
ISBN-10: 1909612669
ISBN-13: 978-1909612662

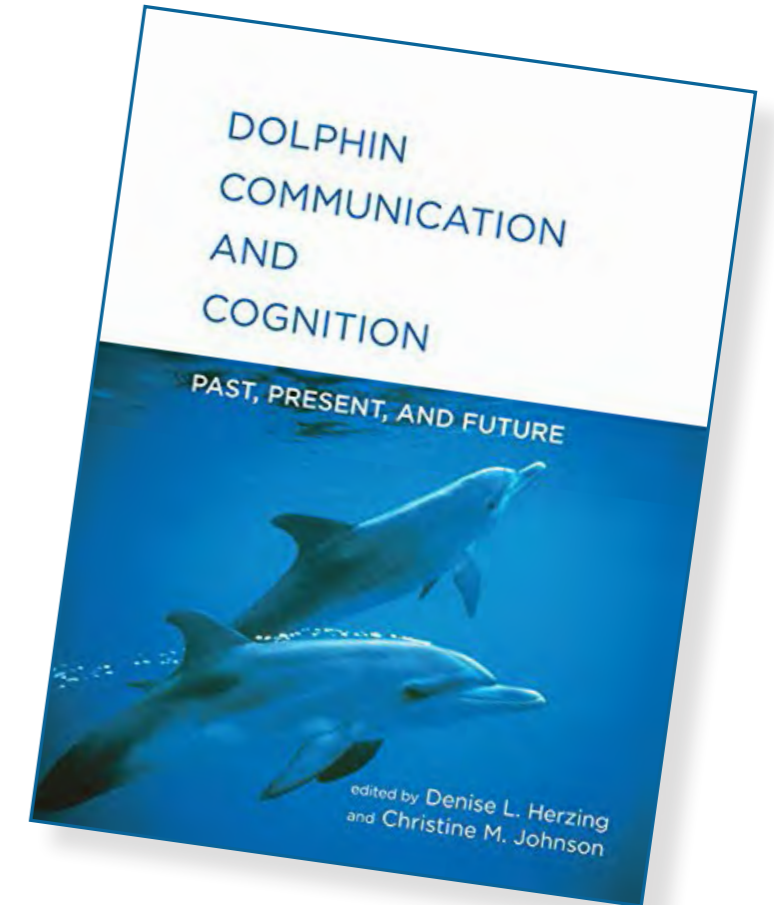


Vertical Reefs

Vertical Reefs: Life on Oil and Gas Platforms in the Gulf of Mexico, by Mary Katherine Wicksten.

There are thousands of oil and gas platforms in the Gulf of Mexico. While some people may regard them as an eyesore, these structures actually provide stable homes for numerous marine animals. Marine biologist Mary Wicksten explains how life starts to congregate on these vertical reefs, and explores the variety of animals that live there. She also examines the differences in the communities that reside at platforms near the shore and those in deepwater.

Paperback: 160 pages
Publisher: Texas A & M University Press
Date: 30 Oct. 2015
ISBN-10: 1623493110
ISBN-13: 978-1623493110

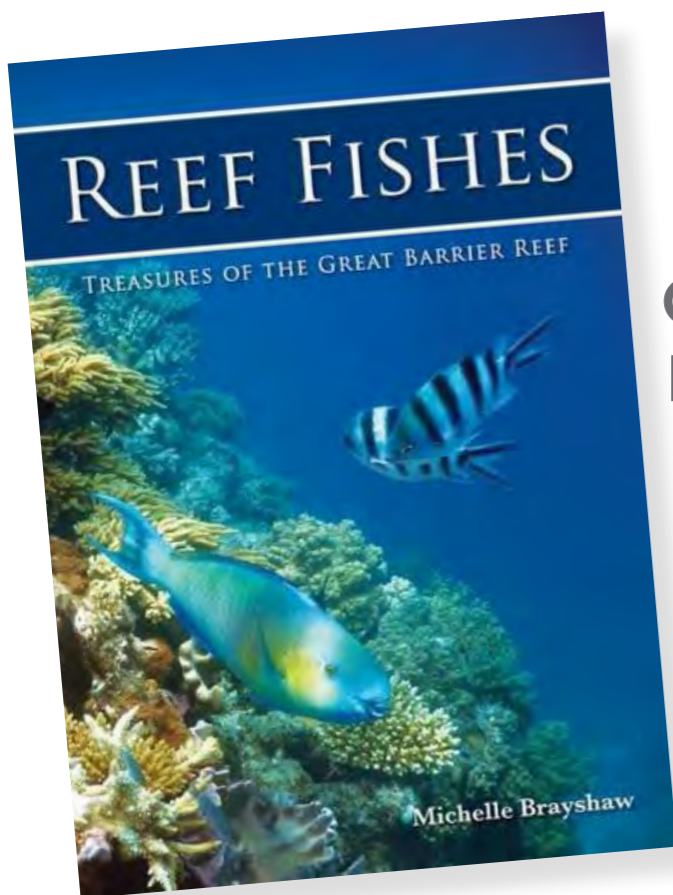


Dolphin Speak

Dolphin Communication and Cognition: Past, Present, and Future, by Denise L. Herzing and Christine M. Johnson.

This book serves as a comprehensive reference for those interested in dolphin communication and cognitive abilities. Topics covered by contributors include dolphin brain and evolution, the anatomy of its sound production and reception systems, and its sensory abilities, as well as vocalisation, abstract reasoning abilities, imitation and learning, social cognition, echolocation and ethical issues. The book also contains a chapter on the future of dolphin research.

Hardcover: 328 pages
Publisher: MIT Press
Date: 30 Oct. 2015
ISBN-10: 0262029677
ISBN-13: 978-0262029674

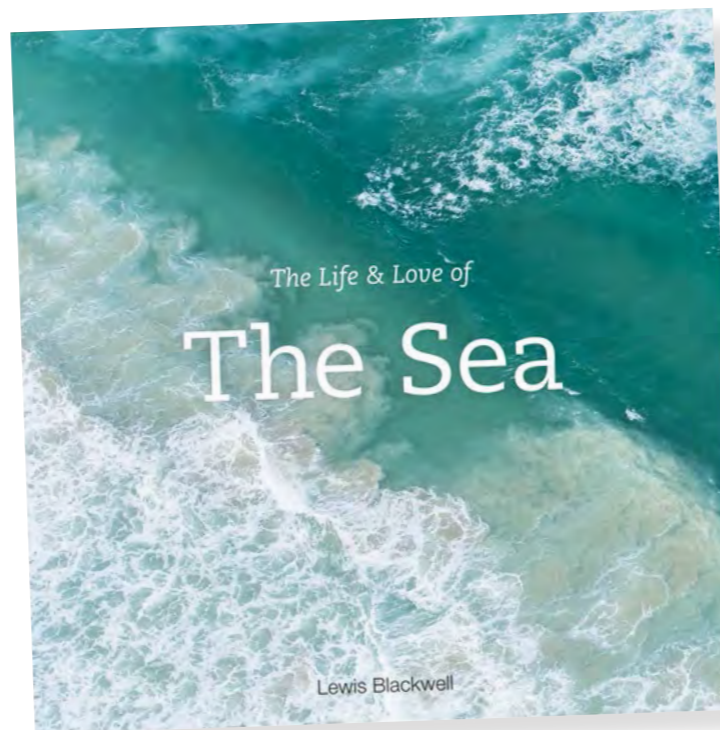


Great Barrier Reef Fishes

Reef Fishes: Treasures of the Great Barrier Reef, by Michelle Brayshaw.

Divers who have visited the Great Barrier Reef would probably recognise many of the fishes featured in this illustrated guide. Besides profiling the common fish species found at the Reef, this book also highlights the important roles they play in the coral reef ecosystem. There is also a small section that depicts the other marine animals found at the Reef, such as turtles, sharks and stingrays.

Paperback: 160 pages
 Publisher: New Holland Publishers
 Date: 1 Sept. 2015
 ISBN-10: 1921517603
 ISBN-13: 978-1921517600

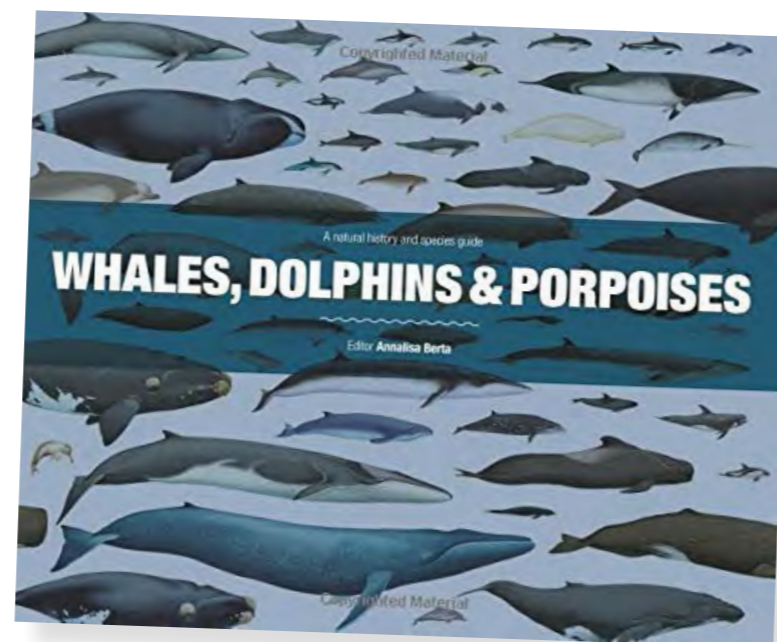


Underwater Photography

The Life and Love of the Sea, by Lewis Blackwell.

Oftentimes, images have a greater impact than words, and this book is a good example of this. It contains stunning photos of the ocean and its residents, in all its glory, ferocity and serenity. There are also images taken above the surface, showing dramatic coastlines, island chains and waves. Bonus footage from award-winning cameraman Steven Hathaway is also available via a scannable QR code.

Hardcover: 216 pages
 Publisher: Abrams
 Date: 6 Oct. 2015
 ISBN-10: 1419718622
 ISBN-13: 978-1419718625

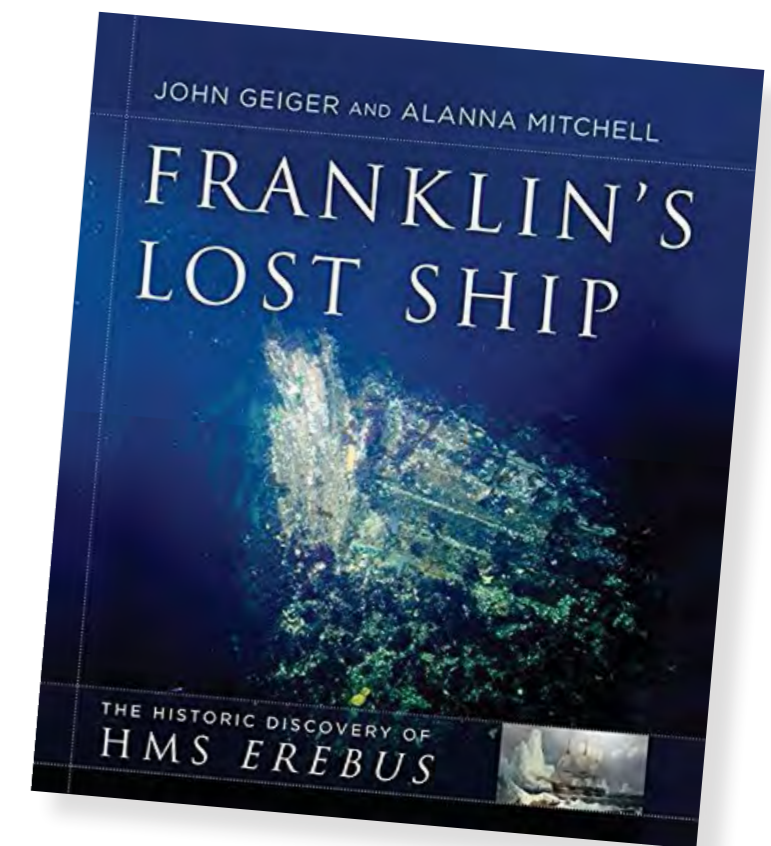


Cetaceans

Whales, Dolphins and Porpoises: A Natural History and Species, by Annalisa Berta.

This book presents a comprehensive overview of the 89 cetacean species in our oceans today. Topics covered include their biology, feeding, mating and communication, as well as species-specific natural history on their anatomy, diet, distribution and conservation status. There are also illustrations featuring key identifiers (like fin shape and colour, tooth shape and characteristic markings) to facilitate species identification.

Hardcover: 288 pages
 Publisher: The Ivy Press
 Date: 18 Sept. 2015
 ISBN-10: 1782401520
 ISBN-13: 978-1782401520



HMS Erebus Wreck

Franklin's Lost Ship: The Historic Discovery of HMS Erebus, by John Geiger.

The two ships that participated in Sir John Franklin's 1845-1848 British Arctic Expedition had mysteriously disappeared without a trace. Then, in 2014, a search effort for the ships succeeded in locating one of the ships, the HMS *Erebus*. This book recounts the expedition, search and discovery of the ship, as well as the first images of the wreck.

Hardcover: 224 pages
 Publisher: HarperCollins Publishers
 Date: 27 Oct. 2015
 ISBN-10: 1443444170
 ISBN-13: 978-1443444170

marine mammals

Whales are much more actively assessing their environment and taking advantage of prey in ways that were unknown before, to maximize energy gain.

— Ari Friedlaender,
Oregon State University's
Marine Mammal Institute



DAN SHAPIRO / US NOAA / PUBLIC DOMAIN

Blue whales off the coast of California, Gulf of the Farallones

Feeding strategies of blue whales revealed

Blue whales are not indiscriminate grazers but instead switch foraging strategies in response to variation in prey density and depth to maximize energetic efficiency. In other words, they always have to consider whether it is worth the bother.

Feeding performance of blue whales vary widely as a function of prey density and distribution, according to new research just published in *Science Advances*. Because rorqual whales are air-breathing divers that exhibit a high-cost feeding mechanism, they are under considerable pressure to optimize their foraging success by weighing oxygen use against possible energy gain. Blue whales, the researchers have found, follow a complex strategy of switching from conserving oxygen when prey quality is low, to intense foraging at the expense of oxygen when prey quality is high.

Maximizing performance

It is hypothesized that foraging behavior is primarily modulated by oxygen use, such that dive duration and lunge frequency are reduced to minimize the amount of oxygen expended. To maximize perfor-

mance, particulate feeders that target single prey items are predicted to increase time spent on foraging as a function of increased prey patch quality.

Some marine suspension-feeding vertebrates, such as baleen whales (Mysticeti), have been likened to terrestrial grazers where the combination of large body size and feeding in bulk on low-trophic level resources yields an energetically efficient foraging strategy.

Big mouthfulls

In contrast to particulate-feeding toothed whales (Odontoceti), such as baleen whales, exhibit several modes of bulk filter feeding, ranging from continuous ram filter feeding (bowhead and right whales, or Balaenidae) to intermittent engulfment feeding (rorqual whales, or Balaenopteridae). Balaenids swim at slow steady speeds to drive prey-laden water into the mouth,

whereas rorquals accelerate forward in a rapid lunge to engulf discrete mouthfuls of targeted prey patches.

Cost

Because of the acceleration and high drag associated with engulfment, the energetic cost of lunge feeding is predictably very high but confers high energetic efficiency when engulfing very dense prey patches.

However, the average densities of zooplankton over broad spatial scales are often several orders of magnitude below the critical threshold required to support the body size of the largest whales. Therefore, rorquals must target dense and often deep prey patches for high prey intake and efficient foraging; otherwise, the energetic cost of lunge feeding will greatly exceed the energy gained from the captured prey. ■



The world-wide perpetual photo and video shootout with close to US\$100,000 in prizes!

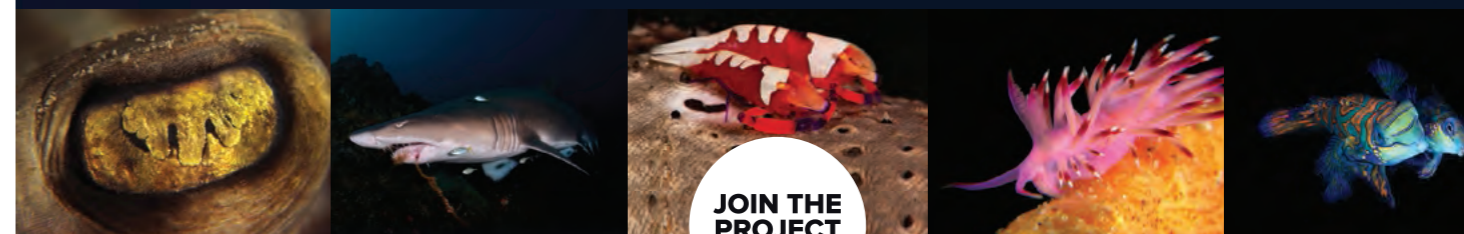
The Underwater Project (UP) is a world-wide perpetual underwater shootout competition.

An evolution from seven years as the Underwater Festival, the UP continues to share the beauty and the issues of the underwater world and shows the rest of the world what we have to lose.

A few new features of the UP are:

- A great new fully featured snapshot map
- Every member will get their own stunning portfolio site with snapshot map and gallery
- Collect and display awards and achievements

- If you have been participating in the Underwater Festival in previous years, your past entries will become part of your portfolio
- Members can choose for entries to be used by non-profits for conservation purposes and/or become available for sale with 50% of profits coming back to the member.



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Edited by
Ila France Porcher

Text edited by Ila France Porcher
Photos by Scott Johnson
Seascapesimages.com

Although born in the land-locked country of Hungary, in Budapest, Dr Csilla Ari fell in love with the sea as a child and has never looked back. Today, she is a research associate at the University of South Florida, where she strives to better understand the biology and behavior of manta rays. She has also set up the Manta Memories project, which aims to help end illegal manta ray fishing.

X-RAY MAG: How did you become interested in studying the behavior of manta rays?

CA: I knew that I wanted to dedicate my life to study and protect marine life since I was 13 years old. It was during a family vacation in Croatia when I first had the chance to try scuba diving. I was so mesmerized by the experience that when I surfaced I decided to try to find out more about this magical world. I became especially fascinated by the majestic and mysterious manta rays after watching a nature documentary, soon after this

first dive. It described how little we know about them and how vulnerable they are.

But growing up in Hungary, a land-locked country, I did not have much option to pursue my dream as a marine

biologist, so I got my master's degree in zoology and my doctorate in neurobiology, while volunteering at oceanography institutes in different countries during the summers. During my doctoral studies, I worked on the neuroanatomy and

neurohistology of several shark and ray species, including mobulids (mantas and mobulas). During these years, I had the chance to explore the brain structures of mantas and mobulas, which reflected some very unique and surprising features.

It was the unusual enlargement of some of their brain parts that got me interested in focusing on their behavior.

X-RAY MAG: What approach did you take to your research?



Cognition In Manta Rays

SCOTT JOHNSON / SEASCAPESIMAGES.COM



shark tales



The first interesting and somewhat surprising fact is that manta rays have the largest brain of all fish species studied so far. Their brain is many times larger than other plankton feeder sharks or cartilaginous fishes with a similar or even larger body size.

— Dr Csilla Ari, Research Associate
University of South Florida

CA: The first interesting and somewhat surprising fact is that manta rays have the largest brain of all fish species studied so far. Their brain is many times larger than other plankton feeder sharks or cartilaginous fishes with a similar or even larger body size. I believe that evolution must have had a very good reason to develop such a large brain and I was extremely curious to find out what it was.

In addition, the forebrain, the part of the brain considered to be responsible for learning,

memory and sensory integration, is especially enlarged in mobulids. Actually, they have the largest forebrain of all batoids, leaving all other batoids far behind. Other areas, those that imply highly developed social behavior in other animals, were greatly enlarged as well. These and some other unique features caught my attention and I started to look for ways to test their sensory and cognitive abilities, as well as their social behavior.

I had gained experience with manta rays in the wild in several

countries by then, and I realized that answering my questions in the wild would be challenging. Some of the conventional methods that are being used to test visual and cognitive abilities are technically impossible to conduct in the wild, so I started experiments in a more controlled environment on captive animals.

X-RAY MAG: What were the findings that caused you to conclude that these animals are using cognition?



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CA: Animal cognition, often referred to as animal intelligence, is an exciting scientific field that attempts to describe the mental capacity of an animal. It developed from the field of comparative psychology and it includes exciting research questions, such as perception, attention, selective learning, memory, spatial cognition, tool use, problem solving or consciousness.

There are no easy ways to test these on manta rays, but I found a widely-used and well-established test that can give us insight on their cognitive abilities. The mirror self-recognition (MSR) test is considered to be a reliable behavioral index to show the animal's ability for self-recognition/self-awareness. Recognizing

oneself in a mirror is a very rare capacity among animals. Only a few, large-brained species have passed this test so far, including Asian elephants, bottlenose dolphins and great apes, but no fish species so far.

So, employing a protocol adapted from primates and bottlenose dolphin MSR studies, I exposed captive manta rays to a large mirror and recorded their behavior. The manta rays showed significantly higher frequency of repetitive behavior, such as circling at the mirror or high frequency cephalic fin movements when the mirror was placed in the tank.

Contingency checking and self-directed behavior included body turns into a vertical direction, exposing the ventral side of

the body to the mirror while staying visually oriented to the mirror. Most surprisingly, such self-directed behaviors were sometimes accompanied with bubble blowing front of the mirror and sharp downward swims.

In apes, similar repetitive and unusual, self-directed behaviors in response to a mirror has been taken as evidence of self-recognition, so the recorded observations on manta rays possibly indicate self-awareness. Further tests are needed to confirm this theory.

X-RAY MAG: Do you have other examples of cognitive behavior?

CA: Those who have been fortunate enough to dive or snorkel with manta rays say that it is a



[Manta rays] are able to change the intensity of coloration of certain patterns on their back within minutes, which might be a new form of communication.

— Dr Csilla Ari, Research Associate
University of South Florida

very special experience and there is a special connection when these animals approach you. Many believe that they are capable of recognizing people and conspecifics, even after a long time period.

They show interest and curiosity, they often voluntarily approach humans for no obvious reason, or even to 'ask for help' when they get entangled in fishing lines. It has happened to me multiple times while snorkeling with wild and also with the captive mantas, that they

swam under me, repeatedly, many times, then slowed down and slowly, very gently lifted me up, almost completely out of the water for a few seconds. Then they slowly swam away. I strongly believe that they have well developed social behavior and communication.

My recent discovery also shows how little we know about them: I documented and reported that they are able to change the intensity of coloration of certain pat-

terns on their back within minutes, which might be a new form of communication. These findings were also highlighted in the prestigious *Nature* scientific journal. I believe they have many more secrets waiting to be discovered and/or understood by us.

X-RAY MAG: What does this mean for our understanding of these important marine animals?

CA: These results suggest that manta rays are likely the first fish species found to exhibit self-awareness, which implies higher order brain function, as well as

sophisticated cognitive and social skills. Those species with elaborate brains that passed the MSR test to date have large, complex and highly foliated brains, complex social behavior, cooperative behavior, and the ability to feel empathy.

If manta rays are among the few species that are self-aware, we might be able to conclude that they also share the same common characteristics and are capable of complex social understanding, cooperative, and empathetic behavior. Self-recognition is also essential for the ability to use their own experience to predict the behavior of conspecifics. This might be a unique ability of this fish species. However, these findings should be interpreted with caution because of the small sample size and because the MSR test might demonstrate only a specific level of a complex capacity of self-awareness.

Our latest focus of research is their physiology, since they are perfectly adapted to extreme

underwater environments. Their morphological and physiological adaptations could be exploited for extending human performance and resilience in extreme underwater environments. Mobulids are able to dive deep (~2,000m), for long hours and their central nervous system is able to function well in extreme low temperatures, oxygen levels and under extremely high pressure. It turns out that they have high blood ketone levels, which are molecules known to function as alternative fuels if glucose is not available.

We think that ketone utilization might be an important physiological adaptation to preserve brain metabolism in deep-diving animals with large brains, a phenomenon we plan to explore further in the future.

X-RAY MAG: What else would you like to share with us about manta rays?

CA: Manta rays are fished illegally in many parts of the world. The

concept of the Manta Memories project was born in 2012. In spite of legal protection, manta ray fishing and trade still happen worldwide, and manta ray populations are being pushed to dangerous levels. Although many positive legal advancements have been taken in recent years to protect their populations, I believe that legal protection is not always enough. At some remote fishing villages in developing nations, people do not have alternative income options; they have no other choice but to fish for manta rays for their survival and to support their families.

So, I decided to set up the Manta Memories project to help these communities to establish alternative income options, so they can give up illegal fishing and trade, without having to worry for their survival. ■

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HTTP://TEDXTALKS.TED.COM/VIDEO/RESEARCHING-MANTA-RAY-BRAINS-DR

Manta Rays



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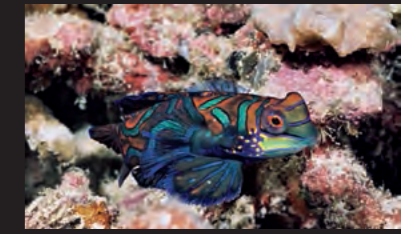
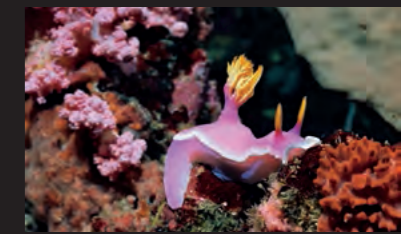
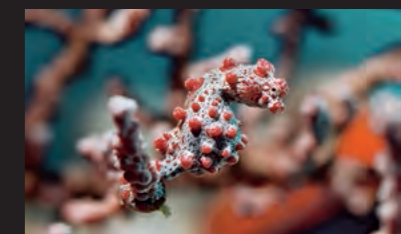


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PETER SYMES

Shark populations on the US East Coast are improving

Results of US National Oceanic and Atmospheric Administration's 2015 Coastal Shark Survey are very good news for shark populations. Numbers have steadily increased since 2001, indicating a healthy rise in shark populations.

The survey began in 1986 and is conducted every two to three years. It covers coastal waters from Florida, where coastal shark species concentrate during the winter and spring, north to Delaware, where many shark species migrate during spring and summer as more northerly waters warm. Following this migratory route, at this time of year, makes it easier to survey the whole population.

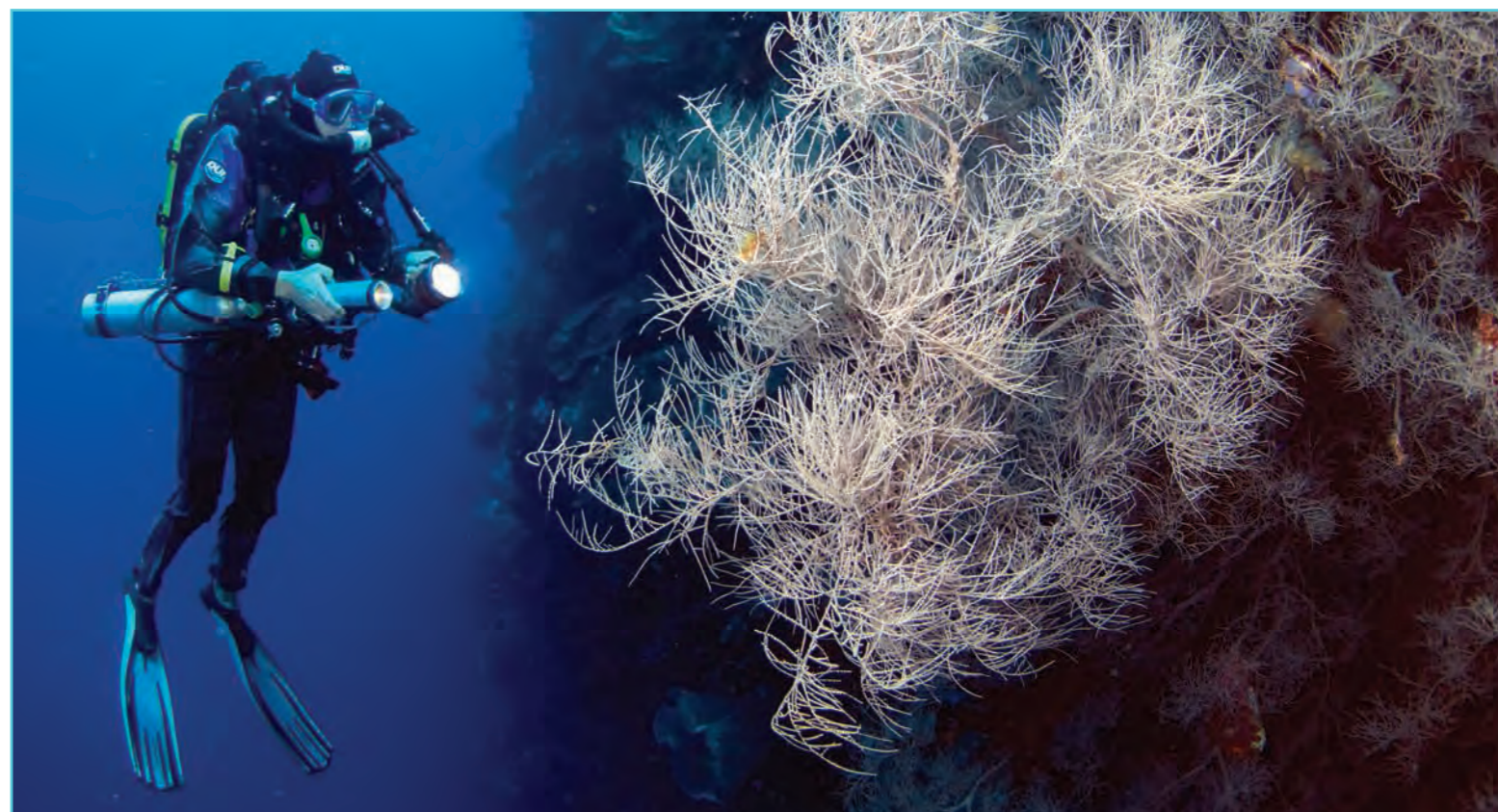
During their field work this summer, NOAA scientists tagged

2,835 sharks, compared to the 1,831 tagged in the previous survey done in 2012.

Great whites and bulls Sandbar, Atlantic sharpnose, dusky and tiger sharks were the most common shark species captured this year. In all, 13 shark species were among the 16 species of fish caught. The three non-shark species were remora, cobia and gold spot eel. The largest captured was a 12.5ft tiger shark off North Carolina's coast.

Normally, the survey doesn't yield great whites or bulls, said Lisa Natanson, a research fish biologist NOAA. However, this year the team caught an unprecedented six bull sharks.

Natanson said the survey's primary goal is to gather information about the distribution, abundance and species composition of sharks found in these waters. Survey objectives also include tagging sharks for migration studies and collecting catch-per-unit-effort data. ■



A CCR experience without equal

At Wakatobi, rebreather divers are not just accommodated, they are welcomed by a staff that understands the special requirements of the equipment, and in some cases, are CCR divers themselves. A supply of oxygen, diluent, and bail-out tanks are available on site, along with ample stocks of sorb with oxygen fills to 206 bar, with helium available by advanced request.

Rebreather groups may be provided with dedicated boats to accommodate their extended profiles. Equally attractive as the support system is Wakatobi's marine environment itself, which offers profiles that are ideally suited to rebreather diving, along with a wide range of marine subjects that become even more accessible to those who dive silently.

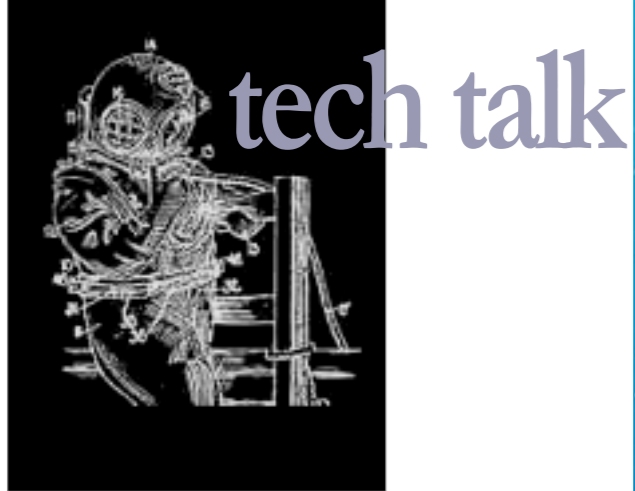
Bring your rebreather and experience Wakatobi today. Learn more at www.wakatobi.com or email office@wakatobi.com.

"Overall, it would be hard to imagine a more perfect environment. You don't have to dive a rebreather to experience all the wonderful attractions of Wakatobi, but having these systems can add yet another layer to your enjoyment of this magnificent ecosystem."

Craig Willemsen, owner, Silent World Diving



www.wakatobi.com



Text by Richard Taylor
Photos by Andrey Bizyukin

As divers, we all learn very quickly that staying too long underwater can often bring about an urgent call of nature. A rush back to shore or back on to the boat is one of the first experiences for many new Open Water Divers, if not that ignominious feeling of having no choice but to make our wet suit slightly warmer for a short time.

It is a simple truth that scuba diving seems to make many of us want to relieve ourselves sooner than we would expect. The number of divemasters who have had to wash “pongy” wetsuits after dive sessions is probably all of them, whilst the sight of fellow divers trying desperately to save some dignity while finding a “private moment” during a surface interval is something that probably no diver has missed, and most have experienced firsthand.

Laugh as we may (or smile sheepishly), the act of urination is as much a part of safe diving as staying hydrated, ascending slowly and breathing continuously. Alternatively, “holding on”, just like diving dehydrated, fast ascents and holding one’s breath, will pretty much lead to pain, injury and, often, some complicated and unpleasant treatment.

However, for most divers, the 30- to 40-minute foray underwater on a single tank isn’t unpleasant and some simple pre-dive preparation ensures that they remain comfortable when exiting. For those who want to explore the depths further and longer as a technical diver, then this issue of bodily function does require some

consideration. This is even more so when you hop into a drysuit.

Drysuit options

Most technical diving texts nowadays discuss using drysuits due to the longer and deeper (and often colder) dives. With this often comes the need to consider

so-called “accessories”, one of which has gained quite popular attention is the P-Valve. There are many makes available, but all rely on the basic principle of a catheter and tube leading to an external valve fitted into the drysuit. Initially the domain of the male diver, recently there has been a trend for the female diver to

include the use of the “She Wee” or other similar devices.

Whilst these points of view are both humorous and educational, they often take the position that there is really no acceptable alternative. However, and this may come as a surprise to many, there was an alternative long before P-Valves,



In Defense of Diapers

— A Handy Solution to the **Call of Nature**



and there will be one long after you have hung up your last drysuit. It's one of those "D" words divers don't really like to talk about: Decompression, Dehydration and Diapers!

"Diaperology"

When we talk about diapers, let's make sure we understand a few things. Firstly, we are not talking about swimming around wearing elasticized plastic pants sloshing around in a bath of our own wee. Secondly, we are not talking about wraparound nappies, with huge plastic safety pins and regulators. Here, we are talking about wearing adult diapers for comfort.

Okay, I appreciate that many people go "Yuck!" and "Eeww!" and such like when they think about using diapers (or adult nappies, if you wish). So, let's have an honest look at the alternative and some of the pros and cons.

First: "No one wears those!"

I am sure most of you have come

across the adult diaper section of the supermarket or pharmacy. Have you ever wondered why they are on the shelves and not hidden away in some private unmarked cupboard? Simply put, many people use them. The global market is worth over US\$8 billion, and it is growing at eight percent -- higher than any other toiletry market (including toilet paper). Over 25 million Americans buy them every year.

Second: "I'm not going to wear them!"

HA! Boy, do I have news for you: One in three women over the age of 18 suffer from some sort of sensitive bladder or incontinence. Fifty percent of seniors have some form of "urinary weakness", whilst 80 percent of people who wear adult diapers are female, due to conditions mostly caused by child-birth. Hence, odds are that you are going to visiting the adult diaper section of the supermarket one fine day. So get over it!

Third: "I don't want to sit in my own waste for hours." Let's break this one down, shall we?

"For hours"

Not all of you are going to be Explorer Club divers spending three-plus hours decompressing from a 250-foot cave exploration dive in the middle of Guatemala. Most of us do this for fun. Most of your students do this for fun. Yes, we may want to channel our own inner Sheck Exley or Lloyd Bridges, but the reality is that most boat trips, cave dives and shore dives last a couple of hours, max.

"My own waste"

Okay, nappies/diapers are there to absorb and contain our waste—specifically, our wee/urine. Diapers are designed to take the liquid away from the body and have it absorbed in gel type pads, so the body is left relatively dry.

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Diapers

hydrated before we dive, not guzzling a gallon of caffeine before we hop in our drysuits and wear that nice tight weight belt or harness strap over our bladders. And if you are diving with a rebreather (CCR), what on earth did your instructor teach you about one of the benefits of "the warm moist air" anyway?

The net result is that if we are well balanced and hydrated before the dive, have gone to the toilet regularly, and have not drunk copious diuretics, our wee requirements will be smaller.

Diaper tips

Now, there is no problem with doing a wee in a diaper. Most babies don't "control the flow", they just let it go when they need to go.

Well, when using an adult diaper, we need to learn the same. Don't hold it in, just relax. The first time you feel like

Fourth: "But I pee SO much after just 30 minutes!" Just how much are you drinking before you go diving? It amazes me the number of people I see who literally guzzle down drinks before a dive. What's worse is, half of it is either grande (or venti) coffees or super-sized Cokes! Have you people never heard of diuretics? These things make you go to the toilet!

Hydration

So we need to talk about hydration. You pee because your body has produced excess fluid waste; the darker it is, the more dehydrated you are becoming. We used to say 64 US fluid ounces per day, or just under two liters, equated to about the recommended six to eight tall glasses of water a day.

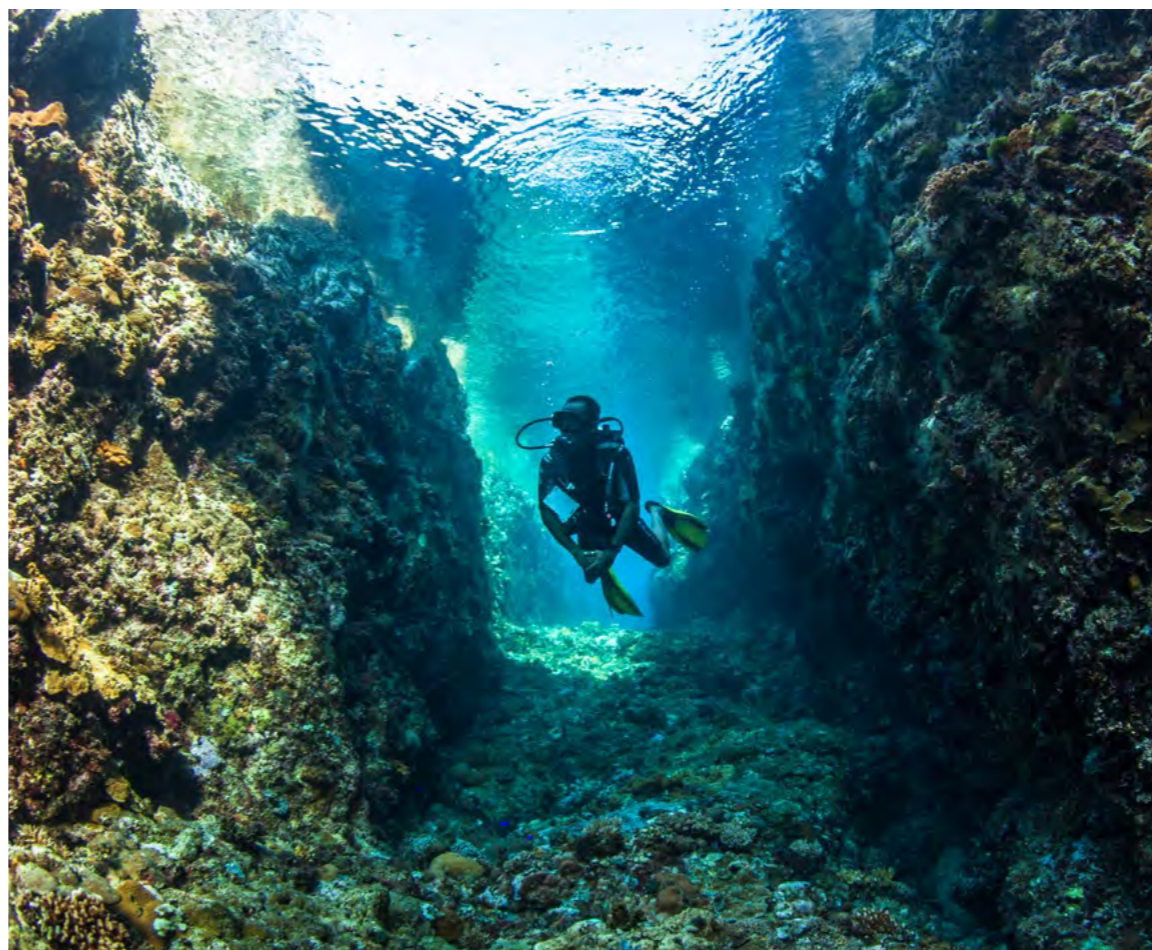
Nowadays, it is considered more appropriate to consider six to eight cups per day (or just under 1.5 liters), in addition to a balanced diet. Your kidneys process about four cups an hour, so when you drink more, what do you

think happens to it? Right. Hello, bladder!

The best way to hydrate your body is to consume a constant intake of small quantities of water. Yes.. WATER! Slowly. Sip it. Don't guzzle. This keeps your body hydrated and avoids excess fluid being directed immediately to your bladder. You will still wee, but they will be regular and smaller.

Yes, we dehydrate more when we dive. It is said that we dehydrate just over one liter of the body's water (33 US fl. oz) for every 88 cu ft of dry compressed air we breathe in (that's about a 12L ali). How precise that is who knows, but the principle is pretty right. Our rate of dehydration increases when we dive for many reasons, the dry air definitely being one.

So we need to compensate for this. The best way to do is by consuming fluids while we dive (water-filled camel packs, anyone?) A more practical alternative is having a well-hydrated body before we dive. This means being





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you need to go, go!

Now, I know many of you are sitting there thinking: "No way, not me!" and "It'll spill into my drysuit!" So, don't take my word for it—test it out for yourself! Get hydrated, limit the coffee and sodas, and try it out in the shower. That's how I was taught to get used to them, and that's how I tell my students to try it out. If at first you don't succeed, then just relax, and tackle it slowly.

Let's be honest, adult diapers are not for everyone! It is a discussion many divers need to have—technical divers and instructors in particular. Regardless of which side of the fence you sit on, it is one that every instructor needs to have a balanced look at. Of the many technical divers I have taught over the years, most of the women have tried diapers, and many instructors now discuss this

subject equally alongside P-Valves. As professionals, we have an obligation to be able to discuss both sides fairly. It is, after all, the diver's choice.

Lastly, don't forget these benefits:

1. They are simple to use and require little "personal preparation" (and just because you wear them doesn't mean you've used them).
2. They are available in most supermarkets or pharmacies around the globe.
3. Based on the stats, chances are high that you may have to use them one day, so you may as well get used to them now.

Safe diving—and a dry and comfortable one too! ■

As one of Australia and New Zealand's first Technical Diving Instructors and Instructor Trainers, Richard Taylor is an avid cave and wreck diver and frequently published technical dive and risk management writer and lecturer based in Wellington, New Zealand. He has served as the Australian regional director and sales representative for TDI/SDI and is a founding member of 'The Sydney Project' mixed gas diving team. He was the safety and diving officer for the joint Australian-Turkish team finding the Australian WWI submarine—the AE2—off Gallipoli. He also founded and directed the OZTeK Australasian Diving Technologies Exhibition and Conference and was honored with the OZTeK2013 Industry Recognition Award for "Exceptional Contributions to the Growth of Technical Diving."

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photo & video

Edited by
Don Silcock

Anemonefish
in anemone,
Raja Ampat,
1/160 f/11
ISO 160

Text and photos by Beth Watson

Raja Ampat in Indonesia is a vast archipelago that incorporates over 2,500 islands. The coral reefs here host one of the highest concentrations of endemic fishes in the Pacific Ocean and the visual impact is stunning.

Situated within the Coral Triangle, West Papua has been coined the Bird's Head Seascape and is considered the world's premier epicenter of marine biodiversity. Bird's Head Seascape lies above a tectonic plate convergence zone, making it one of the most geologically active places on Earth. The currents of the Pacific Ocean flow through this region,



View from atop Mt. Pindito, Wayag, Raja Ampat, 1/800 f/8 ISO 160



Shooting Wide

In Raja Ampat

bringing in rich nutrients and creating an environment, which cultivates extreme marine diversity.

This fantastic province has an endless array of extraordinary pho-

tographic opportunities, both above water and below. Underwater photographers will have the arduous decision of whether use a macro or wide-angle lens in this wildly beautiful

region. The massive coral bommies, shallow water mangroves, shoals of glass sweepers and schooling fish are best recorded using a wide-angle or fisheye lens. It is difficult to capture

the essence of the region's splendor using a macro lens. Consider shooting wide, and focus on the entire scene. Please also take time to observe and enjoy the macro species as well.





photo & video



Composition

Wide-angle photography brings about its own set of unique challenges. Creating impactful, colorful and sharp images requires thought and preparation. There are several variables that need to be considered when photographing underwater wide-angle scenes.

Scan the reef and water column, looking for visual impact. A good composition will engage the viewer, whether it is simple or complex. Sometimes, the "less is more" theory works well. Bird's Head Seascape is often an underwater extravaganza. There can be so much action that it becomes difficult to know where to look, and much less what to shoot.

After the decision has been made on what to shoot, some factors need to be considered before setting up for the shot. In what direction is the sun shining? Which direction is the current running? How much air is left and what is my depth? Do I have proper buoyancy to capture the shot?

After these questions are answered, pro-

ceed with your camera settings, strobe positioning, etc. Practice this sequence often; it won't take long before this becomes second nature, and the questions and answers will come quickly. The result will be improvement in photography and diving skills.

A few lucky people have a natural eye for composition while others often struggle. Visualize the final image before it is captured. Look at the works of other photographers whom you admire. What do you like and dislike about their images? What draws your attention? Is it the color, subject, lighting, lens choice or composition? Don't emulate other photographers; take what is inspirational, build on that, practice and create your own style of photography.

Camera settings

It is important to know what camera and strobe settings are dialed in before you enter the water. This will facilitate quicker



Goliath Grouper Photo Competition 2015

In an effort to increase awareness on the plight of [Atlantic Goliath Grouper \(*Epinephelus itajara*\)](#) and to further their Federally protected status, the [South Florida Underwater Photography Society \(SFUPS\)](#) is holding the first international photo competition in support of the species.

Atlantic Goliath Groupers were on a fast track to extinction but thanks to conservation efforts they thrive in South Florida waters. Every year from August through October hundreds return to local waters off West Palm Beach County for a mating ritual of collective spawning. Start planning your underwater photographic expedition to swim with one of the friendliest fish in South Florida.

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- Location:** Palm Beach County, Florida
- Prizes:** Dive Travel Packages, Scuba Equipment, UW Photo Gear, and More
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adjustments underwater, improving your chances of not missing the shot. A good starting point for camera setting would be f/11, 1/100, ISO 100-160. Once in the water, meter the water and adjust accordingly. Set the focus point 1/3 up from the bottom of the scene. This will provide good overall clarity and depth of field for the image.

The background color and brightness

Schooling scad, Aerobok Jetty, 1/100 f/9 ISO 160; Colorful pinnacle, Black Rock, 1/100 f/8 ISO 160 (right)





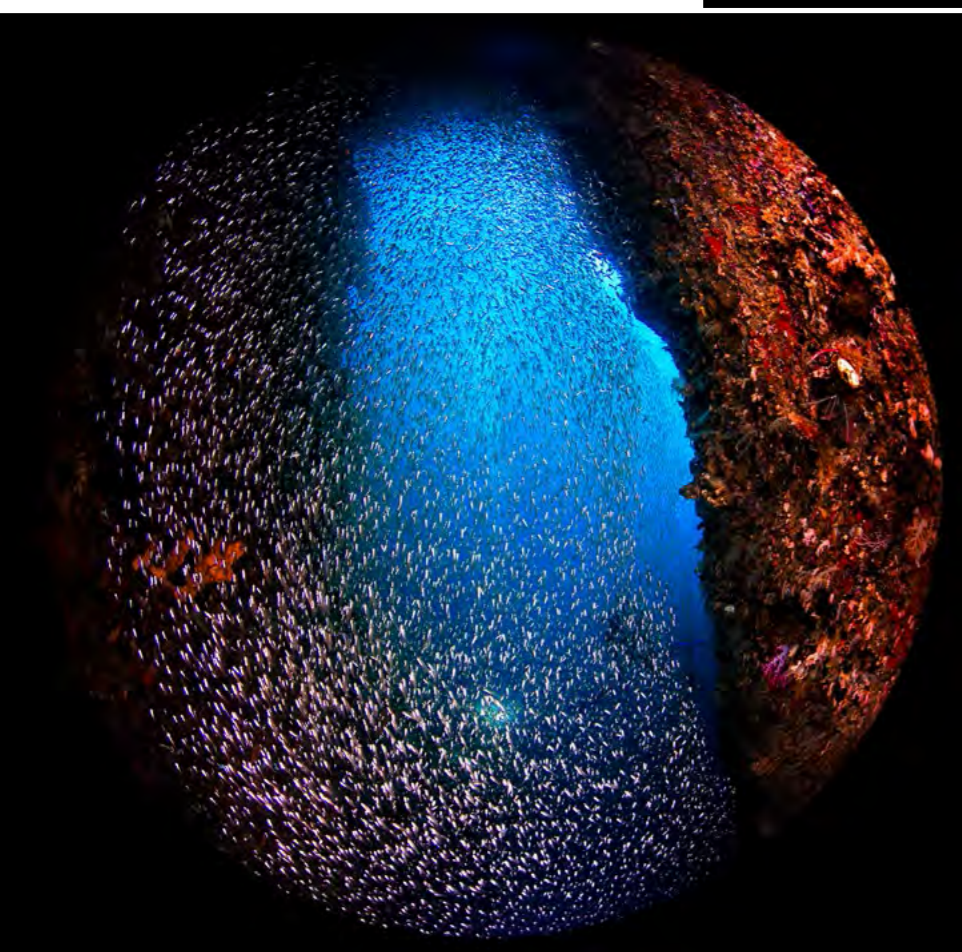
photo & video

Schooling barracuda, Barracuda Point
1/250 f/8 ISO 320;
Vibrantly colored
soft corals, Yeben
Shallows, 1/100 f/20
ISO 160 (far right)

is controlled by the shutter speed. The higher the shutter speed, the darker the background. If a blue background is too dark, lower the shutter speed to create a background with lighter shades of blue. However, if there is a moving subject in the frame, a minimum shutter speed of 1/100 to 1/125 is required to freeze the action. If the shutter speed is increased, it may be necessary to raise the ISO to compensate.

Artificial light

Lighting wide-angle scenes can be chal-



lenging. It takes time, patience and, most of all, practice. Balancing ambient light with artificial light can be a hurdle for those new to the technique.

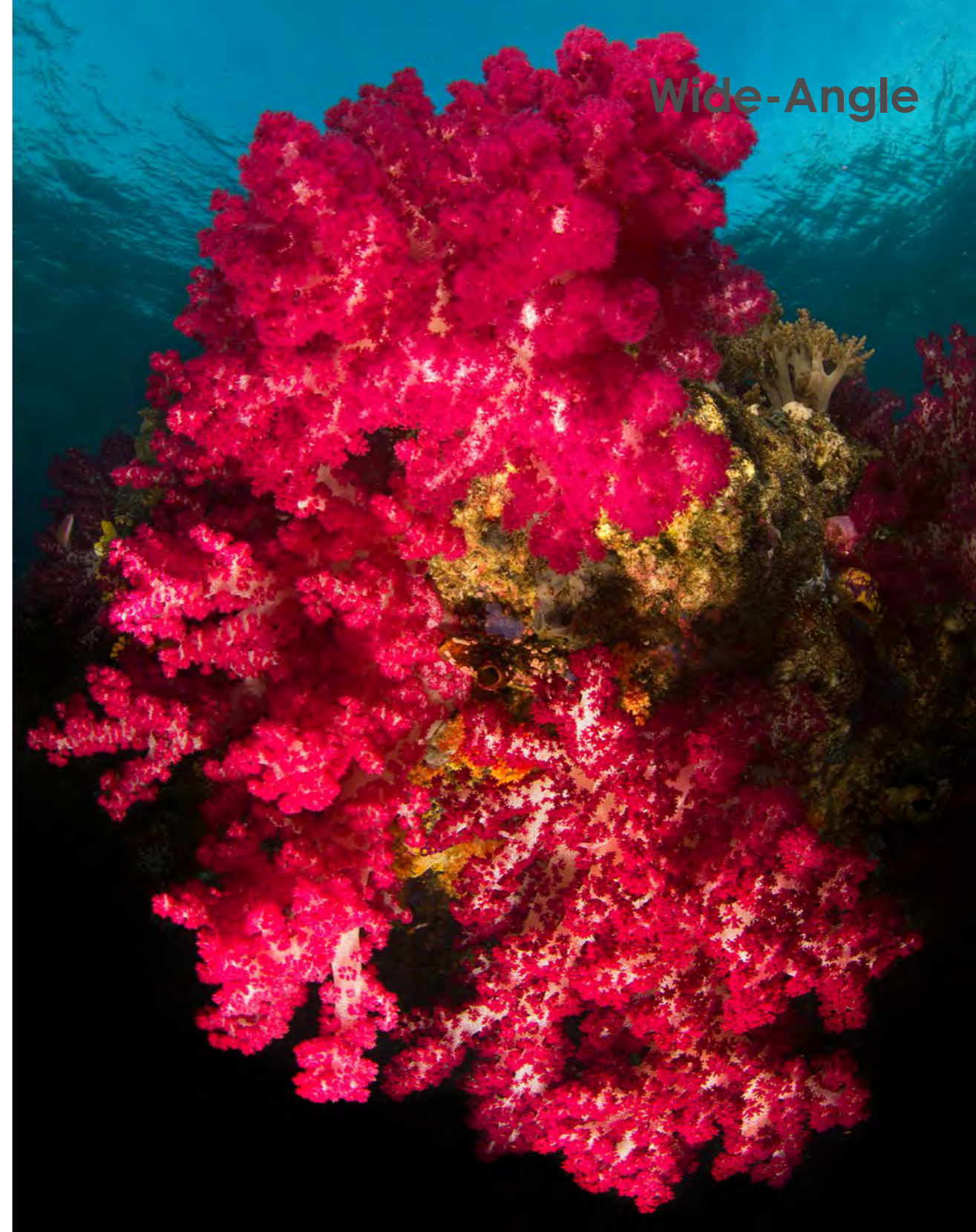
When lighting wide-angle scenes, several variables need to be taken into consideration. The position and strength of the sunlight, distance to subject, strobe power and camera settings all contribute to the end result.

Shooting a scene that is parallel to your camera lens will enable the entire scene to be evenly lit. Otherwise, the strobes will

not reach the distant areas of the image, resulting in diminished colors and dark spots. Use a diffuser on the strobes to soften and spread the light for even distribution.

For wide-angle images, longer strobe arms are ideal as they will add more lighting coverage. However, this does not necessarily apply to super wide-angle lenses, such as the Canon 5-15 fisheye lens. If long arms are used, it may be necessary to draw them in. Otherwise, the strobe light may not reach the center portion of the image, causing a dark spot. A solution would be to place a third strobe above the camera.

To prevent strobe flare and backscatter, extend the strobes behind the camera lens and angle them outwards. This is especially crucial when using a fisheye lens. Another technique is to position the sun behind you and adjust the strobes above the camera at the 10 and 2 o'clock positions. Aim the strobes in the same direction the sun is shining through the water. This will mimic the sun and add additional light on the subject. Experiment with dif-



Wide-Angle

ferent strobe positions to find out what works best for different situations.

A good starting point for strobe power is 1/4. Most wide-angle scenes can be adequately lit without cranking up the strobe to maximum power. Dial in the strobe settings manually instead of relying on TTL. It can be difficult to properly expose a wide-angle scene using TTL.

Ambient light, reflections and silhouettes

Eye-popping, colorful images can be achieved with ambient light. To get good color in your shots, shoot with the sun behind the camera and close to the surface. Less color absorption will take place in shallow water, creating colorful, sharp and detailed images.

Mesmerizing shoal of silversides, White Arrow, 1/125 f/8 ISO 160



photo & video

Reflections are fun and easy to shoot. Be creative and think outside of the box. Reflections can be inspiring and thought-provoking. Experiment with shooting in shallow water near the surface. Angle the camera until the reflections are visible in the viewfinder. The calmer the water, the more mirror-like the effect will be.

Silhouettes are captured by positioning the subject in front of the sun or light source. Attempt to cover



Patrolling manta, Barracuda Point, 1/125 f/9 ISO 320; Dappled Light, Yeben Shallows, 1/160 f/11 ISO 160 (right)

will begin to shimmer and dance through the water column. This daily short-lived phenomenon is known as dappled light. To capture this magical light, it's best to shoot in shallow water, 10 meters or less.

A higher aperture setting will create a sharper, crisper image. Adjust the ISO or shutter speed

Wide-Angle



The mangroves, Mangrove Slope, 1/100 f/10 ISO 160

up the entire light source with the subject. Be careful not to over-expose the highlights. Faster shutter speeds are required to stop moving subjects, creating a sharper image. A silhouette image can be dynamic, compelling and will most likely benefit from a black and white conversion. All these considerations will impact decision-making, camera settings and the camera angle.

Dappled light

Approximately one hour before sunset, sunlight

to compensate for dark images. It is good practice to check the histogram, evaluate, and make sure the highlights have not been overexposed.

Provided the sun is overhead, dappled light is visible for a short period every day. Be prepared and find the subject/composition early in the dive. Experiment with camera and strobe settings to find the optimal combinations before the light condition reaches its peak.

Snell's Window

Another interesting shooting technique is incorporating Snell's Window into an image. This is present at every dive and can be seen by looking up at the surface. It shows up as a bright

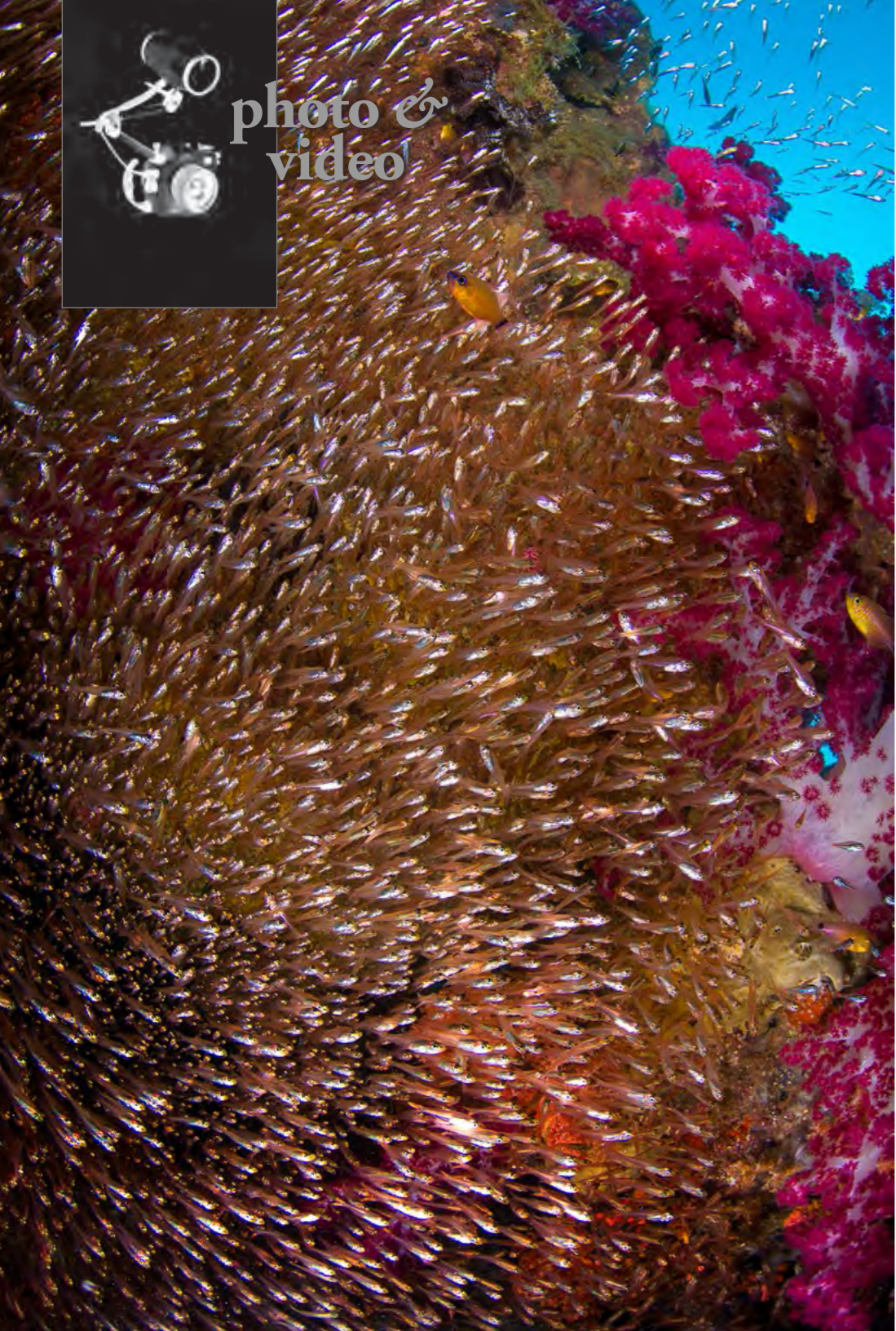


The mangroves, Mangrove Slope, 1/80 f/7.1 ISO 160





photo & video



Wall of glass fish, Edi's Black Forest, 1/125 f/10 ISO 160

circle directly overhead; the water outside the circle is usually darker. Refraction of light entering the water causes this intriguing phenomenon.

When the water is calm, navigate close the surface and a portion of the sky or shoreline can be seen from

below. Position, then angle the camera until the sky or shoreline is visible in the viewfinder. Unveil your creativity and experiment with composition and lighting.

A shallow area with interesting top-side scenery is a perfect location for



The shallows, Mangrove Slope, 1/50 f/10 ISO 160; Glass-fish and bommies, Citrus Ridge, 1/160 f/13 ISO 320 (left)



shooting Snell's Window. Throughout Bird's Head Seascape, trees and foliage line the shoreline, protruding out over the waters. The dive sites Yeben

Crank up the aperture, up to f/16 for DSLR's and f/11 for compacts; this will ensure that the entire scene is in focus. If the image is too dark, increase

Shallows and The Passage offer great photo opportunities.

Over-Under

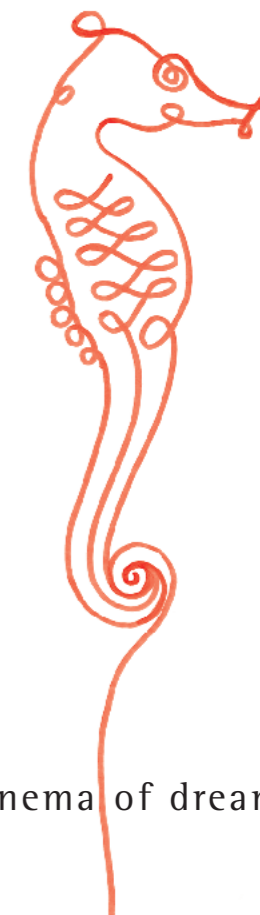
Another term for an over-under image is split-shot. Here, a single frame contains both an underwater and topside subject. It is best to use a fisheye lens with a large dome port.

the ISO or slow the shutter speed. Strobes are typically used to light the underwater portion of the image. Meter and expose for the top-side portion, put the focus on something underwater for best results. To prevent water droplets from forming on an acrylic dome port, rub shampoo or RainX on the port before the dive and rinse it off in the water. Another technique is to spit, rub, dunk, and shoot. Be quick, as water droplets can form on the port after a couple of seconds. Glass dome ports aren't as susceptible to water droplets as acrylic ports.

Conclusion

Diving Bird's Head Seascape is a wonderful experience, both above water and below it. The photographic opportunities are truly remarkable, from schooling fish to amazing coral bommies, and everything else in-between. It's a destination that begs to be re-visited.

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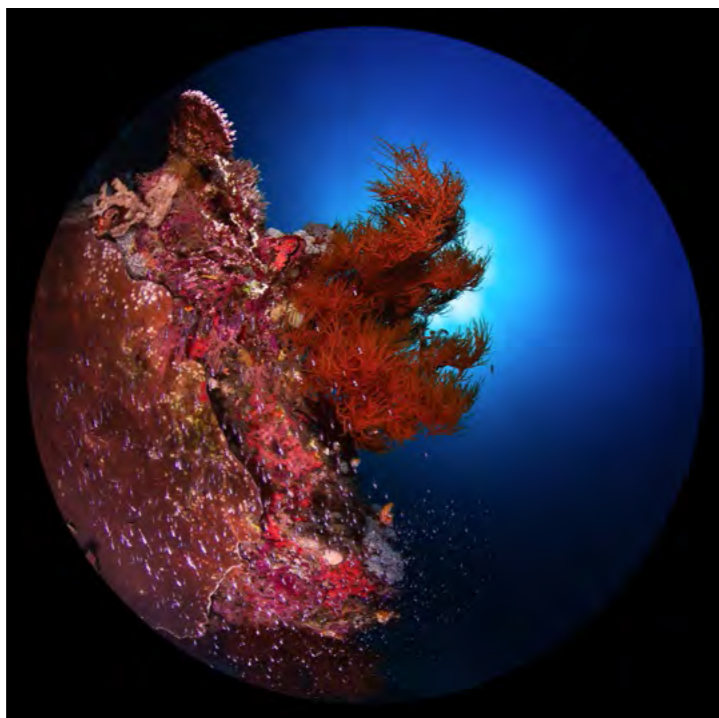


Early morning light, Raja Ampat, 1/640 f/8 ISO1250

Take it to the next level. Trial and error is intrinsic to improving photography skills. Learn from mistakes. It may require many captures and discards before the next printworthy image is created. Be a visionary—if you see it, you can shoot it!

Tips & tricks

- Include a diver in the scene. This adds interest, scale, and gives the viewer a sense of “being there”.
- Take control of the camera. Try shooting with manual settings.
- Void/Negative space is a welcome element in image composition.
- Always shoot in RAW, if possible. This will allow for non-destructive editing practices.
- Don't sweat over the white balance of an image, as this can be easily corrected in post-processing.
- Look at other photographer's works and learn from them.
- Be creative and think outside of the



- box. Try new techniques.
- Venture outside your comfort zone.
- Expect the unexpected. ■

Beth Watson is an awarding-winning, internationally published underwater photographer based in the US state of Missouri. She conducts workshops in underwater photography at premier dive destinations around the world. To find out more about her next workshop, please visit her website at: www.bethwatsonimages.com.

Wide-Angle



Soft coral and schooling scad, Aerbork Jetty, 1/125 f/8 ISO160; Pristine seamount, Mayhem, 1/160 f/13 ISO160 (left)





photo & video

Edited by Peter Symes

PRODUCT SHOTS COURTESY OF THE MANUFACTURERS



Mini 5000

Built for the wide-angle videographer, the new Aquavolt Mini 5000 arcs its 5000 lumens in a 100-degree beam angle and yields an eye-warming 5000 Kelvin, NeoFix writes. An interchangeable battery system permits easy swapping of batteries between dives. The Mini 5000 can use the FR1 Remote Control unit, enabling lighting control while keeping your hands on your housing. Depth rated at 150m. Fixneo.com



Radiant Pro 2500

Our contributor, Larry Cohen, brought a couple of Fantasea's Radiant Pro 2500 Video Lights to Norway for use with both stills and video, and he seemed pretty pleased. Results will be posted in an upcoming feature. Fantasea states operation modes include wide angle white light (120 degrees), narrow angle white light (15 degrees), red light, Ultra Violet (UV) and Blue light and two flashing modes (white and red) that can serve for signaling or SOS purposes. In the flashing modes, the light can provide up to eight hours of burn time (assuming the batteries are fully charged). Fantasea.com



Need for speed?

Available for purchase later this year, the 128GB Lexar Professional 2000X SDXC UHS-II card will be the fastest UHS-II memory card available at this capacity on the market, boasting read transfer speeds up to 300MB per second. Lexar.com

Spare camera batteries no longer permitted in checked bags

To reduce the risk of lithium battery fires in aircraft cargo and baggage compartments the US Department of Transportation has taken the step of prohibiting spare lithium batteries from checked baggage (including baggage checked at the gate or on-board the aircraft).

Henceforth, spare lithium batteries will have to be packed in carry-on luggage, and batteries must be individually protected so as to prevent short circuits (e.g., by placing them in original retail packaging, by otherwise insulating

terminals by taping over exposed terminals, or placing each battery in a separate plastic bag or protective pouch).

Batteries must not come in contact with metal objects, such as coins, keys or jewelry, and steps must be taken to prevent crushing, puncturing or pressure on the battery.

Note: "spare" refers to lithium batteries not installed in a portable electronic device i.e. being inserted into the camera. ■



PETER SYMES

You may no longer bring extra lithium camera batteries in the checked luggage. They must go in the carry-on.



PETER SYMES

Scenery dictates our perception of color

Our color perception changes between seasons and in particular how we process the color known as unique yellow, scientists at the University of York have found. Unique yellow is particularly interesting to scientists as it is stable across large populations—everyone agrees what unique yellow looks like despite the fact that people's eyes are often very different.

The researchers wanted to find out why this color is so stable and what factors might make it change. They thought that unique yellow might depend not on the biology of the eye but on the color of the natural world.

"In York, you typically have gray, dull winters, and then in summer, you have greenery everywhere. Our vision compensates for those changes and that, surprisingly, changes what we think 'yellow' looks like," PhD student and lead author, Lauren Welbourne, said. "It's a bit like changing the color balance on your TV."

"This is the first time natural changes in the environment have been shown to affect our perception of color. For me, as a vision scientist, it is fascinating as it is telling us more about how visual processing works," said Welbourne. ■

SOURCE: UNIVERSITY OF YORK

Our perception of yellow changes with the season. This process is very useful because you can adapt to these huge seasonal changes in environmental color and continue to see and discriminate between colors accurately.

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Nicolas Pain



P O R T F O L I O



Text edited by Gunild Symes
All artwork by and photos
courtesy of Nicolaoas Pain

British artist, Nicolas Pain, creates sinuous and sublime bronze sculptures of marine life, full of movement and evoking an atmosphere of water, inspired by his own adventures under the waves as an avid scuba diver. X-RAY MAG interviewed the artist to find out more about the self-taught artist's graceful sculptures and what excites him about the underwater world.

X-RAY MAG: Tell us about yourself, your background and how you became an artist.

NP: I always liked painting and drawing but enjoyed making models most of all as I was growing up. Looking for a means of turning my artistic skills into a career, I initially studied graphic design and entered the advertising industry on graduating in 1990.

I didn't really take to this, so I then moved into video games in 1999, working as a 3D modeller and texture artist. I eventually ending up as the art studio manager for one of the United Kingdom's leading game developers—if you are into driving games, you've probably played some of the titles I've worked on over the years.

I started sculpting in my free evenings and at weekends as my career became



more management-orientated. I needed a creative outlet with a direct response to my diving.

X-RAY MAG: Why marine life? How did you come to this theme and how did you

PREVIOUS PAGE:
Manta Ray Flight
by Nicolas Pain.
Bronze sculpture
52 x 25 x 33cm



Manta Rays, by Nicolas Pain. Bronze sculpture, 40 x 25 x 37cm; Three detail views of *Manta Rays* (left)



develop your style of sculpture over time?

NP: I started diving in 2000 and quickly became hooked. The choice of subject matter for my work was then very easy and natural: the creatures I encountered while diving. My first piece was the *Octopus*, which was inspired by a year in which I frequently saw these fascinating animals both in the UK and abroad.

A particularly memorable occasion was under the stern of the wreck of

the *Hispania* in the Sound of Mull, which gave me the idea to seat it [the octopus] on a rock. The other pieces then swiftly followed, after I exhibited the *Octopus* at the Society of Wildlife Artists annual exhibition at the Pall Mall Galleries in London, encouraged by a very positive response to my debut piece.

My work has then developed to focus more on the movement of undersea creatures, an aspect of my work which is very much driven by my diving. The final configuration of

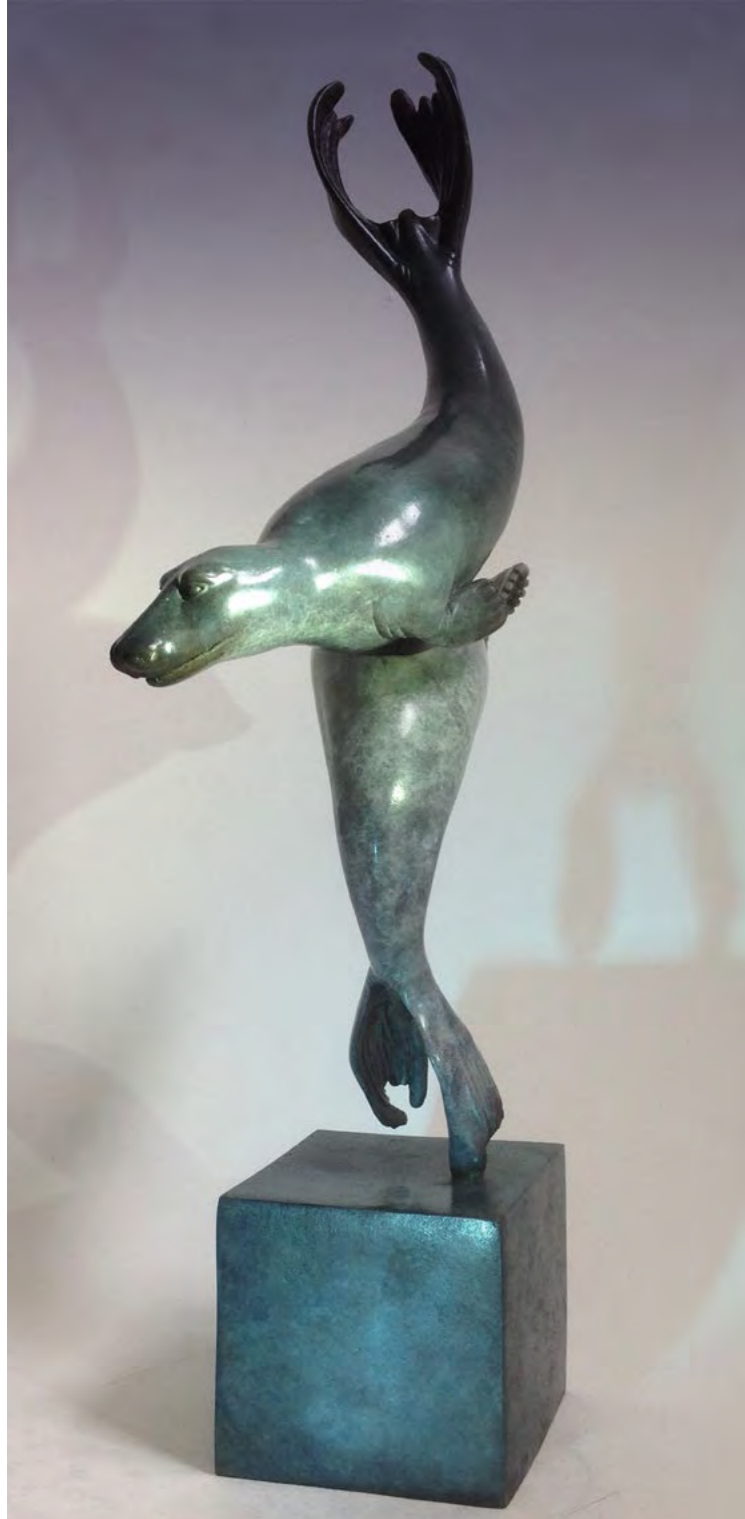
the *Hammerhead Sharks* came out of the problem of how to mount and display the individual animals without interfering with their fluid swimming motion. This resulted in, after much trial and error, balancing them fin tip to fin tip without a mount or base. I worked this out by building a large wooden frame and hanging individual models from wires until I achieved a satisfactory balance and composition. This is a theme that I have pursued in my most recent work the *Grey Seals* and *Manta Flight*.



THIS PAGE: Two views of *Hammerhead Sharks*, by Nicolas Pain. Bronze sculpture, 54 x 20 x 21cm

THIS PAGE: Various views of *Grey Seals*, by Nicolas Pain. Bronze sculpture, 46 x 25 x 12cm

Nicolas Pain



that sparks my imagination, the way a creature moves or how a group of creatures move together. Another source of inspiration is the work of underwater photographer and friend, Rob Bailey.

Once I have decided on a subject, I then make a number of rough models to get a

sense of the overall shapes and configuration of the final piece. This can take a lot of iteration, but when this is resolved, I then make much more detailed models and really focus in on the creature's anatomy and muscle

structure. The final models are then used to produce moulds for waxes, which are used in the lost wax casting method. The resulting bronze casts are then chased to emphasise smaller details, treated with a chemical patina and polished with tinted waxes to produce the final coloration that you see.

X-RAY MAG: What is your relationship to marine life and the underwater world? How did you get into diving and how has diving influenced your art? In your relationship with fish and the sea, where have you had your favourite experiences?

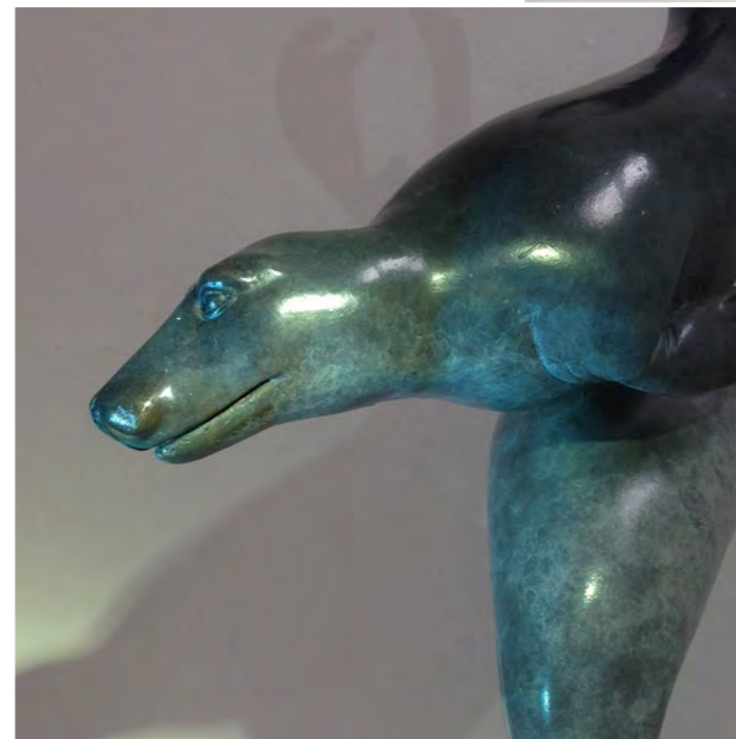
NP: I have always been fascinated by the underwater world probably starting with the Jacques Cousteau documentaries of the early 1970s, which I watched as a child. They were full of weird and wonderful creatures and the promise of sunken treasure. I started diving

15 years ago with a local BSAC club where I made many good friends and learnt a great deal. As my interests and desire to undertake more exploratory trips broadened, I bought a small RIB and now mainly dive with my girlfriend, Rose, who is a marine wildlife jeweller.

Diving has had a profound influence on my work, both in terms of the choice of subject matter but also the portrayal of the movement of these creatures. I think seeing them move underwater in a different medium is an enduring theme that I strive to reflect in my work.

My favourite experiences are those special encounters with marine animals; the octopus will always be a favourite because of the multiple different shapes this creature can assume. I'm now working on a larger more detailed sculpture.

Another special memory is a day when our diving was actually blown out, and we were



X-RAY MAG: What is your artistic method or creative process? In step-by-step terms, how do you create your artworks?

NP: Some of my work starts simply by diving and seeing something



walking on Looe Bar Cornwall. The bar was unusually covered with a warm-water species of jellyfish, which had been blown off-course, including Portuguese man o'war. It was then that we found a juvenile loggerhead sea turtle; he was hypothermic and dehydrated.

We called the Blue Reef Aquarium in Newquay and arranged to meet the guy who runs the rescue program. We then carried the turtle in a bucket of sand to the nearest village, Porth Leven, where we handed him over to Matt from the aquarium. Squirt, as the aquarium later christened him [the sea turtle], made a full recovery and was later released in Tenerife.

Of course, dolphins are always exciting fun both here in the UK and in the Red Sea. I'm always surprised how big they are. We've often see small family pods in Cardigan Bay

when diving on Sarn Badrig in North Wales.

X-RAY MAG: What are your thoughts on ocean conservation and how does your artwork relate to these issues?

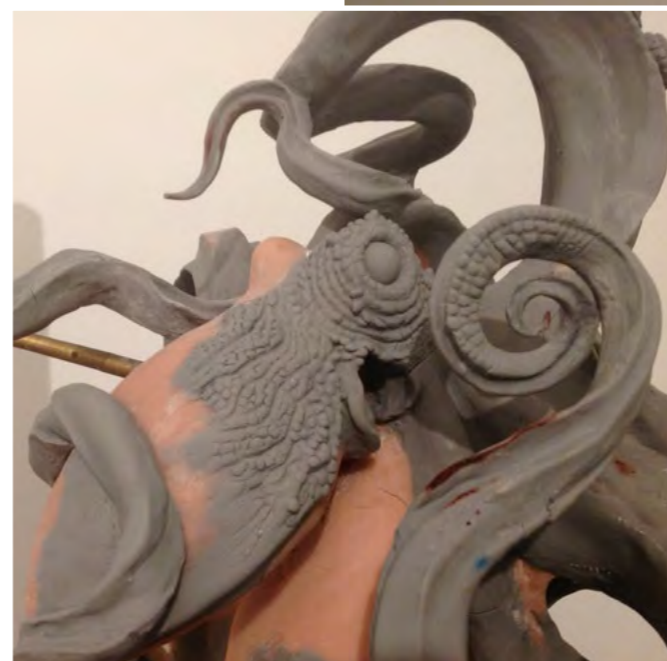
NP: I am very concerned with the declining levels of marine wildlife through over-fishing and pollution. I often think for every fish I see, there would have been 10 more 50 years ago.

I exhibit my work with the David Shepard Wildlife Foundation in their annual London exhibition. Fifty per cent of the proceeds goes to the charity. So I was very pleased that my *Grey Seals* sold there earlier this year.

I think my work represents a simple appreciation and admiration for marine life and hope that it



THIS PAGE: Three bronze sculptures by Nicolas Pain: *Cuttlefish*, 43 x 34 x 34cm (above); *Octopus*, 25 x 19 x 19cm (top left); and *Seahorses*, 42cm (inset)



Two views of *Octopus iii*, the artist's latest work in progress; The artist, Nicolas Pain, at work (right)

NP: My main audience is largely made up from divers who often relate my sculptures to their personal

experiences. I also have a growing cliental of non-divers who have an interest in wildlife again, who often describe personal encounters with marine creatures as the attraction of my work. I find this reassuring, that my work is capturing the essence of these animals so that it evokes these responses and memories in others.

X-RAY MAG: What are your upcoming projects or events?

NP: I'm currently working on two new pieces at the moment: a much larger and more detailed free-standing octopus and a large manta rays sculpture. I'm aiming to have these ready for exhibition next year.

A selection of my work will be



on display at the NEC Dive Show, Birmingham, UK (24-25 October 2015). My work is also on display in the No. 4 Gallery, just above

St Abbs harbour. I'd really like to hear from readers and hope to exhibit my work internationally in the near future. ■

For more information about the artwork and commissions, please visit the artist's website at: Nicolaspain.co.uk

communicates this respect to others.

X-RAY MAG: How do you come to your ideas and what or who inspires you? What is the message or experience you want viewers of your artwork to have or understand?

NP: Diving, above all, is my main inspiration. My first hand experience of seeing the animals move underwater is a unique experience that brings an additional dimension and authenticity to my work. I think my work has as simple message:

Look at this creature. It is complex, beautiful and precious. It deserves our respect and many now need our protection.

X-RAY MAG: What are the challenges and/or benefits of being an artist in the world today?

NP: I think the Internet is one of the greatest benefits of the world today. It has enabled me to reach a much wider audience than I could have in the pre-World-Wide-Web days. I have a lot more direct contact with clients and many more opportunities to display my work. My main challenge is never having enough time—either for diving or artwork

X-RAY MAG: How do children and adults respond to your work? What insights have you gained from the process of showing your work to different audiences?