



GLOBAL EDITION
July 2019
Number 92

Sharks
Southern Honshu

Wrecks
Lake Zurich

Indonesia
Halmahera

Ponza
Rebreather Meeting

Albania
Viroit Cave

UW Photo
Rembrandt Lighting

SOUTH AFRICA

Sodwana Bay

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Copenhagen, Denmark

www.xray-mag.com

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COVER PHOTO: *Yellow-dotted flatworm at Pinnacles dive site, Sodwana Bay, South Africa*
Photo by Kate Jonker (katejonker..com)

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Schooling coachman at Mushroom Rock, Sodwana Bay, South Africa. Photo by Kate Jonker.



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Keep Going Back to Basics

Once upon a time, I conducted some Advanced Open Water Diver classes. A standard exercise I always performed at the onset of the course was to revisit the procedure for finding the correct weighting, which is part of the standard curriculum in all entry-level dive courses.

Novice divers, who have yet to fine-tune their weighting, tend to be a tad over-weighted. The groups I taught the Advanced curriculum invariably ended up leaving a substantial heap of superfluous leads behind on the jetty as we set out to do the first dive. It had never occurred to any of the participants to go back and revisit the curriculum or conduct any of the exercises from their previous course. As a result, almost without exception, every student had gone on carrying too much weight as they went on diving.

Most skills in life and work take time to acquire and fine tune. Even accomplished musicians keep on practising scales. We rarely fully appreciate the breadth and depth of new wisdom the first time we are taught it. We surely do not retain much of it, for starters.

In fact, it has been known since the 1880s that humans tend to halve their memory of newly-acquired knowledge in a mat-

ter of just a day or two—unless the material is consciously reviewed. This is also why skilled educators and presenters will take steps to reiterate and rephrase key subject matter during their presentations. If you think back on your dive training, perhaps you can recall how your instructor concluded each session by rehashing the main points, reminding you about how and where these points fit into the bigger picture.

I find myself going back to the basics ever so often, for a number of reasons. Regarding rebreather diving, I seem to have become a perpetual refresher student, as I keep on falling out of practice for extended periods of time, due to the demands of running a business. So, I really have no choice but to go back to the basics, as I want to stay safe and do the prudent thing.

But it's all good. I do not mind acknowledging my inadequacies and climbing the learning curve from the bottom once again. It seems my perspective always gets better during each climb, and each ascent gets smoother and quicker.

Regarding photography, which I do almost every day, there is a much higher level of proficiency, stemming from both routine,

experience and continual study of techniques. Yet, there is always room for improvement, and studying new techniques is fun. I frequently go back to basics in photography, as it brings some added clarity and purity every time.

Going over your old manuals, course materials and text books again not only refreshes your memory, but next time around, you may discover new contexts or connections.

Perhaps you could lose some weight too.

— Peter Symes
Publisher & Editor-in-Chief





News edited
by Catherine GS Lim

from the deep NEWS

Blue Belt of Marine Protection Created in United Kingdom

Here's some good news for marine creatures in the United Kingdom—a large area almost eight times the size of London has been designated as a series of protected blue belt zones. Covering some 12,000 sq km of England's seas, the area will range from the Northumberland coast to the seas south of the Isles of Scilly.

It will comprise 41 marine conservation zones specially designated to provide protection for animals both under and above the ocean surface. Hence, creatures like eider ducks, rare stalked jellyfish, long-billed curlews, basking sharks and short-snouted seahorses will come under its fold.

According to a government press release, the expansion is in line with its "manifesto commitment to create a Blue Belt of marine protection for Britain's overseas territories and its own coast, and builds on the ambition of the 25 Year Environment Plan."

The establishment of the 41 zones is the most significant expansion to date of England's "Blue Belt" of protected areas, bringing the number of Marine Conservation Zones in the United Kingdom to 91, and the number of Marine Protected Areas to 355.

Stauromedusae
or stalked jellyfish

Michael Gove, the environment secretary, said: "Establishing this latest round of marine conservation zones in this 'year of green action' is another big step in the right direction, extending our blue belt to safeguard precious and diverse sea life for future generations to come."

Although applauding the new marine conservation zones, conservationists cautioned that it was essential the areas be well managed.

Joan Edwards, director of living seas at The Wildlife Trusts, said "Now we need good management of these special areas to stop damaging activities such as beam-trawling or dredging for scallops and langoustines which harm fragile marine wildlife."

Alec Taylor, head of marine policy at WWF, agreed, saying in an article in *The Independent*: "We need proper management



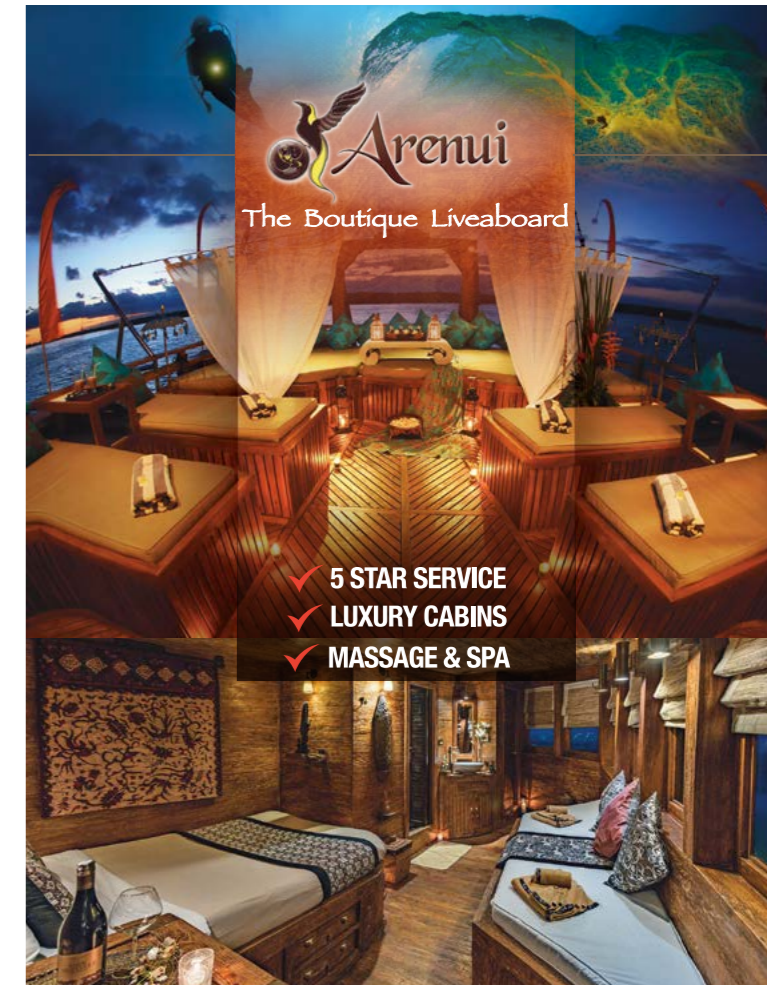
Basking shark

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Short-snouted seahorse

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Deepest submarine dive in history completed by Five Deeps Expedition at Challenger Deep

It was during the fourth mission in May that explorer Victor Vescovo reached the deepest point on earth within the Mariana Trench with the support of the expedition team, using the operational submersible, the *Limiting Factor*.

The first human to make multiple solo dives to the hadal depth in the Triton submersible, Vescovo set a new deep-diving record. A maximum depth of 10,928m (35,853ft) was reached, which is 16m (52ft) deeper than previous manned dives.

"It is almost indescribable how excited all of us are about achieving what we just did," said Vescovo after his arrival in Guam upon the completion of the dives. "This submarine and its mother ship, along with its extraordinarily talented expedition team, took marine technology to an unprecedented new level by diving—rapidly and repeatedly—into the deepest, harshest area of the ocean. We feel like we have just created, validated, and opened a powerful door to discover and visit any place, any time, in the ocean—which is 90 percent unexplored."

It was filmmaker and explorer James Cameron who last visited the bottom of Challenger Deep in 2012, in his submersible, the *Deepsea Challenger*. Nearly six decades before him, US Navy Lieutenant Don Walsh and Swiss scientist Jacques Piccard made

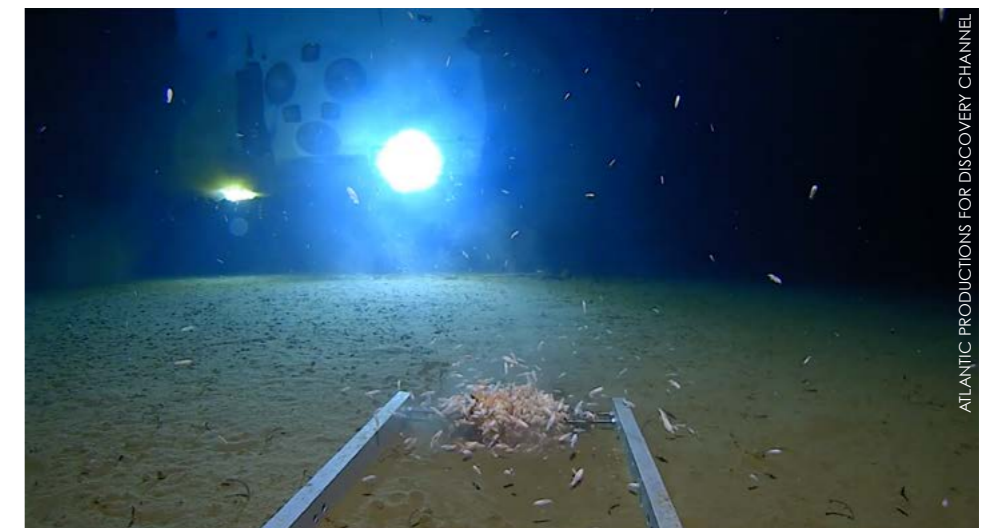
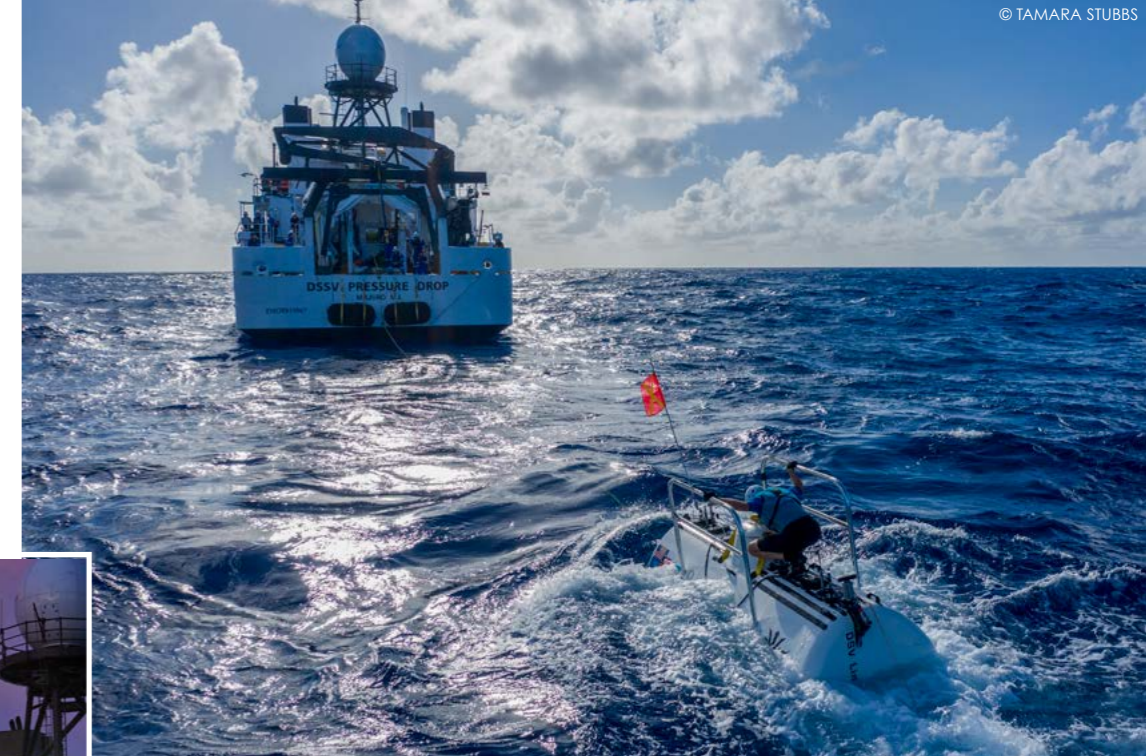
the first-ever dive at Challenger Deep in 1960, using a US Navy deep submergence bathyscape, the *Trieste*. They reached a depth of 10,912m. Walsh was aboard the DSSV *Pressure Drop* for the *Limiting Factor's* historic dive.

"Victor Vescovo's imagination and fierce curiosity, Triton Submarines' technical brilliance, and the outstanding performance of the officers and crew of mother ship, *Pressure Drop*, all converged to make this expedition a huge success. And I was there to see it," said Dr Walsh (Captain, USN Ret.).

Designed and built by Triton

Submarines, the *Limiting Factor* is the world's deepest diving submarine currently in operation. Expedition leader and EYOS Expeditions co-founder Rob McCallum said: "This vehicle is effectively a reliable elevator that can transport us to any depth, in any ocean. During this expedition we have traversed over 110 vertical kilometres (68 miles) and proved the capabilities of a vehicle that will be a platform for science, film-making

The expedition vessel DSSV *Pressure Drop* and the Triton submersible DSV *Limiting Factor* at the Mariana Trench in the western Pacific Ocean (right and below); Underwater image of *Limiting Factor* during the Mariana Trench dive (lower right); Victor Vescovo piloting the submersible *Limiting Factor* on the bottom of the Mariana Trench (bottom left); Dr Don Walsh congratulates Vescovo on his historic dive to Challenger Deep in the Mariana Trench (bottom center)



depth of 10,823m (+/-10m) or 35,509ft (+/-33ft) was shallower than that of the Mariana Trench's Challenger Deep.

A Kongsberg EM124 multi-beam sonar was used to conduct sonar mapping of the Horizon Deep, covering over 13,100 sq km of the ocean floor, with a resolution of 75m. The collected data will be donated to the GEBCO Seabed2030 initiative.

"Less than a month after diving five times to the bottom of the Mariana Trench, we dove the submersible *Limiting Factor* a sixth time below 10,000 meters to continue our exploration of the world's deep trench systems.

There were some lingering doubts if the Horizon Deep might just be deeper than the Challenger Deep, and it is close—only 105 meters shallower—but it is not," said Vescovo. "The expedition is very proud to have confirmed the exact depth and location of the deepest points in four of the world's oceans, and we look forward to finishing up our mission in the Arctic Ocean."

A five-part documentary series of the Five Deeps Expedition is being filmed by Atlantic Productions, which will air on the Discovery Channel in 2019. ■

Learn more at: fivedeeps.com.

and exploration of Earth's hidden recesses."

The planet's second deepest point reached

In June this year, Vescovo became the first person to solo dive to the bottom of the Southern Hemisphere's deepest point—Horizon Deep in the Tonga Trench. With the world's first manned descent into the Tonga Trench, the Five Deeps Expedition team confirmed that the Horizon Deep's

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Ship's wheel on recently discovered wreck of a motorized cargo ship thought to date from the late 19th or early 20th century

Text and photos by Jens O. Meissner and Helmut Spangler

Why travel far when good things lie right at your doorstep? In our case, the “good thing” was Lake Zurich, a midsized lake in the German-speaking part of Switzerland. The city of Zurich is located on the northern end of the 40km-long lake, which still holds some secrets in its depths. In this article, we present two wrecks recently found in the lake and the journey of their exploration.

A big chunk!

May 2017, a dull day. We were on a mission to search for “something big” in Lake Zurich. A strange track on the lake bottom near a well-known dive spot piqued our curiosity. It was our lucky day! Surprisingly, during the dive, we bumped into one of the old wrecks of the lake—exactly at our planned point of return. We gave

ourselves three extra minutes, and then we returned to the surface to celebrate and to plan new exploratory dives on the wreck.

A body of water has to be just large enough that it eventually unlocks one's curiosity to explore

its most hidden corners. For Lake Zurich, this moment caught us at the end of 2016. The dive center 7Oceans had just relocated to a building near Sust, a harbor in Horgen on the western shore of the lake. With this move, the time

to get to new dive spots shrank to a minimum, our range expanded dramatically, and new dive sites awaited exploration.

Lake Zurich

Lake Zurich has been part of

inland seafaring since humans began settling in the area, approximately 8,000 years ago. Located between the northern borders of the Alps and reaching 40 miles into the lowlands to the north, it was an excellent

waterway to transport goods of all kinds, but mainly heavy cargo such as stone, sand, wood and cotton. Archaeologically, Lake Zurich is protected as a UNESCO World Heritage Site because of the lake dwellings, which are

Lake Zurich

— *Deep Cold-Water Wreck Diving in Switzerland*





Clearly recognizable composite construction on the wreck of a 19th century cargo ship with cabin, recently discovered in Lake Zurich



thousands of years old, located in the shallow waters along its shores. The rest of the dwellings found here date back to the sixth millennium BC and are intensively researched and documented by the respective cantonal (Swiss member state) departments of archaeology. But the cultural treasure also comprises up to 60 shipwrecks that are estimated to be lying on the floor of the lake, which is up to 136m deep.

We found the track on the lake bottom close to a well-known dive site, known for its drop-off wall, and we were curi-

ous about what was lying down there. Just a couple of years ago, we found a wreck with a concrete hull near Horgen at a depth of 50m. Sadly, it sank during its launch ceremony, 100 years ago. But it has become a boon for divers who want

to visit a completely preserved wreck—and is an excellent target for rebreather trimix dives.

Risk assessment

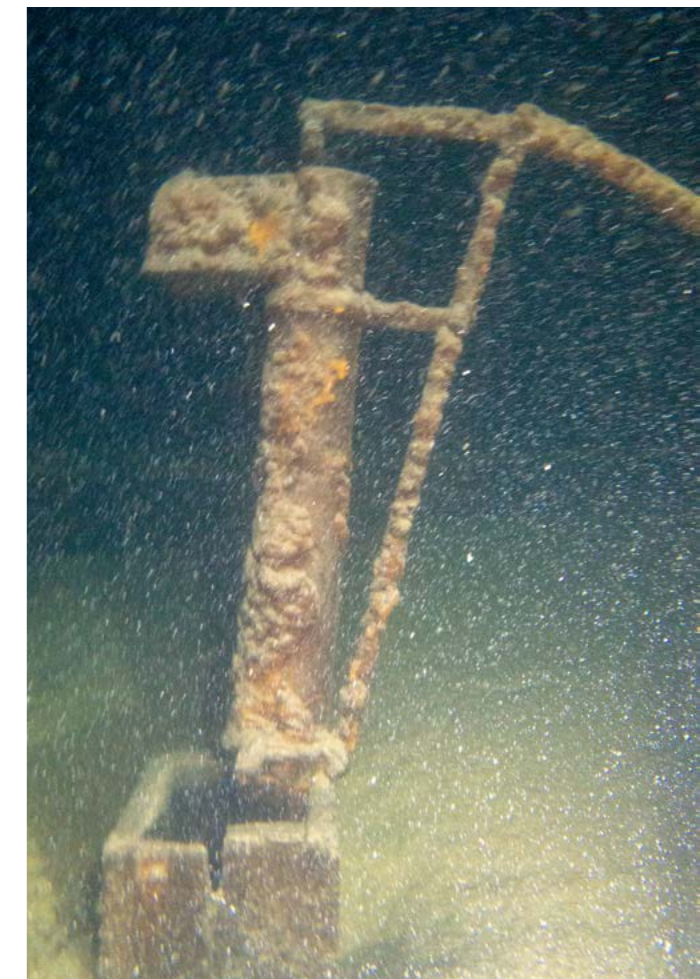
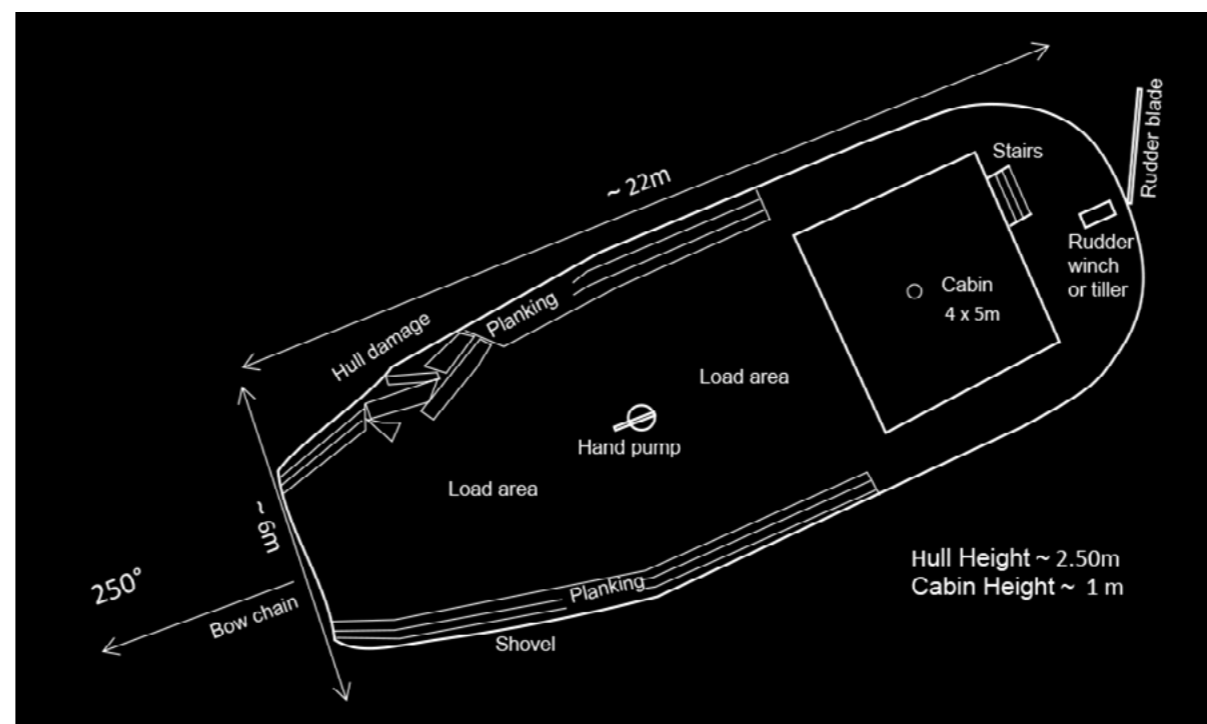
New dive sites always require new risk assessment, and solutions to mitigate the risks. In the case of Lake Zurich, the biggest operational risk was the shipping traffic. Zurich is a metropolitan area with one million inhabitants. Thus, passenger transports are very frequent at the northern end of the lake. It took quite a while to identify the time slots that allowed us safe decompression diving. Our wreck of a cargo ship (in Swiss, a *Ledischiff*) lay at

Date	Time/Depth	Remarks
03.08.17	78m/94ft	Discovery! Found wreck of a cargo ship with cabin at point of return.
22.08.17	47m/51ft	Dive aborted. Harness malfunction.
30.08.17	75m/97ft	Unsuccessful. Found small sailing boat instead. Lost diving torch.
06.09.17	75m/104ft	Unsuccessful. Found a kayak instead. Retrieved dive torch.
20.09.17	39m/34ft	Unsuccessful. Called off the dive due to malfunctioning gear.
11.10.17	74m/91ft	Unsuccessful. Went too far. Found a canoe instead.
18.10.17	80m/100ft	Unsuccessful. Went too deep. Frustrations arose.
25.10.17	75m/122ft	Unsuccessful. Different strategy: Laid guideline after searching 10 minutes.
08.11.17	76m/146ft	Rediscovery! Laid a second guideline directly leading to the wreck.
15.11.17	77m/77ft	Unsuccessful. Not far enough. Aborted dive due to leaking glove.
29.11.17	60m/90ft	Searched downwards of the track on the lake bottom. Gear malfunction. Surface temperature dropped to 9°C. Heating vest failure. It got uncomfortable on decompression stops.
06.12.17	76m/90ft	Found wreck. First videography. One rebreather oxygen cell dropped out. Surface temperature lowered to 7°C. Decompression stops were nasty now. Cable broke in heated glove.
13.12.17	74m/86ft	Found wreck on detour via first guideline. Leak in left glove. Lost camera. End of season!

Table 1: Exploration history of the wreck of a 19th century cargo ship with cabin in Lake Zurich

the end of the track on the lake bottom, at around 75m depth. But the exploration was not a linear process (see Table 1).

As the exploration history shows, retrieving the wreck after the first discovery brought new problems. The lake floor quickly drops down to 65m, then flattens out to a maximum depth of approximately 90m at this site. The area at around 70 to



A hand pump used to remove bilge water (above); Diagram of the first wreck site (left)

Starboard side of the first wreck—a 19th century cargo ship—recently found in Lake Zurich



A typical rudder blade for a cargo ship, or *Ledischiff*, excellently preserved (right); Hook for rudder lashing (below) on the wreck of a 19th century cargo ship



80m depth is 300m wide. The lake bed has slight hillocks, so navigation is a real challenge. At depth, it feels like one is in a dark desert as depth contours are missing, other landmarks are absent and maximum visibility never exceeds eight meters. Water is 4 to 5°C all the time, and the surrounding area is completely black.

Since landmarks were missing, compass navigation did not work very well. It was better to mark the area with guidelines, which were 30m in length each. The lines served as reference points

for further exploration. The few landmarks that we found (i.e. diverse small vessels) helped us get a better overview. In the end, we could reach the wreck with a high likelihood of finding it. Our research and documentation of the wreck was conducted in cooperation with the Department of Underwater Archaeology of the Canton of Zurich.

The cargo wreck

The shipwreck measures 22m in length, six meters in width and approximately three meters in

height. It has a cabin at the stern and a cargo area, which spans over the first two-thirds of it, with a beam pump in the middle. The ship has noticeable steering gear, with a rudder blade and winch behind the cabin. The winch could pull up the rudder to allow disembarking on the shallow banks of the lake. This type of steering gear was a special construction specific to this region and has only been found once before in Switzerland. The rudder blade has a typical curved form.

When the ship sank and hit the lake bottom, the interior collapsed, and the impact completely demolished the cabin. A further investigation of the details is pending. There is a good chance that this ship sank on 29 September 1858, when the steamship *Rapperswyl* rammed the cargo ship in dense fog at the village of Thalwil. Interestingly, the lake's daily newspaper at the time reported that the ship and its cargo were salvaged a week after the event. The collision damage we found at the starboard bow exactly fits the description in the paper. However, a suspicious part in the cabin looks to be a driving



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Lake Zurich

Historical photo of a cargo ship (above), similar to the motorized cargo ship found (right)



Horn cleat (left) and bow (above) on the first wreck site found—a cargo ship

One wreck never shows up alone

In 2017, a tip from the local lake police drew our attention to another suspicious wreck site near Thalwil. Since it is a metropolitan region, Lake Zurich

offers the advantage that divers can potentially enter the lake anywhere, if permitted. During the first wreck exploration, we used a boat ramp. This second wreck site had a landing stage, occasionally used by a couple of swans, some bathers and a boating school. The place was the perfect spot to sort out all of our gear prior to the dive.

Again, preparations were made to avoid contact with any boat traffic during the dive or during decompression stops. Since Thalwil is a landing place for at least three regular shipping lanes, it was more difficult to find an open slot, but not impos-

sible. Besides the passenger transports, the presence of fishing boats and tourist vessels make a direct ascent from a dive to the surface in the middle of the lake an unacceptable risk. Hence, our exploratory dives were clearly overhead dives. The shipping timetable in fall and winter opened up more safe opportunities for diving compared to the summer months. The best time to dive the site was brief and fell between late October until it got too cold for safe and convenient decompression stops in the beginning of December.

Both wrecks lay in the 4°C zone. During every dive, we spent up to 70 minutes in this temperature, which made heated undergarments necessary. It took around 25 minutes to get to the wreck. We limited our time there to a maximum of 15 minutes to keep the dive time within three hours, which we

defined for ourselves for different reasons, namely risk, appetite, opening hours and family time.

During this exploration, we learned our lessons and optimized the exploration speed significantly (see Table 2 on next page).

In this endeavor, we quickly started to lay lines, which guided us through the 10 to 20m section that usually has extraordinarily low visibility. This was especially annoying since at least a third of the decompression time was in this depth zone. There was also additional risk regarding safety during decompression stops or finding our way back to the entry point of the dive.

Anyone who experiences a decompression stop here, with nearly no visibility and the constant noise of heavy engines overhead, will confirm that this is an unnerving place. The high frequency of vessels of all kinds passing overhead is

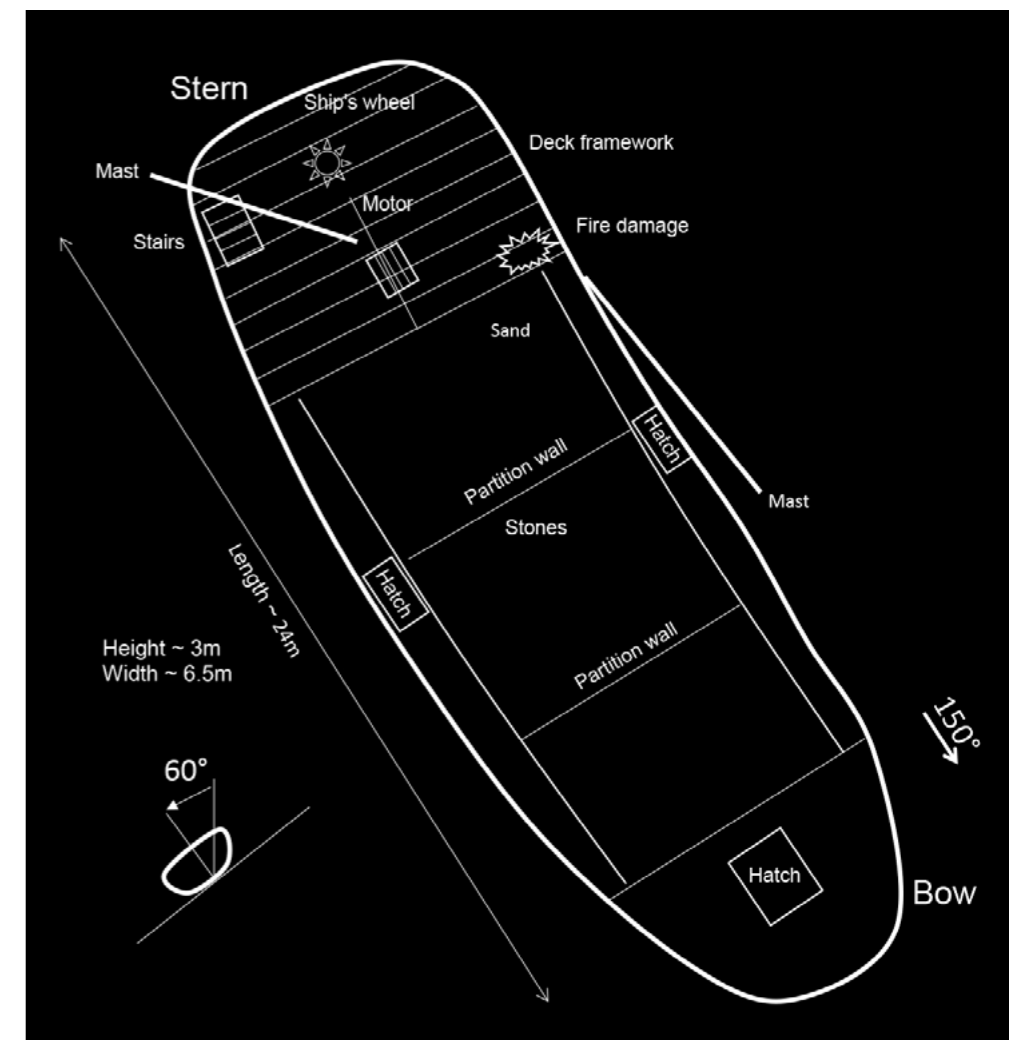


Diagram of the second wreck site, with a motorized cargo ship



Ship's wheel (left), starboard side (above), and motor block (right) on the second wreck found—a late 19th or early 20th century motorized cargo ship

nets, it often happened that a ghost net would drift into the muddy waters. The risk of entanglement was definitely a factor, and we trained ourselves to handle a threat such as this. So far, we had managed to handle the risks of these dives successfully. With better planning and fewer gear malfunctions, our exploratory dives went much quicker than they did on the first wreck.

Motorized cargo wreck

The wreck at this site was 24m long, six meters wide and lay at a 60-degree angle on the relatively hard lake floor, below a 10m wall at around 80m depth. Everything was covered with silt and lake marl. This wreck was remarkable, since it was by far the best-preserved wreck that

has been discovered in Lake Zurich so far. Again, the cabin covered a fourth of the length at the stern, whereas the rest comprised a cargo hold with three different segments. The unroofed cabin gave us a view and insight into the vessel's interior life. It still had covered portholes in place. The middle of the cabin hosted a two-cylinder engine, which also drove the bilge pump. Additionally, it drove a hydraulic system that could open the bottom of the cargo hold in order to dump the cargo into the lake (whatever it was). The steering gear and the helm sat in place, but the rudder blade had been lost during the descent. The hull had a double wall and the space between was used for hydraulic pipes and storage of the rudders. The hull was

Date	Time/Depth	Remarks
20.06.18	62m/76ft	Setup dive.
29.06.18	29m/52ft	Shallow prospecting dive.
11.07.18	75m/110ft	Installed first guideline.
25.07.18	26m/71ft	Visibility was very poor, and the guideline was broken by an anchor or a fish hook. We worked on fixing it until we had to ascend to a shallower depth.
31.07.18	101m/85ft	Check of targeted depth.
06.08.18	98m/115ft	Success! Discovered a motorized cargo vessel.
29.08.18	89m/80ft	Emptied pony bottle, resulting in a nice drysuit squeeze pattern on the skin afterwards.
10.09.18	100m/143ft	Wreck exploration. Focus: starboard.
12.09.18	101m/153ft	Wreck exploration. Focus: larboard.
03.10.18	101m/145ft	Wreck exploration. Focus: bow and middle.
10.10.18	101m/144ft	Wreck exploration. Focus: middle and stern.
17.10.18	101m/143ft	Wreck exploration. Focus: stern, cabin and engine.
24.10.18	101m/150ft	Installed a second guideline to optimize access route.
07.11.18	82m/102ft	Installed a guideline extension to optimize decompression route.
14.11.18	85m/85ft	Controlled all lines.

Table 2: Exploration history of the wreck of a motorized cargo ship in Lake Zurich



accessible via two hatches, starboard and larboard.

The cabin showed traces of a fire. However, this could not have been the cause of the sinking of the vessel, because the hull of the ship was intact. Very often, ships' crews would heat their cabins with hot coal embers or a small

oven, and a fire could easily spread if a ship was caught in bad weather. This ship had a composite hull made of wood and a steel framework, a technique quite commonly used between 1830 and 1900. However, the built-in engine looked like a Sulzer two-cylinder gasoline engine. Sulzer manufactured these units





Cleat (right), deck cabin (far right), and covered portfhole (below) on the recently discovered wreck of a motorized cargo ship in Lake Zurich, estimated to date from the late 19th or early 20th century



around 1910 at a factory in Arbon, which would mean that this wreck was younger in age.

Conclusions

The research on these wrecks is ongoing. For both wrecks, the investigation is challenging, since ships on Lake Zurich were never named. Information about them may be available in more than ten different public or private archives around the lake. However, the documents are difficult to read and definitely not digitalized. So, until now, both wrecks have kept their secrets, including the original reasons for their sinking—the exact dates

and description of the circumstances are still missing. We will continue to search further parts of the ships, which may help us with their identification.

The next step will be the investigation of the hydraulics and the engine of the second wreck. This is not a trivial undertaking, since these parts sit below an iron framework, which once held up the deck. Of course, we will produce more videos and photos to document the actual state of the wrecks and their details. Up to today, all our photographs and videography have been sufficient enough for documentation rather than presentation.

To summarize, we reiterate a few of the crucial aspects of our exploratory projects that led to the improvement of our resilience on difficult dives to achieving actual success in our explorations:

- Identification of adequate time slots for dives on the wreck sites. Not only did these time slots have to fit into our agendas but also into the “rhythm” of the lake and its recreational, commuter and shipping traffic.
- Aiming to improve our approach and to adapt to situations. In our case, it meant laying guidelines in risky passages of the lake in order to approach the dive sites more quickly, as well as return safely during decompression stops.
- Progressive approach: We made our way step by step, which prevented us from progressing too quickly in our explorations. We learned patience in coping with situational frustrations.
- Preparation routines: We completed our preparations for the dives several days prior to the dives themselves. We planned the dives with a lot of time in reserve, even though the dives took place at our doorstep.
- Training to cope with gear malfunctions and preparation of emergency scenar-

ios, especially training of relevant skills during the off-season.

- Last but not least, close collaboration with local authorities, especially the local lake police and the Department of Underwater Archaeology of the Canton of Zurich. ■

Jens O. Meissner is a lecturer of Organizational Resilience and Risk Management at Lucerne University of Applied Sciences and Arts, and a lecturer of Management at the University of St. Gallen in Switzerland. He researches management practices in technical diving as well as its inherent risks. He has dived since 1990 and is today a research diver and TDI instructor with 7Oceans in Horgen, Switzerland.

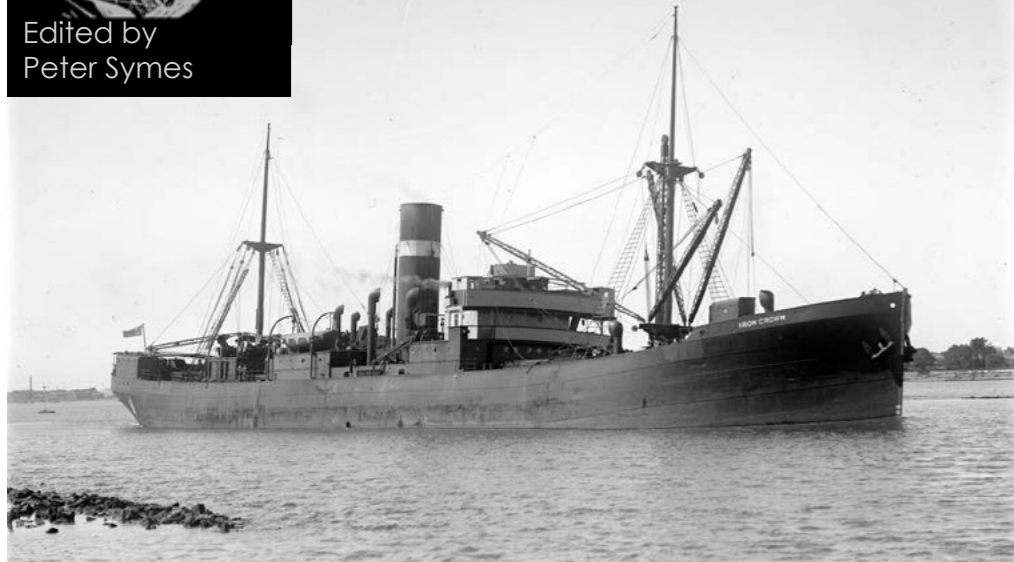
Helmut Spangler is the owner of 7Oceans, the only full-time technical dive center in Horgen at Lake Zurich in Switzerland. He is a TDI and SSI Instructor Trainer, as well as a DIR rebreather instructor.



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SS *Iron Crown* was an Australian iron ore carrier, which was sunk during World War II by a Japanese submarine.

WWII shipwreck found off Australia

The wreck of the Australian ship, *SS Iron Crown*, which was sunk in Bass Strait by a Japanese submarine in World War II, has been found after 77 years.

The *SS Iron Crown*, a 100m-long (330ft-long) ore freighter, was sunk by a Japanese submarine on 4 June 1942 while travelling through Bass Strait with a cargo of manganese ore. The heavily-loaded freighter was hit by a torpedo from the submarine and sank within 60 seconds. Out of her 43 crew members whom she was carrying, 38 were killed, with the survivors being picked up by the British ocean liner *SS Mulbera*

Found at 700m

Experts on the CSIRO research vessel *Investigator* used multi-beam sonar equipment and a special drop camera to locate the shipwreck in 700m of water about 100km (60 miles) off Victoria.

The ship was found upright and "relatively intact", officials said. Its bow, railings and anchors were also found in place.

Peter Harvey, a maritime archaeologist with Heritage Victoria, said it is one of Victoria's worst shipwrecks in terms of loss of life.

"The *Iron Crown* is historically significant as one of only four World War II shipwrecks in Victorian waters and is the only ship to have been torpedoed by a submarine in Victorian waters," Harvey said. "Locating the wreck after 77 years of not knowing its final resting place will bring closure for relatives and family of those that were lost at sea, as well as for Australia's maritime community." ■

SOURCE: CSIRO

Well-preserved 12th-century "Viking-style" ship discovered in a German port of Wismar

The wreck of a 12th-century "Viking-style" ship was discovered in just 3m (10ft) of water when workers were extending the Baltic Sea port of Wismar.

Archaeologists from Stavanger Maritime Museum say that the vessel is of Viking descent and was likely to have carried cargo like timber, stones and beer. Analysis of the ship's timbers revealed that the hunks of wood were originally from Western Sweden.

Maritime archaeologist Dr Jens Auer, who led the project, described the ship as a descendant of Viking vessels and said, "It was a heavy, load-bearing cargo ship." It had overlapping pine planks, clinker-style, with "beautiful curved construction" and was made during a relatively peaceful period of the time. It is estimated that the ship had a crew of 8 to 12 men.

Was it under repair?

The location of the wreck in shallow water on the edge of a sheltered bay makes it unlikely that the vessel wrecked as the result of an accident. The good condition of the preserved parts of the ship is indicative of an attempted repair rather than an age-related scrapping. Possibly the ship was slung onto the port side in shallow water to repair damage to the keel, or to examine the keel for damage. Why the planned repair was not carried out remains unclear. Significant damage may have rendered repair impossible or uneconomical. ■

SOURCE: LANDESAMT FÜR KULTUR UND DENKMALPFLEGE MECKLENBURG-VORPOMMERN



The "Great Ship of Wismar" was 24 to 26m long, 8m wide and could carry 50 to 60 tons of cargo. The construction of such large, sea-going merchant ships required vast resources and are indicative of a professionalised maritime trade in bulk commodities. The owners would have been rich merchants, members of the nobility or the clergy.



Amphorae at the shipwreck site off the coast of Protaras, Cyprus

Undisturbed ancient Roman-era shipwreck found off Cyprus coast

The study of the wreck, loaded with transport amphorae, most probably from Syria and Cilicia, is expected to shed new light on the breadth and the scale of seaborne trade between Cyprus and the rest of the Roman provinces of the eastern Mediterranean.

The ship is understood to be the first from the ancient Roman period to be found in Cyprus in good condition, according to a statement put out by the Cyprus Department of Antiquities.

Amphorae in and around the wreck identify the ship as a merchant vessel that transported cargo between Syria and the southern coast of modern Turkey, known in ancient times as Cilicia. Amphorae are narrow-necked pottery jars used by the ancient Greeks and Romans for storage and shipment of oil and wine.

The site was found by Spyros Spyrou and Andreas Kritiotis, off the popular beach resort of Protaras in the southeastern part of the island. They were working as

volunteer divers with the University of Cyprus's maritime archaeological research laboratory.

A group of archaeologists, students and volunteers is already documenting the ancient wreck in conjunction with colleagues at the Cyprus University of Technology and the Department of Antiquities. The effort is the first underwater project to be fully financed by the Cyprus government, which praised the role of volunteers in the discovery and protection of the site. Their actions, said the authorities, send "an optimistic message regarding the protection of cultural heritage by Cyprus society". ■ SOURCE: DEPARTMENT OF ANTIQUITIES, CYPRUS

Edited by
Scott Bennett



PIXABAY

Carbon-offsetting your dive trip

Let's face it: Flying is convenient because it is fast. And flying is the only realistic option going from one continent to another. Unfortunately, airplanes emit various particles and gases, including carbon dioxide (CO₂), one of several greenhouse gases that occur in the atmosphere.

When functioning properly, these gasses regulate the earth's temperature. According to the US Environmental Protection Agency (EPA), human activity is responsible for the majority of greenhouse gas increases over the last 150 years.

What options do we have?

Rather than mothball our gear, things can be done to offset the problem. The most effective means to reduce CO₂ emissions is to reduce fossil fuel consumption. For trips closer to home, consider more environmentally friendly options. Instead of a short-haul flight, travel by bus, train or fuel-efficient vehicle.

For those not willing or able to reduce their travel, carbon-offsetting is an option. Carbon offsets are initiatives aimed at decreasing greenhouse gas or carbon dioxide emissions by supporting projects that invest in clean energy technologies, planting trees, or buying and compensating for the carbon emitted from emissions trading schemes. Offset providers widely vary in terms of their areas

of focus and charges, with operations determined by their respective locations.

Is it just a modern-day indulgence?

Critics claim it merely allows polluters to feel better about their emissions and discourages the effort to reduce emissions to reduce them. Although this may be true to a degree, offsetting carbon emissions is preferable to doing nothing at all.

In recent years, various organizations have appeared to calculate carbon footprints and offer ways to carbon offset flights. Most airlines have internal practices to decrease their carbon footprint, but some airlines also offer customers the opportunity to get involved, providing the opportu-

nity to buy carbon offsets when booking a flight. Unfortunately, not all of these provide high-quality carbon offsets.

Although various calculators can estimate flight-related carbon emissions, some merely give a rough estimate by considering mileage flown. Others consider class of service, as larger seats take up more space and account for a greater amount of fuel used per passenger. Some even consider the plane type, as some aircraft are more fuel efficient than others. However, exact loads, cargo weights, taxi times and fuel utilized would be necessary to make an exact calculation.

Make a real difference

For those willing to purchase carbon offsets, research is paramount. With companies eager to take your money, it is crucial and find a project that really makes a difference and is not some token scheme to milk passengers from their hard-earned cash. As consumers, we simply do not have

the resources, time or access to evaluate individual projects in detail. The next best option is to obtain suggestions from environmental organizations that list certified and verified carbon-offsetting projects.

Making the right choice

Such organizations include Gold Standard, Green-e and Climate Action Reserve. On each organization's website, projects are sorted by location and offset types. Gold Standard makes it easy to donate to a particular project on its website, while Green-e and Climate Action Reserve refer you to individual projects.

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There are other factors potential buyers should ask offset vendors. Have the carbon offsets been certified to a recognized standard to ensure quality? Are 100 percent of offsets validated and verified by accredited third parties? What is the company doing to educate consumers about climate change and the need for government policy to deal with it? Is the company a member of the International Carbon Reduction and Offset Alliance (ICROA), which has a Code of Best Practice that members must adhere to?

In short, there are solutions to every problem. With plenty of inexpensive options to curb emissions, air travel is not something to be scorned. Seeing the world is both a joy and a privilege, and despite the environmental concerns that face us today, it is something that we should never have to give up. ■



PIXABAY

Diving South Africa's
Sodwana Bay

Text and photos by Kate Jonker





The name “Sodwana” comes from the Zulu words *Siso dwana*, which mean “us alone.” History has it that a group of Zulu women were harvesting mussels on a deserted stretch of beach along the northern coast of KwaZulu-Natal when a landing party for the British Royal Navy came ashore and asked them who they were and what they were doing there. Not understanding this strange language, the ladies replied “*Siso dwana*” (“us alone”) and from that day, this beautiful piece of unspoilt coastline has been known as Sodwana Bay.

Being just over 400km north of Durban on the eastern coast of South Africa, and off the beaten track, the area was left somewhat unexplored until the late 1940s. Recognising its rich diversity in flora and fauna both along the coastline and beneath the waves, the then Natal Parks Board proclaimed Sodwana Bay a nature reserve in 1950.


Today, Sodwana Bay forms part of the iSimangaliso Wetland Park, which is South Africa's first UNESCO World Heritage site and South Africa's largest marine protected area (MPA).

The iSimangaliso MPA provides safe nesting grounds for endangered leatherback and loggerhead turtles, and its submarine canyons are home to the incredibly rare coelacanth, a fish that has been around since the time of the dinosaurs.


Sodwana Bay is a year-round diving destination, and the best way to



Powder blue surgeonfish (above) at Wayne's World; Twobar anemonefish (left) guards its anemone at Stringer Reef; Bigspot rockcod at a cleaning station (top left) and Nalolo blenny (previous page) at 7 Mile Reef

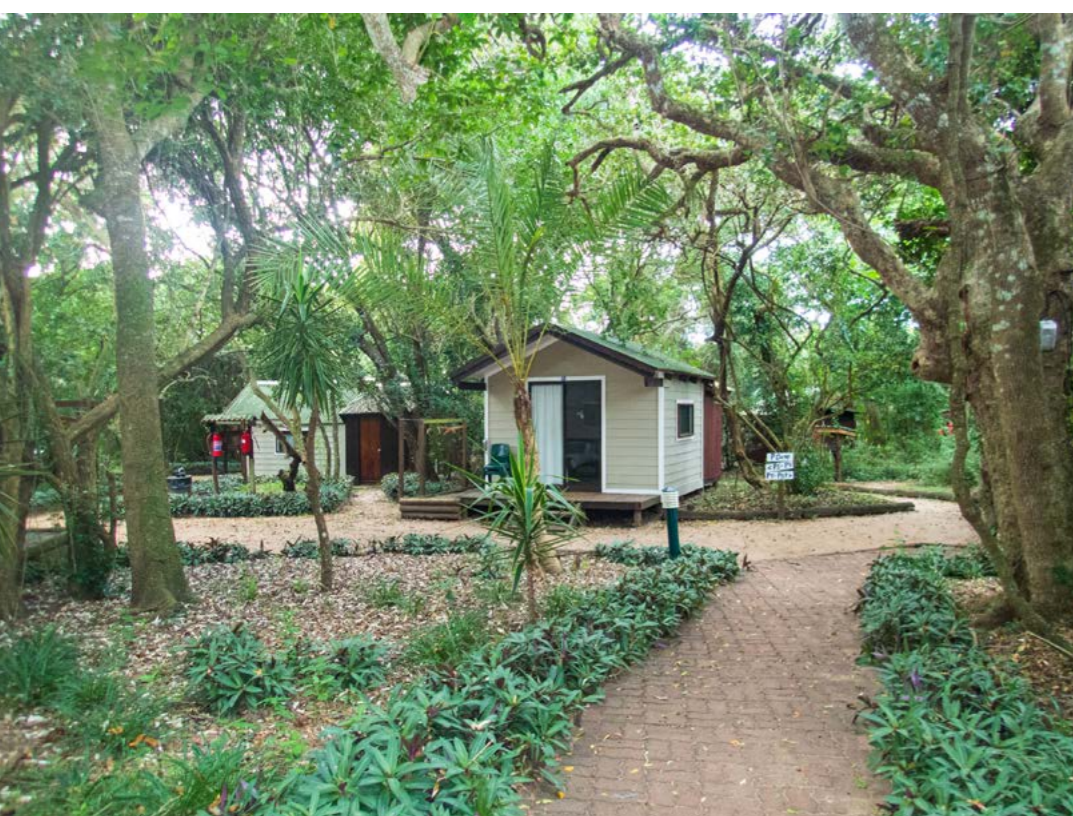



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The view over Sodwana Bay (above) from the top of Jesser Point, seen on our way out to 7 Mile Reef (right); The little chalets at our accommodation (left)

forests and pineapple plantations. Once off the main highway, you might see giraffe, zebras, warthogs and other small animals that can be found in the many game reserves that border the road. The trip is made even more exciting as herds of cattle grazing along the roadside seem to take an innate pleasure in crossing the road just as you reach them.

This is Africa!

The resort

The small settlement of Sodwana Bay comprises a handful of dive operations, restaurants, bars and guest lodges. There are also a couple of dive resorts located inside the iSimangaliso Wetland Park, and on a recent trip there, I chose to stay at one of these.

After checking in, I was taken down a shady path to my

accommodation, a well-maintained little wooden chalet nestled amongst the trees that form part of Sodwana Bay's coastal forest. A large glass sliding door led out onto a little deck. As I unpacked, I could hear birds singing in the trees while boisterous vervet monkeys chattered as they watched me from the branches above. Just when I thought it could not get any better, a tiny red deer ran across the path in front of my chalet and a huge family of mongoose dashed past, stopping briefly to check me out. I really felt as if I was at one with nature.

The dive operator

It was with great excitement that I climbed aboard the special tractor-drawn trailer early the following morning to go down to the beach. After a ten-minute



ride through the dense, jungle-like forest, we arrived at the beach and stopped at the large gazebo that belonged to our dive resort. Before I could step off the trailer,

a friendly beach assistant called Steven was smiling and shaking hands with me in true African style, telling me he would look after my gear for the week. We

get there is to fly to King Shaka International Airport in Durban and hire a car or arrange a transfer through the resort you will be

staying with. A five-hour drive along the main highway will take you through lush green scenery of sugar cane fields, blue gum



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Filefish at 5 Mile Reef (above); Incredible visibility at Sodwana Bay, with our dive boat overhead (right)

settled on a fee and from there on, my gear was his gear and he handled it professionally and with kid gloves.

Whilst our dive boat was being loaded, our divemaster, Tim, briefed us thoroughly on the diving and safety procedures at Sodwana Bay and gave us a detailed description of the reef we would be diving.

In Sodwana Bay, the boats launch from the beach through the waves and take divers to the many reefs that are named after their distance from Jesser Point, the rocky outcrop that provides reasonably protected launching at Sodwana Bay, and probably where the Zulu ladies were found harvesting mussels by the Royal Navy. Some of the reefs are quite large and many

have a number of different dive sites located on them.

The reefs

The reefs of Sodwana Bay are formed from fossilised sand dunes, which are densely covered with pristine hard and soft tropical corals. These are the world's most southerly coral reefs after those of Lord Howe Island just off the eastern coast of Australia.

The corals of Sodwana Bay thrive on the nutrient-rich water that flows up from the deep canyons close to shore, during a process called upwelling. In turn, the reefs provide a healthy habitat for a diverse and vibrant marine life—from tiny nudibranchs, tropical fish and pelagics, to larger visitors such as manta rays and whale sharks.





The beach launch

After our briefing, we walked down to our 6m-long semi-inflatable RIB (zodiac) where our gear was safely secured to a dive rack, which ran down the middle of the boat. A tractor driver pushed the boat into the water using a long metal pole. In other beach-launch destinations, it is quite common for the divers to have to turn the boat around and push it into the water themselves—so this was a breeze!

Our skipper George shouted “Mamas up!” and the female divers hauled themselves up over the pontoons and onto the boat. As soon as the boat was afloat, the male divers were asked to climb on board. We were all handed life jackets (a safety precaution for beach launches in South Africa), and George

started up the motors and skilfully steered us through the waves. Once through the waves, we handed our life jackets back to George, who stowed them and took us out to our dive site.

George and most of the other skippers have grown up in the area and have worked their way up from being beach assistants, like my friend Steven, to the prized position of boat skipper. They become one with their boats and with the ocean—they know exactly when to go through the waves and when to hold back, and where the dolphins can be seen on the way to and from the dive sites.

The diving

Our first dive was at the largest reef system in Sodwana Bay, known as Two Mile Reef. Being only two miles from Jesser Point, it was a quick ride out. Before long, we were putting on our gear

Bluebanded and dory snappers at Stringer Reef (above); Twobar anemonefish at Caves and Overhangs (top right); Divers get ready to jump aboard the zodiac boat (right).





Scorpionfish at Bikini (above); Beautiful thistle soft corals at 7 Mile Reef (top)

and getting ready to enter the water. Whilst I rinsed my mask, I marvelled at the warmth of the ocean and how I could clearly see the coral reef below me at 16m. George counted us down and we rolled backwards into the clear blue Indian Ocean.

The reef below us was festooned with a confetti of orange, pink and purple anthurids as they hovered over the corals. Parrotfish bobbed up and down with their unmistakable style of swimming, their beaks grinning at everyone they saw. There seemed to be cleaning stations under every little overhang and above every table coral, with little cleaner wrasse and even larger wrasses grooming the many fishy inhabitants on the reef.

It was absolutely beautiful. I floated in the gentle surge, amongst the corals and fish, marvelling at the magnificence

of this underwater world. Sadly, all too soon, our dive was over and we had to ascend to do our safety stop.

We all clambered back onto the boat, chattering excitedly about what we had seen and how warm the water was. George steered us carefully back to land, where the boat came to a stately halt on the beach. Steven came to pick up my gear, which was loaded onto the back of a pickup truck and returned to the gazebo where it was kitted up for the next dive. All we had to do was check our air, and our gear was whisked away to our boat for the next dive.

During our surface interval, we walked up to the little restaurant at the top of the hill that overlooked the bay and relaxed over cups of coffee and delicious snacks.

Our next dive was at another



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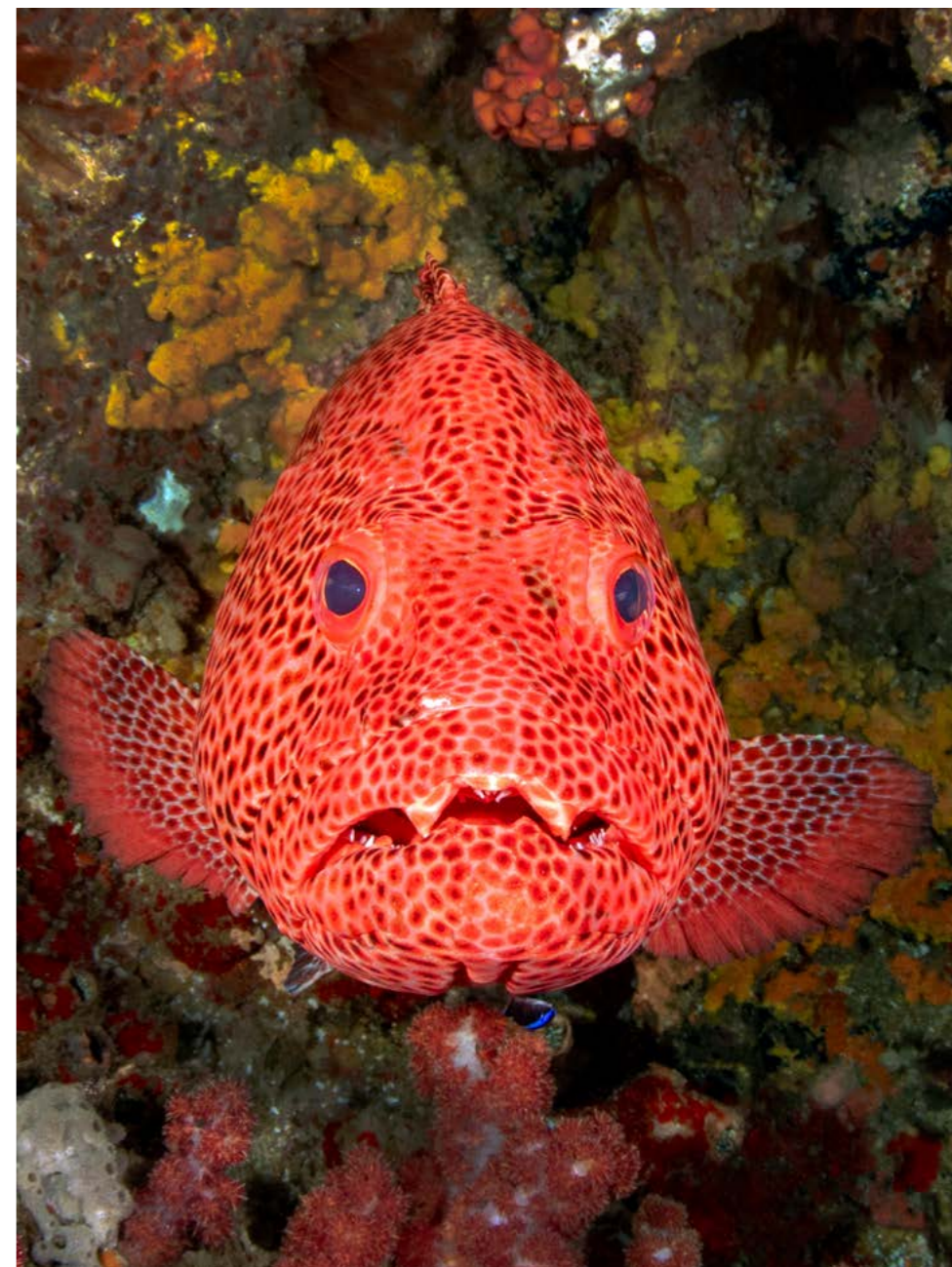
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Glassfish-filled swim-through (above) and tiger rockcod at a cleaning station (right) at 7 Mile Reef; Ember parrotfish, initial phase, at Wayne's World (left)



er dive site on Two Mile Reef called Wayne's World, and it was just as beautiful as our previous dive. We spent over 60 minutes exploring and watching the life on the reef and trying to capture it all on camera.

Friendly service & atmosphere

Most dives are done in the morning with launches at 7:00, 8:30 and 11:30 a.m. As we were only doing two dives a day, Steven took care of my gear, washed it and hung it up to dry overnight, so it was ready for me to check and use the

following morning.

The rest of the afternoon was spent enjoying a leisurely lunch at the resort's outside restaurant, lounging beside the pool, going through photographs, trying to identify what we had seen, and discussing where we would like to dive the following day.

The rest of our days followed a similar routine with two dives in the morning and relaxing in the afternoon. We really felt welcome and very well looked after. Every member of staff met us with beaming, happy smiles—from the



CLOCKWISE FROM TOP LEFT: Green sea turtle and wrasse share a meal together at Mushroom Rock; Humpback snappers at Anton's Reef; Ember parrotfish, terminal male, at Stringer Reef; Rosy-brown glossodoris nudibranch at Bikini dive site; Horseshoe hawkfish at Pinnacles

beautiful "Mama" who cleaned our chalets and greeted us every morning with the biggest, broadest smile, to the security guard who patrolled the camp every evening and shook hands and introduced himself to us the first

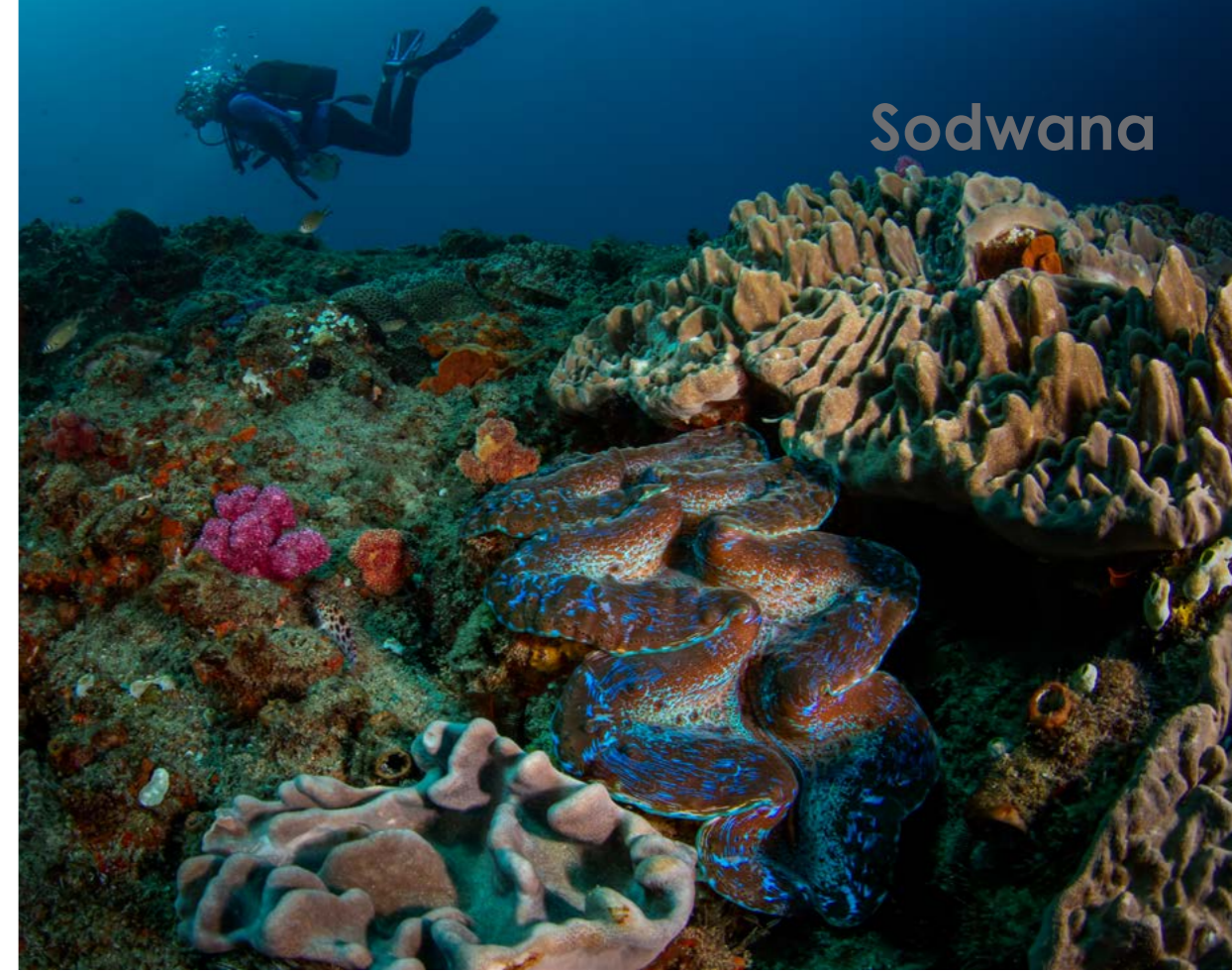
The dive sites

Two Mile Reef is the largest reef in Sodwana, being over 1.8km long and 900m wide. Its depth ranges between 8m and 35m and most of the dives are shallow enough for Open

night we were there. Every day, we dived the magnificent reefs of Sodwana Bay, each with its own unique characteristics.

Water divers. Two Mile has incredible topography, consisting of gullies, overhangs and swim-throughs. The variety of fish life and corals is incredible.

Some of the most popular dive sites on Two Mile reef include Wayne's World, Caves and Overhangs, and Coral Gardens, with their beautiful hard and soft corals; Simon's Cave, with the opportunity of seeing game fish; and Pinnacles, which has a small cave sometimes occupied by whitetip reef sharks. Anton's is a



Two-bar anemonefish (left) and marbled leopard grouper and humpback snapper (above) at 7 Mile Reef; Giant clam at Pinnacles dive site (top right); Titan triggerfish at Coral Gardens (bottom right)



very popular site as it is home to large numbers of schooling fish, turtles and bait balls of many species.

Other Two Mile Reef dive sites include Roonies, Hopscotch and Mellow Yellow, which are slightly deeper dives and offer visitors the opportunity of seeing larger marine life such as mantas, hunting pelagics and sharks. Bikini is an important cleaning station and a macro photographer's playground, with shrimps, eels, juvenile fish and nudibranchs galore.

There are other reefs farther from Jesser Point, and these include 9 Mile Reef, with its huge green tree corals; 7 Mile Reef, with

incredible topography, schools of fish, many cleaning stations and vibrant soft corals; Snappers College, with its vast number and variety of snappers, which can be found schooling there; Lettuce, named after a huge area covered with lettuce coral; and Stringer, which is home to so many huge parrotfish, potato bass, nudibranchs and two-bar anemone fish.

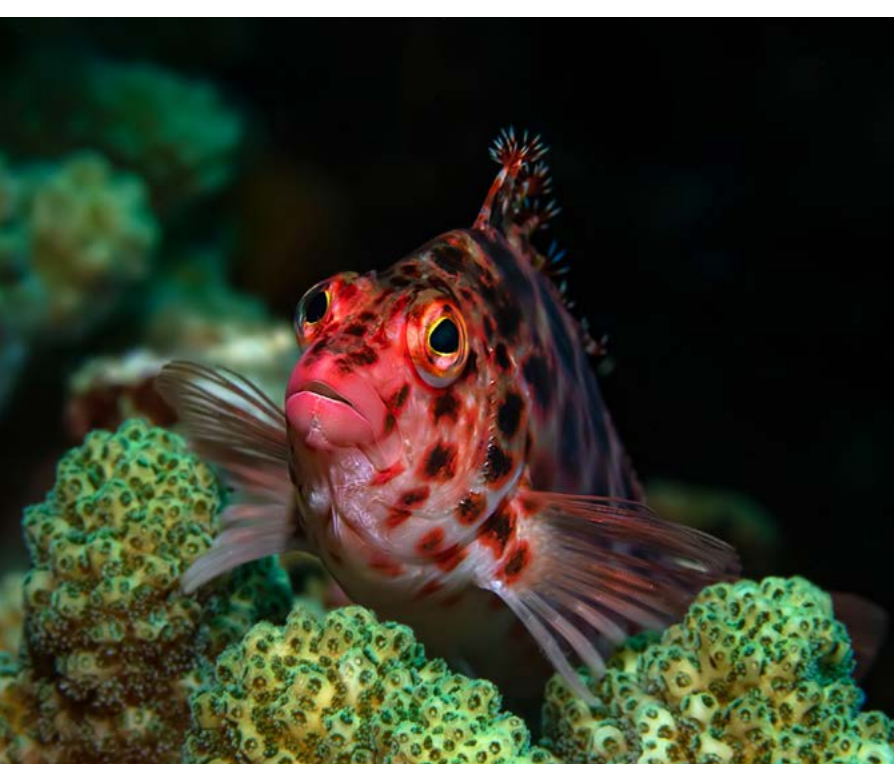
All of the reefs we dived in Sodwana Bay were teeming with an immense variety of fish life—from butterflyfish, damselfish, wrasse, angelfish, triggerfish, snappers, anemonefish, scorpionfish, gobies, blennies and eels. We encountered potato bass, turtles and bluefin



Potato bass at Hotspot (above); Bluefin kingfish at Bikini dive site (right)



Sodwana



Spotted hawkfish at 7 Mile Reef (above); Potato bass at Stringer Reef (right)

kingfish at Stringers and Anton's, and beautiful nudibranchs at Bikini and Pinnacles—and even a zebra shark at Quarter Mile Reef.

The huge variety and number of marine species here bears testament to the success of the 10,700 sq km iSimangaliso MPA, which has 1,200 recorded species of fish, 43 types of hard corals and 11 different species of soft corals. The offshore expansion of iSimangaliso was proclaimed in 2019, enabling the protection of the most accessible coelacanth population on the planet. Thirty-three individual coelacanths, each recognised by their distinct spot patterns, live in this MPA.

iSimangaliso is a Zulu word that

means “miracle and wonder,” a name that aptly describes the pristine and intricate ecosystems of this World Heritage Site. It is easy to imagine that day, many years ago, when the British Royal Navy landed on this beautiful stretch of coastline and were told by the Zulu ladies “us alone.” The area has been so well protected that I doubt much has changed since then! ■

Kate Jonker is an underwater photographer and writer based in South Africa. She teaches underwater photography, is a dive guide and dive boat skipper for Indigo Scuba in Gordon's Bay, and leads dive trips across the globe. Visit: katejonker.com.



fact file

South Africa



SOURCES: US CIA WORLD FACTBOOK, CDC, GOV, IMAT.ORG, NICD.AC.ZA, STATE.TRAVEL.US, WIKIPEDIA.ORG, XE.COM

History South Africa has been inhabited by humans since prehistoric times, according to the fossil record. In the modern era, the Khoisan and Bantu people settled in the region. In 1652, Dutch traders landed at the southern tip of modern-day South Africa and founded 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. As a result, subjugation of the indigenous people intensified. The years 1899 to 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 multiracial elections saw the end of apartheid and brought in majority rule. Challenges for the country since then include reining in corruption, restructuring state-owned enterprises and attracting foreign investment. Government: republic. Capital: Pretoria.

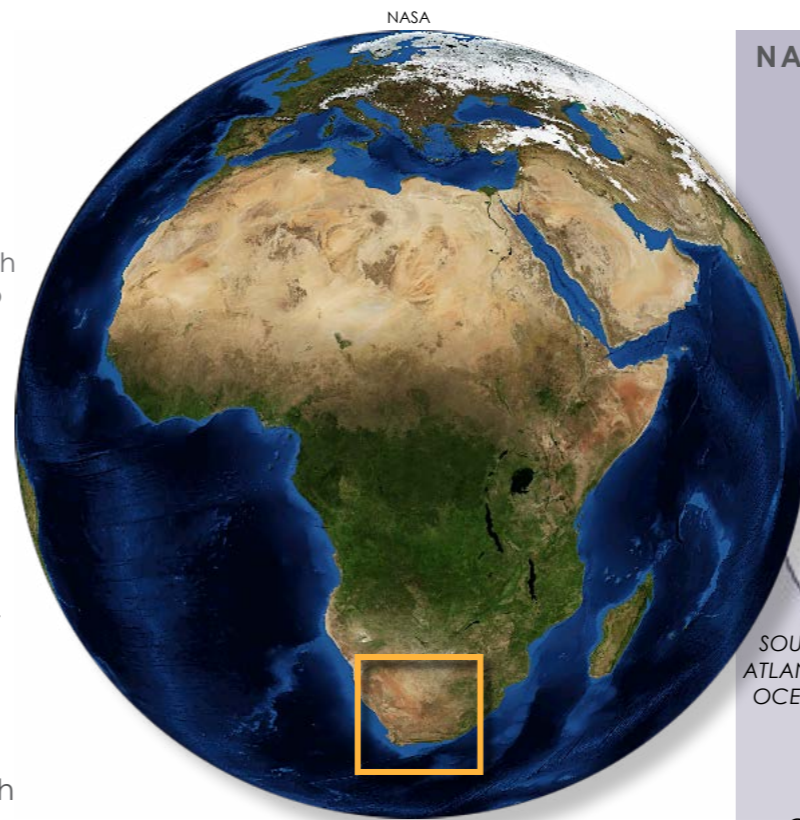
Geography South Africa is located at the southern tip of the continent of Africa. The country of Lesotho is completely surrounded by South Africa, which also almost completely surrounds Swaziland. Coastline: 2,798km. Terrain comprises a vast interior plateau surrounded by rugged hills and a thin coastal plain. Lowest point: Atlantic Ocean 0m. Highest point: Njesuthi 3,408m. Natural hazards include 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.

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 among the top 20 in the world. Its modern infrastructure supports an efficient distribution of goods to major cities throughout the region. Growth has slowed in recent years. Challenges include high unemployment, an outdated infrastructure and unstable electricity supplies, which limit growth. New power stations and management programmes are being installed and implemented by the state-run power company, but it faces a growing high debt burden, and accusations of mismanagement and corruption. Recent economic policy aims to control inflation as well as empower a broader economic base. But the country faces challenges such as skills shortages, a decline in global competitiveness, and numerous strikes. Cities are pressuring the government to deliver basic services to those in poverty, increase jobs, and provide affordable higher education. Economic growth is further thwarted by volatility of the rand, political infighting within the ruling party, and reluctant international investors wary about

RIGHT: Location of South Africa on global map
FAR RIGHT: Location of Sodwana Bay on map of South Africa
BOTTOM LEFT: Pennant coralfish, or coachman, at Stringer Reef



the country's long-term economic stability. South Africa's international debt was downgraded to junk bond status by most major international credit ratings agencies in late 2016.

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

Population 55,380,210 (July 2018 est). This figure factors in the effects and mortality rate of AIDS in the population. Ethnic groups: black African 80.9%, coloured 8.8%, white 7.8%, Indian/Asian 2.5% (2018 est). Religions: Christian 86%, ancestral, tribal, animist, or other traditional African religions 5.4%, Muslim 1.9%, other 1.5%, nothing in particular 5.2% (2015 est), Internet users: 29,322,380 or 54% (July 2016 est).

Currency Rand (ZAR). Exchange rates: 1USD=14.24ZAR, 1EUR=16.24ZAR, 1GBP=18.26ZAR, 1AUD=10.07ZAR, SGD=10.54ZAR

Language The official languages include isiZulu 24.7%, isiXhosa

15.6%, Afrikaans, 12.1%, Sepedi 9.8%, Setswana 8.9%, English 8.4%, Sesotho 8%, Xitsonga 4%, siSwati 2.6%, Tshivenda 2.5%, and isiNdebele 1.6%. Other languages include Khoi, Nama and San 1.9% (2017 est).

Health There is an intermediate degree of risk for food or waterborne diseases such as bacterial diarrhoea, hepatitis A and typhoid fever. Wear long sleeves and pants, and use insect repellents containing DEET and netting against malaria from mosquitoes and Crimean Congo haemorrhagic fever from ticks. Beware of schistosomiasis infections from snails in freshwater lakes, rivers and streams in the provinces of KwaZulu-Natal and Limpopo (including Kruger National Park). Please refer to your health department for required and recommended vaccinations and precautions.

Security Most visitors enjoy their trips to South Africa without incident. However, there is a high level of crime, particularly in cities

at night. Please refer to your state department for security alerts and updates. The country's emergency line is 10111.

Visa Two completely blank visa pages are required in your passports. Otherwise, entry will be denied and you will be forced to return home. Passports must be valid for at least 30 days. Tourist visas are issued at point of entry. Visitors with US and UK passports do not require a visa in advance for tourist travel up to 90 days. Please refer to your state department or local South African embassy for visa requirements and updates.

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Websites
South Africa Tourism
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US CIA WORLD FACTBOOK / PUBLIC DOMAIN



Southwestern Halmahera

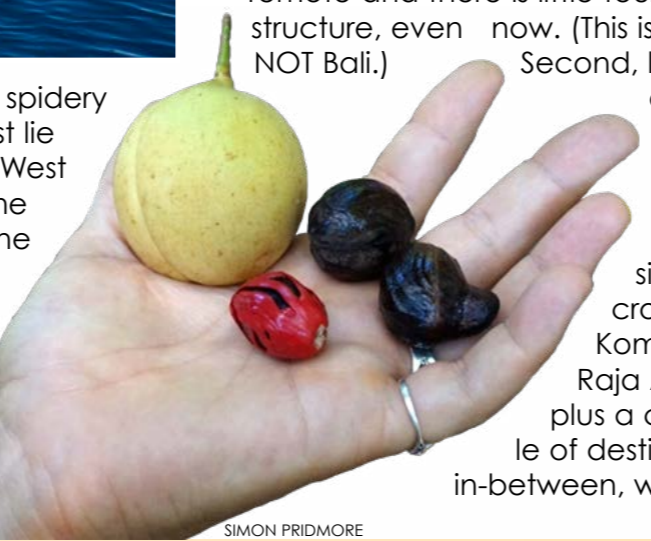
Text by Simon Pridmore
Photos by Andrey Bizyukin,
Simon Pridmore and
Vadim Zverev

Indonesia's New Playground for Divers





Southwestern Halmahera in North Maluku province (above and left); The *Tambora* liveaboard (right), an Indonesian-built *phinisi*—our home for ten days; Nutmeg and mace (below); Local fisher in dug-out canoe (lower left). PREVIOUS PAGE: Juvenile sweetlips and staghorn coral



The appearance on the radar of a new world-class area for scuba diving is a rare and extremely welcome event. It is even better news when it is a place as steeped in history and culture as this one.

This new dive destination is a collection of rocks and islets in the northeastern region of the vast Indonesian archipelago, on the edge of the Pacific Ocean. They lie southwest of Halmahera, a large, heavily forested, sparsely populated island, sculpted by volcanic forces into the shape of a letter "K." To the north of Halmahera lie the Southern Philippines,

to the northwest lurks similarly spidery Sulawesi, and to the southeast lie the islands and mountains of West Papua. These waters are at the heart of the Coral Triangle—the planetary epicentre of species diversity.

How is it, you might ask, that divers have only started visiting these islands comparatively recently? Just look

at the map. They are situated between Lembeh, Bunaken and Manado Bay on one side and Dampier Straits and the rest of Raja Ampat on the other side. Of course, the diving is going to be spectacular!

A combination of factors seems to have been involved. First, the islands are remote and there is little tourist infrastructure, even now. (This is definitely NOT Bali.)

Second, liveaboards tend to focus on the two jewels in Indonesia's diving crown, Komodo and Raja Ampat, plus a couple of destinations in-between, which they

visit on transition cruises. Southwestern Halmahera requires a detour from these routes. Third, somehow, nobody in the diving world thought to follow up on a 2005 survey of the area carried out by American-born Australian ichthyologist Gerry Allen, PhD, during which he recorded a phenomenal 803 species of fish

in 37 hours of diving at 28 locations. (If anyone did follow it up, they managed to miss all the good places, or they kept quiet about it.)

This is part of the Indonesian province of North Maluku, which is likely to be a new name to you. However, it has not always had such a low international pro-



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Fort at Ternate (left); View of the skyline and harbour of Ternate (above); Cloves (right), mace (lower right) and nutmeg (below) set out to dry in the sun; View of Ternate at the foot of the volcano, Mount Gamalama, in the background (bottom left)



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file. Hundreds of years ago, these islands were highly sought after by spies, explorers and entrepreneurs from Western Europe, who were desperate to find the source of cloves, nutmeg and mace.

These enormously valuable and rare spices, sold at huge profits by Chinese and Arab traders, were fabled to emanate from mysterious dots of land on the edge of the known world. The nations of Western Europe expended huge effort to find the source of the spices, in order to cut out the traders and take the profits for themselves.

Christopher Columbus was one of these explorers and it was his quest to find a western route to the "Spice Islands" that subse-



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quently led to his bumping into the Americas.

Now, the same islands are being sought after for very different rea-

sons: lots of fish, sharks, spectacular underwater scenery and superb coral reefs—in short, world-class diving.

The isles of cloves

Our gateway to South-western Halmahera was the island of Ternate, dominated by the flattened cone of the active Gamalama volcano. Ternate and its similarly shaped (though more cone-like) neighbour Tidore were at one time the only place in the world where clove trees grew.

The two islands were ruled by sultans whose clove monopoly made them extremely rich, although they spent most of the



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money they made on armies to fight one another. Their power and wealth, however, did not last long, following the arrival of representatives from the major Western European naval powers.

Once the Europeans discovered where the cloves came from, their superior marine and weapons technology gave them control of

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Tidore, as seen from Ternate (above); Taxis line up, awaiting customers, in Tidore (right); View from Tidore mountainside (far right)

the supply. The first to arrive were the Portuguese, closely followed by the Spanish, the Dutch and the British. Then, they spent the next couple of centuries fighting each other over the precious spices, until roots and seeds were smuggled away to be planted on tropical islands elsewhere and the islands were no longer special.

This period in history is visible today in the clove, nutmeg and



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cinnamon trees that dominate the forested lowlands of Ternate and Tidore and in the various ruined forts of various nationalities dotted around the coast. We spent the first two days of our trip getting over the jetlag and doing a little sight-seeing, learning about the history, savouring the spicy fragrance of the forests, visiting the world's oldest clove tree and watching people harvest and dry the crops in the

sun. We even stopped and bought some spices to take home. The cloves made our bags smell wonderful!

The other evolutionary

Ternate's second major claim to historical fame is that it was, for a time, the home of Alfred Russel Wallace. Wallace was living on Ternate when, in 1858, he sent to Charles Darwin his seminal paper on evolution, entitled "On the Tendency of Varieties to Depart Indefinitely From the

Original Type." This was even referred to as the Ternate essay, and in its nine pages, it describes the theory of evolution by natural selection.

On receiving this paper, Darwin immediately decided to publish his own work on evolution, and arranged for the Ternate Essay and two of his own papers to be read to the Linnean Society of London on 1 July 1858. The world would never be the same from that day onwards.

We visited the house Wallace lived in when he was in Ternate, but it is a little underwhelming. There is nothing in the way of a museum there, just a small bungalow with a caretaker, indicative of the low level of tourist infrastructure in the region.

We stayed in Ternate at Vila Marasai, run by a gentleman named Pak Hasrun, who used to work as a tour guide. He has established an excellent homestay comprising 11 air-conditioned rooms with



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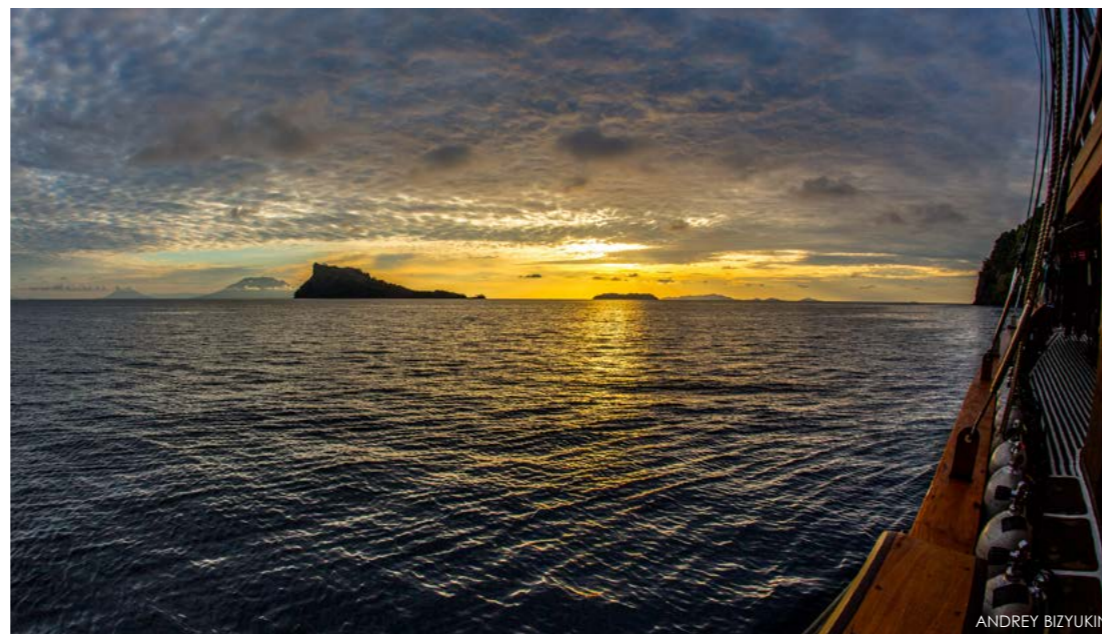
Marketplace in Tidore



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ANDREY BIZYUKIN



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The *Tambora* liveaboard (left), which is an Indonesian-built *phinisi*, was our home for the ten-day trip (left); Divers head to a dive site in a smaller motor boat (top center); Volcanos in silhouette against the sunset, as seen from the liveaboard boat (above); Deck of the *Tambora* liveaboard (right)


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ensuite bathroom (although some rooms have no hot water) in a large two-storey house just out of the city and above the university. Vila Marasai seemed to offer a much more attractive option to the grey concrete-block business hotels in the centre of town. Pak Hasrun can serve meals and arrange reasonably priced tours.

Out to sea

So, while we found the big islands of

Ternate and Tidore fascinating, fun and fragrant, we had really come all this way to dive. On our fourth morning, we bid farewell to Pak Hasrun and took a taxi to the dock in front of an enormous mosque to join the *Tambora* liveaboard for a ten-day cruise around the islands to the south and west.

The *Tambora* is a *phinisi*, a wooden ship built on an Indonesian beach to a design that harks back to the days of

explorers and spice traders, although she is much more comfortable than the ships they sailed. The word "phinisi" is thought to come from "pinnacle." The word is French, and in the 17th century, pinnaces were small warships with two or three masts and a flat stern. The *Tambora* is one of the very few liveaboards that plies these seas and even she is only there for a few weeks a year. There are no land-based dive centres running dive trips to

the area at the time of writing.

Soma Village

Our first dive of the trip was a muck dive-cum-checkout dive at Soma Village on the western side of Makian, another volcano in the chain that stretches down from Ternate and Tidore along Halmahera's western coast.

The wall to the north of the village has some beautiful topography, a gorgeous colourful reef top, especially in the morning sun, plenty of fish and some wonders for sharp-eyed spotters to find. The jetty in front of the village is a great spot for night diving and makes a good day



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Divers head to a dive site off Halmahera (above); Ornatte ghost pipefish (far left); Boxer crab (left); A walking shark, the Halmahera epaulette shark (below) uses its pectoral fins to "walk" on the sea floor; Diver under coral-encrusted lava arch (left)



the Goraici archipelago, diving first off the cape of Siko Island, then around a very distinctive double rock formation offshore, where we found an especially fabulous site that the *Tambora* calls Yellow Wall. This is best dived when the sun is high in the sky and when there is sufficient current running to open up all the coral polyps, bathing the wall in a sea of gold, like an underwater rapeseed field.

We also explored a number of seamounts elsewhere in the Goraici Islands. The diving was lovely everywhere:



dive too. This is a critter dive. Start on the sand slope below the jetty and make your way up slowly looking for octopus, scorpionfish, pipefish, razorfish, flying gurnards, cockatoo waspfish, nudibranchs, various shrimps and crabs. Watch out for big, black, spiny urchins under the jetty itself and spend some time scouring the halimeda (green macroalgae) between the jetty and the shore for more critters. You will only be in about 2m of water here.

The Goraici Archipelago
We spent the next four days in

colourful soft corals plastered every rock larger than a pebble and each dive seemed fishier than the previous one. We saw multiple reef sharks at every site

we dived, not a given these days anywhere in the Coral Triangle. In several places, tuna, wahoo and schools of surgeons, snapper and fusiliers buzzed us as we floated at the end of our reef hooks, watching the show. We hardly saw any evidence

of coral damage from dynamite fishing; the two patches we did come across were in the shallows. The rest of the seascape was untouched and several huge coral bommies looked extremely old. It was great to see such healthy reefs.



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Kajoa Island

Our next port of call was Kajoa Island, where the best diving was on the northern side. Like so many islands in northeastern Indonesia, Kajoa is an exposed ancient reef, uplifted by tectonic activity.

Above water, among the twisted clefts and ridges, the rocks show the forms and fossils of ancient coral skeletons so clearly that you can identify which species they were. Below the surface, the same corals are alive and glowing in the



ANDREY BIZYUKIN

Diver with giant sea fan (left); Diver under a lava arch (above and right), festooned with corals and sponges

sunlight. Pink soft corals hang over small caves, tall green tubastrea sprout from pinnacles and outcrops, and black coral bushes obscure small canyons in the reef. It really is a beautiful place, a paradise for wide-angle photographers.

The majority of the fish life can be found around the largest of the pinnacles, the top of which is at about 24m. Look here for schools of batfish, sweetlips, surgeons and black snappers, as well as blacktip reef sharks. In the shallows, there are some large caves in the rocks that snake enticingly as much as 50m into the island before the passage becomes too small and you have to turn around. Bring a flashlight.



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Lata Lata Island

The next day, we were floating off Lata Lata Island, preparing to do a couple of dives on an undersea crater. It was 20 to 25m deep, with pillars in the centre, towering up almost to the surface, with steep walls around the edge. The pillars constitute a great dive on their own, but if you are up for a spot of hard finning, you can combine them with various sections of the outer wall. Follow the direction of the current or, if there is none running, just take your pick. Reef sharks are abundant all over the crater, as well as schools of fusiliers, snapper and sweetlips. There is lots of tiny stuff to be found among the coral growth on the pillars too: cowries, seahorses, pipefish and the like.

Penambuan, Bacan Island

For the first six days of our trip, the

only people we saw were occasional passing fishermen in their outrigger canoes. We saw no divers or trawlers, and all the islands we had seen since Makian seemed completely uninhabited.

As we were far beyond the nearest phone masts, we were also out of reach of the world—Paradise. We realised our isolation was at an end when we saw phones appearing in the hands of the boat crew and spotted the village of Penambuan on the horizon. We were heading there not so much for a social media fix as to profit from some superb muck diving.

Penambuan is on the western side of the large island of Bacan, which is known for its semi-precious stones and is especially famous throughout Indonesia for having been the source of a particular

stone presented to then US President Barack Obama, when he visited Indonesia.

There are critters aplenty among the sandy slopes all over Penambuan Bay, but the best site at the moment is the town jetty, where a rusted old freighter is tied up. The ship has made its last journey and now acts as a power station for this part of town.

After a couple of dives there, we debated whether the jetty was holding the freighter up or if the ship was holding the jetty up. As you cruise around the pillars of the jetty and gaze at all the marine life that assembles here, you see that some of the pillars have rusted away and now swing free in the gentle current, suspended a metre or so above the seabed.

On the hull of the ship, gorgeous,

Matote octopus (above); Sea whips, sponges and sea fans on reef (top left); Divers on pinnacle (top right)



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White-eyed moray eel

lush, soft corals obscure the metal completely and droop down into the water like a hanging garden of red, orange, pink, yellow, white and blue. Beneath this wondrous sight roam catfish, batfish and a couple of fat fish—large barracuda that evidently feed very well. Peeking out from beneath the junk on the seabed are an array of moray eels of different types. Besides the

odd giant frogfish clinging to the sponge-encrusted pillars, there are stonefish, scorpionfish and crocodilefish galore, all happy to pose decorously and motionless for passing photographers.

The Batinti Straits

The final dives of this fantastic trip were in the Batinti Straits, between Bacan and the southern

Halmahera mainland. The action centred around two islands, Proco and Nanas. Our first dive at Proco was relatively sheltered and very good for macro-photography, with a variety of pigmy seahorses to be found, as well as ribbon eels, jawfish, leaf scorpionfish and frogfish, but the second dive was much more dramatic in terms of both scenery and wildlife.

We had blacktip reef sharks accompanying us throughout most of the dive, the undercuts in the reef wall were full of lobsters and an enormous dome-shaped sand patch at around 27m was packed full of garden eels, as far as the eye could see. Farther along the wall, at a depth of around 18m, we found a small lava arch to swim through just at the point on the reef where the



Trumpetfish and whip coral with crinoids

Tiny frogfish (left); Tiny pygmy seahorse (above); Tiny stonefish (right); Feather stars (top right)

you can expect passing pelagics such as tuna and mobula rays, and we were lucky enough to see both! Blacktip reef sharks and great barracuda cruise the reef, and we had a school of batfish with us for part of the dive. On top of the reef, we found a patch of sand between outcrops where several jawfish had set up house and were all busy redecorating their terraces in some kind of jawfish "beautiful homes" competition.

Back to Spice Land

With the diving all done for this trip, we headed back to Ternate, with the Halmahera coastline to starboard and the string of volcanoes lined up with almost military precision to port. As the sun set over these iconic peaks, we thought about all the explorers, spice merchants, adventurers, soldiers and sailors, who in centuries past, had gazed in wonder at this very view from the decks of ships not so dissimilar from ours and marvelled, as we were doing now. For us, though, it would only take 24 hours to get home. Hundreds of years ago, it would have taken them months! ■

Simon Pridmore is the author of the international bestsellers Scuba Confidential: An Insider's Guide to Becoming a Better Diver, Scuba Professional: Insights into Sport Diver Training & Operations and Scuba Fundamental: Start Diving the Right Way. He is also the co-author of Diving & Snorkeling Guide to Bali and Diving & Snorkeling Guide to Raja Ampat & Northeast Indonesia, and a new adventure travelogue called Under the Flight Path. His recently published books include Scuba Exceptional: Become the Best Diver You Can Be, Scuba Physiological: Think You Know All About Scuba Medicine? Think Again! and Dining with Divers: Tales from the Kitchen Table. For more information, see his website at: SimonPridmore.com.



schools of fusiliers and surgeons were at their most substantial. Covered in soft corals, it made for an unforgettable image. Tiny Nanas is home to a small group of fishermen who live in three stilt houses on the shore. The best site here begins in front of the houses and runs west along the reef to a sharp point. Features include a massive field of staghorn coral, big schools of fusiliers close to the point and lots of colourful soft corals. Nanas is in the middle of the channel, so

fact file

Indonesia



SOURCES: US CIA WORLD FACTBOOK, CDC.GOV, STATE.TRAVEL.US, WIKIPEDIA.ORG, XE.COM

History In the 13th century, Muslim merchants from Persia came to Indonesia and established trade links to India and Persia. With trade, they brought Islam to the Indonesian people, especially in Java. The Portuguese came in 1511, seeking spices, after conquering the Islamic Empire of Malacca. The Spaniards followed, spreading Christianity, especially in the Moluccas, comprising Minahasa/North Sulawesi and Maluku. In the early 17th century, the Dutch came and made Christianity the predominant religion of North Sulawesi. During WWII from 1942 to 1945, Indonesia was occupied by Japan. Indonesia declared independence just before Japan's surrender. But it was not until 1949, following four years of sporadic negotiations, brutal confronta-

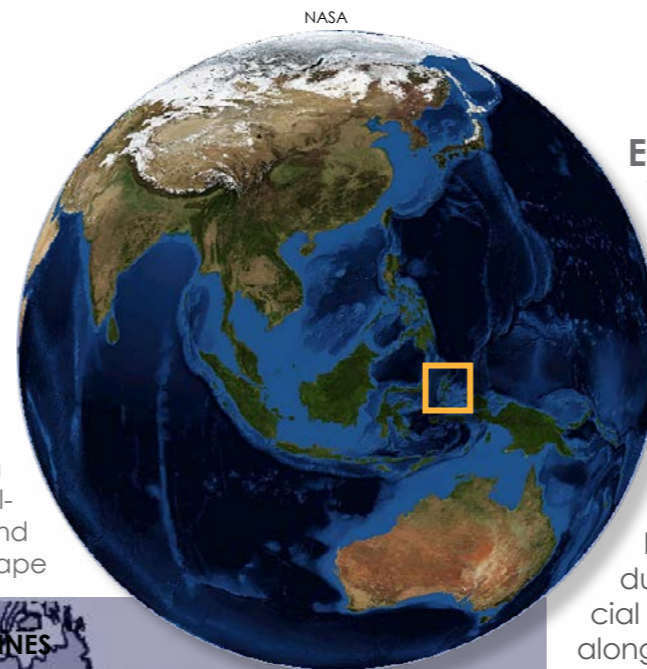
tions and UN mediation, that the Dutch finally agreed to transfer sovereignty. The ensuing unstable parliamentary democracy saw conflicts continue until martial law was declared by President Sukarno in 1957. A futile coup in 1965 by alleged Communist sympathisers removed Sukarno from power. From 1966 until 1988, Suharto was president of Indonesia, but following some street riots, he was

toppled in 1998. Free and fair legislative elections took place in 1999. Indonesia is the third largest democracy in the world. Government: Republic. Capital: Jakarta.

Geography Located in Southeast Asia, Indonesia is an archipelago situated between the Indian and Pacific Oceans. Coastline: 54,716km. Terrain consists primarily of coastal lowlands, with mountains on larger islands. Natural hazards include earthquakes, tsunamis, volcanoes, severe droughts, forest fires and occasional floods.

Climate Tropical, hot and

RIGHT: Location of Halmahera on global map
BELOW: Location of Halmahera on map of Indonesia
BOTTOM LEFT: View of Halmahera's mountainous and forested landscape



Economy Indonesia is Southeast Asia's largest economy. It has experienced slowing growth since 2012, primarily due to a decrease in commodities exports. Indonesia did outperform its neighbours in the region during the global financial crisis, posting growth along with only two other G20 members—China and India. Its annual budget deficit is capped at 3% of GDP, and the country's government decreased its debt-to-GDP ratio from a high of 100% soon after the Asian financial crisis of 1999 to 34% currently. Standard & Poor's upgraded Indonesia's sovereign credit rating to investment grade in May 2017. Challenges the country continues to face include poverty and unemployment, an infrastructure that is inadequate, corruption,

complicated regulations and unequal resource distribution amongst its regions.

Currency Indonesian Rupiah (IDR). Exchange rates: 1USD= 14.25IDR; 1EUR=16.01IDR; 1GBP=18.09IDR; 1AUD= 9.93IDR; 1SGD= 10.43IDR

Population 262,787,403 (July 2018 est.) Ethnic groups: Javanese 40.1%, Sundanese 15.5%, Malay 3.7%, Batak 3.6%, Madurese 3%, Betawi 2.9%, Minangkabau 2.7%, Buginese 2.7%, Bantenese 2%, Banjarese 1.7%, Balinese 1.7%, Acehnese 1.4%, Dayak 1.4%, Sasak 1.3%, Chinese 1.2% (2010 est). Religions: Muslim 87.2%,

Protestant 7%, Roman Catholic 2.9%, Hindu 1.7% (2010 est). Note: Indonesia is the country with the largest population of Muslims in the world. Visitors are encouraged to respect local traditions and dress modestly. Internet users: 143 million or 53.7% (Dec. 2017)

Language Bahasa Indonesia is the official language. It is a modified form of Malay. English and Dutch are also spoken, as well as local dialects (of which Javanese is the most widely spoken).

Health There is a high degree of risk for food or waterborne diseases such as bacterial diarrhoea, hepatitis A and E, and typhoid fever, as well as vectorborne diseases such as chikungunya, dengue fever and malaria. Check with the WHO or your dive operator for prophylaxis recommendations and required vaccines. Bring insect repellents containing DEET. International Certificate of Vaccination required for Yellow Fever if arriving from an infected area within five days.

Hyperbaric chamber

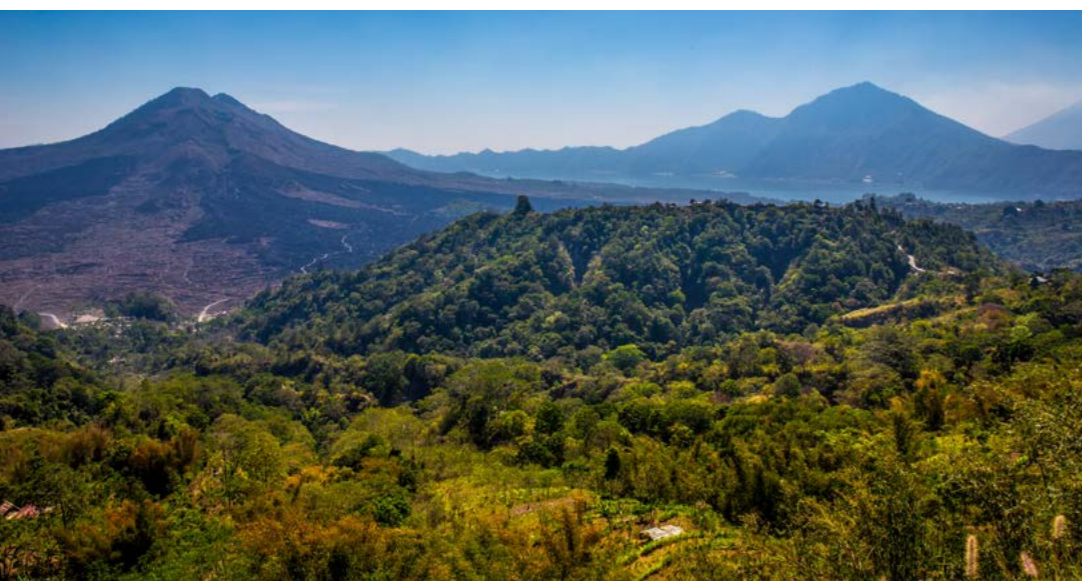
Manado: Malalayang Hospital
Tel: +62 0811 430913
Makassar: Rumah Sakit Umum Wahidin Sudirohusodo
Tel: +62 0411 (584677) or 584675

Travel/Visa/Security

Citizens of over 160 countries entering Indonesia via Jakarta, Ujung Pandang, Manado, Bali and certain other entry ports do not need to pay for a visa on arrival, as long as their visit does not exceed 30 days. The list of countries includes ASEAN nations, EU states, Australia, the USA, Canada and Japan.

Websites

Indonesia Travel
indonesia.travel/en



Shark Dives of **Southern** *Japan's*
Honshu

Text and photos by Andy Murch





Hundreds of banded houndsharks gather for the shark feed at Ito near Tateyama in Chiba Prefecture (above); Banded houndshark (top right)

For a relatively small nation, Japan has an exceptional degree of marine biodiversity—especially among sharks and rays. Exotic elasmobranchs can be encountered virtually anywhere along the meandering coastline of southern Honshu (Japan's large central island), but there are a handful of hotspots that shark fans should try not to miss.

Ito

Ito is a quaint little fishing village near Tateyama in Chiba Prefecture. From Ito's tiny harbor, the ocean appears calm and

tranquil, but a few hundred meters from shore, there are so many banded houndsharks that they block out the sun.

The shark encounter at Ito came about when avid diver Kan Shiota learned that local fishermen were having problems with sharks. The 1.5m-long predators were stealing fish and causing damage to the fishermen's nets, so Kan had the brilliant idea of luring the sharks away from the fishermen to a site where he could bring divers to see them instead. On paper, it sounded great, but the houndsharks turned out to be much shier than he had anticipated. No matter how much bait he brought with him, the sharks remained extremely skittish, but Kan was undaunted.

Initially, he left a few fish on the reef and retired to the boat. After a few months of

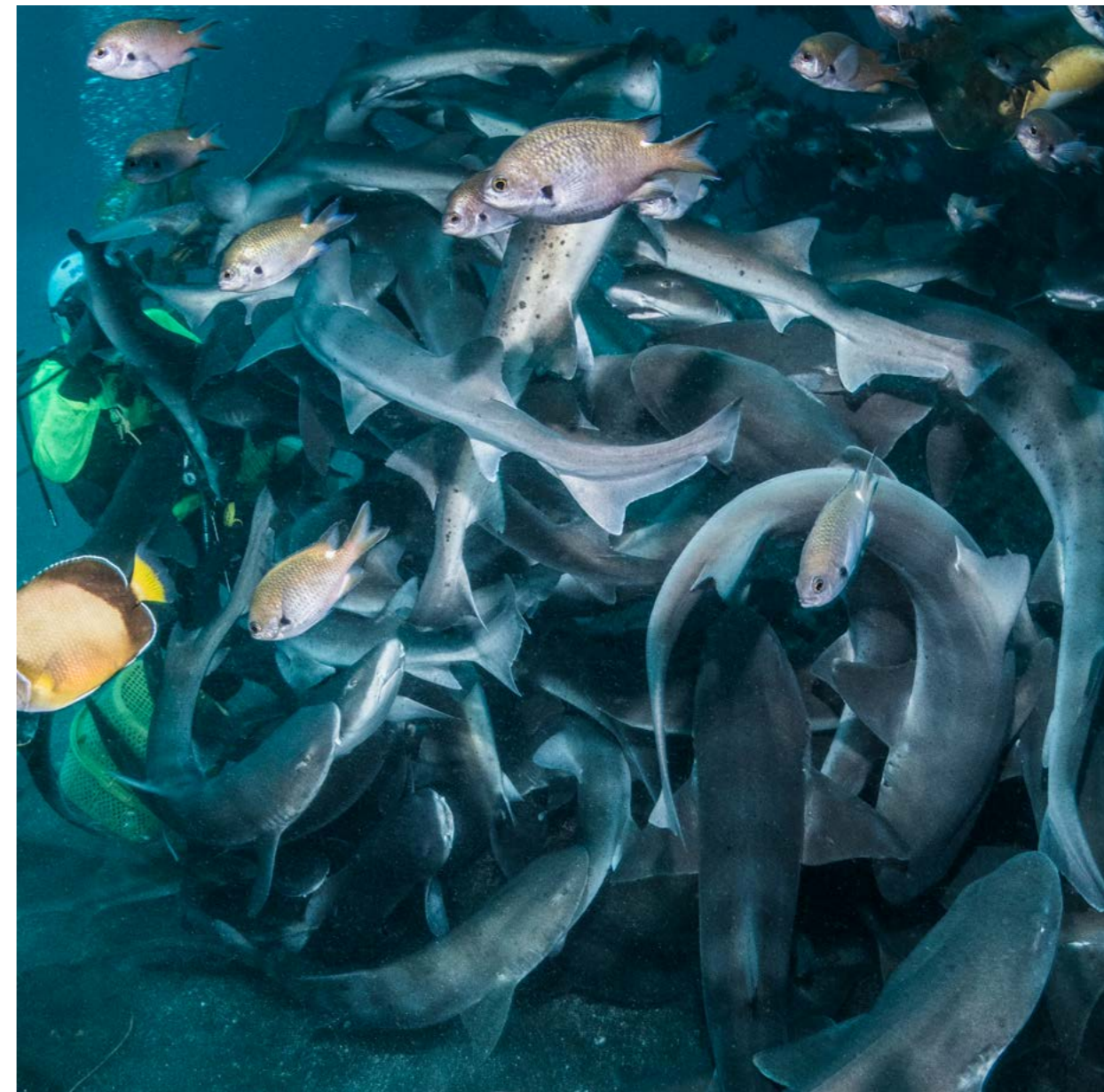
this, the sharks became more confident, and he was able to stay underwater with them, as long as he kept his distance. Once they got used to his bubbles, he crept closer, until they eventually grew comfortable enough for him to swim among them while they fed.

Encouraged by the houndsharks' newfound bravery, Kan brought along some other divers, but the animals immediately panicked and disappeared again. It was extremely frustrating, but Kan refused to give up. After five long years, the sharks were finally habituated enough to tolerate large groups of noisy divers.

Today, the banded houndshark feed at Ito attracts hundreds of sharks, which completely ignore the humans swimming around them.



Honshu



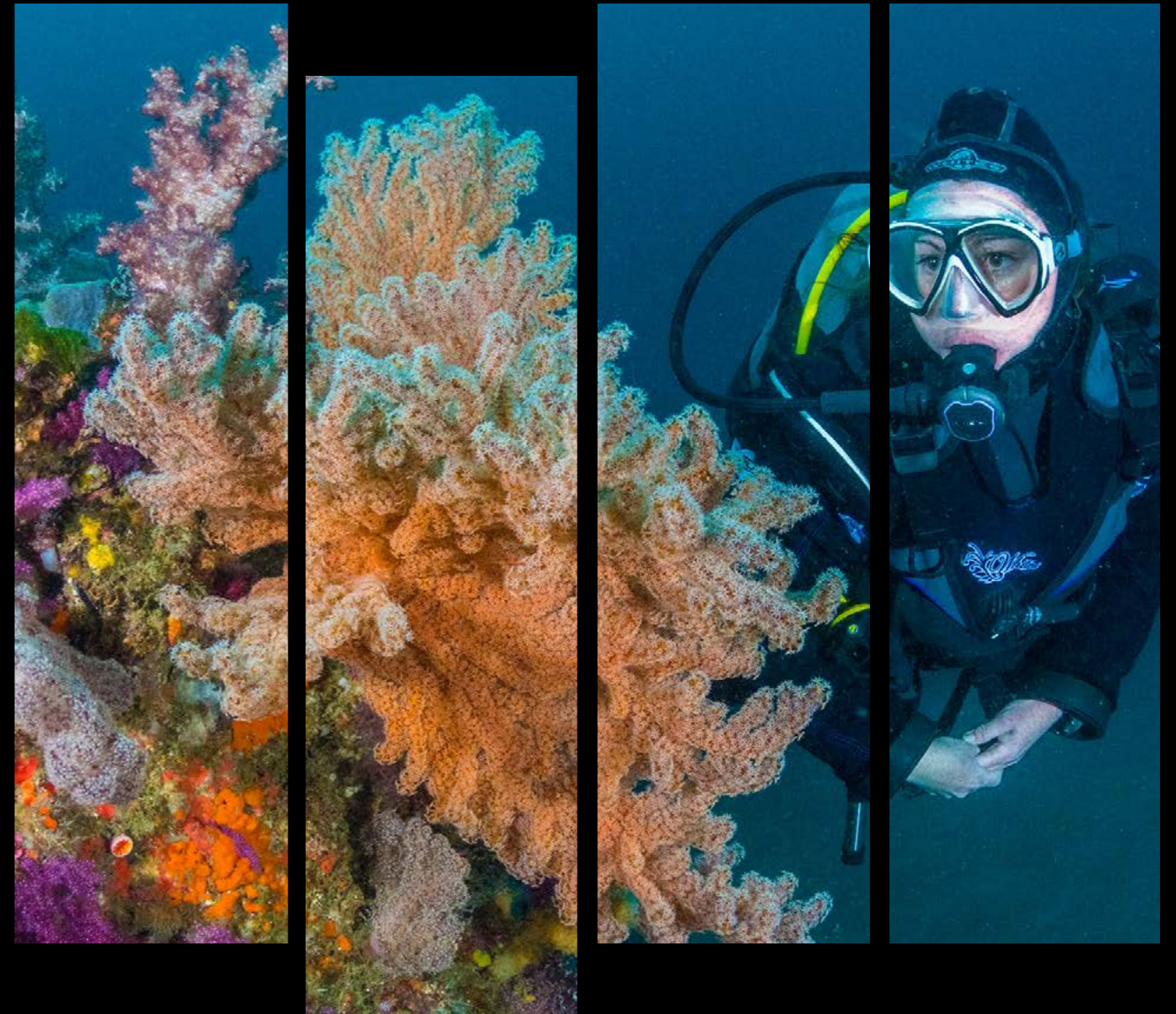
A real sharknado! Once feeding starts, the sharks form a tightly woven ball of mouths and fins, twisting and writhing like a big cartilaginous organism (above); Banded houndsharks are usually impossible to approach, but at Ito, they are happy to pose for the camera (previous page)



The feed at Ito also attracts scores of red stingrays that are easily as bold as the rays at Stingray City in the Cayman Islands. It is an impressive spectacle, watching the sharks and rays swirling around the bait crate. But it is not just the number of animals that makes the encounter interesting. Once the feed gets going, the sharks form a tightly woven ball of mouths and fins, which twists and writhes like one enormous cartilaginous organism—a real-life sharknado!

Beyond the shark feed, Ito's lush soft coral reefs are also worth exploring. Exotic fishes of all shapes and sizes abound, and it is not uncommon to find zebra-striped Japanese horn sharks secreted away under dark overhangs. Lucky divers may even run into an intricately patterned

Ito's colorful reefs (above); Hand-feeding red stingrays in Ito (top)



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One of the brilliant advantages of diving in the Kinki region in western Japan is access to tropical diving with a huge range of marine life — even in the winter months. The quality of diving in Japanese waters simply cannot be disputed. In fact, nutrient-rich waters off the coast of Kinki mixed with the warm current called “Kuroshio” or “Black Current” from the south, make this region one of the absolute best diving spots in Asia.

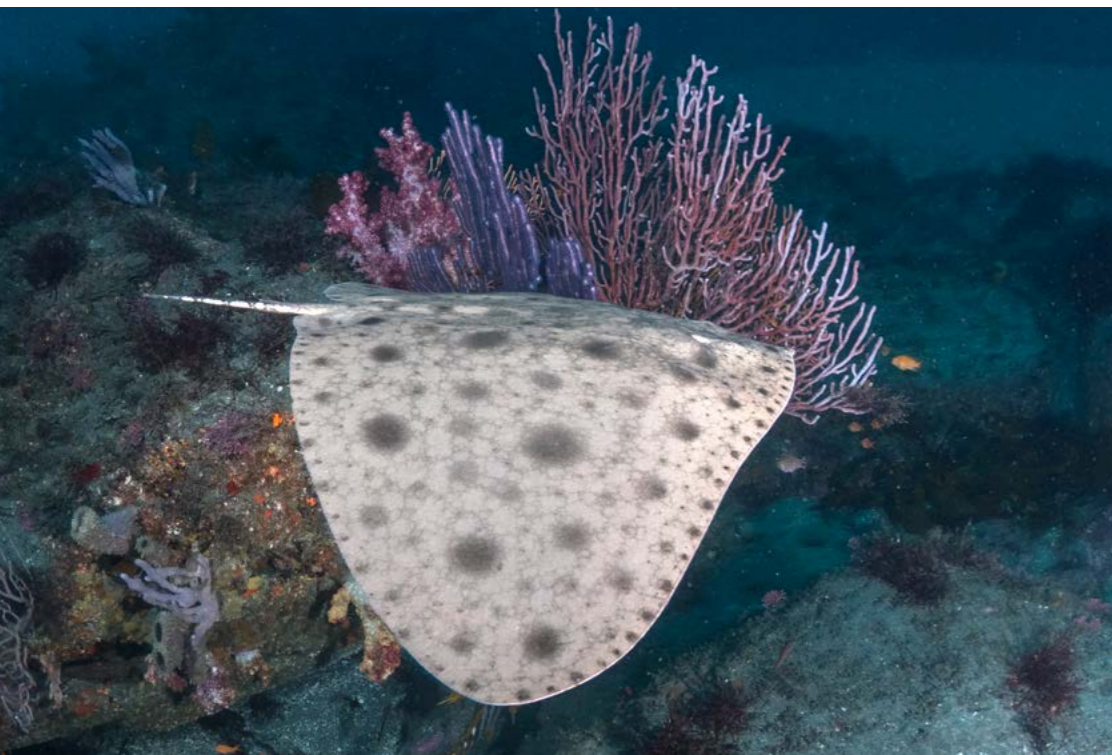


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Honshu

A rarely seen star-spotted smoothhound



Japanese butterfly ray or two, gliding gracefully over the seafloor.

Hatsushima Island

Farther west, around Tokyo Bay, Hatsushima Island is another must-

see destination for avid shark divers. The island is home to some of the largest Japanese horn sharks you could ever hope to point a camera at. But the most notable predators here are the Japanese angelsharks. Over the winter months, angelsharks migrate inshore from deep water and take up residence on the sand flats surrounding the island's shallow reefs.

Superficially ray-like in appearance, the flattened sharks flex their pectoral fins until a fine layer of sand covers them to the point of invisibility. With just their eyes and spiracles exposed, the angels wait patiently for a hapless fish to swim within striking distance. Then they explode upwards, mouth agape, clamping down on their prey with needle-sharp teeth.

Superficially ray-like in appearance, the flattened sharks flex their pectoral fins until a fine layer of sand covers them to the point of invisibility. With just their eyes and spiracles exposed, the angels wait patiently for a hapless fish to swim within striking distance. Then they explode upwards, mouth agape, clamping down on their prey with needle-sharp teeth.



A beautiful Japanese horn shark at Hatsushima Island (above); An intricately patterned Japanese butterfly ray (left)



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Diver with an enormous Japanese horn shark (above) and a Japanese angelshark (left) at Hatsushima Island.

should yield numerous animals.

Like Ito, the rocky reefs around Hatsushima are well stocked with colorful marine life. Large schools of fish swim back and forth, and kidako moray eels appear to inhabit every crevice large enough to accommodate them. The island itself is quite small, so there are a limited number of dive sites. But it is well worth the effort to get to this little gem, located off the eastern coast of the Izu Peninsula.

Izu lies tiny Mikomoto Island—a barren outcrop of rock topped by a lonely lighthouse. Based on the drab terrestrial terrain, one might be tempted to skip Mikomoto completely, but that would be a huge mistake. In September and October, the island attracts hundreds of schooling scalloped hammerheads as well as other pelagic shark species, such as grey reef sharks and oceanic blacktip sharks.

Although the hammerheads are an impressive sight, they can, of course, be seen at numerous other destinations

Mikomoto Island

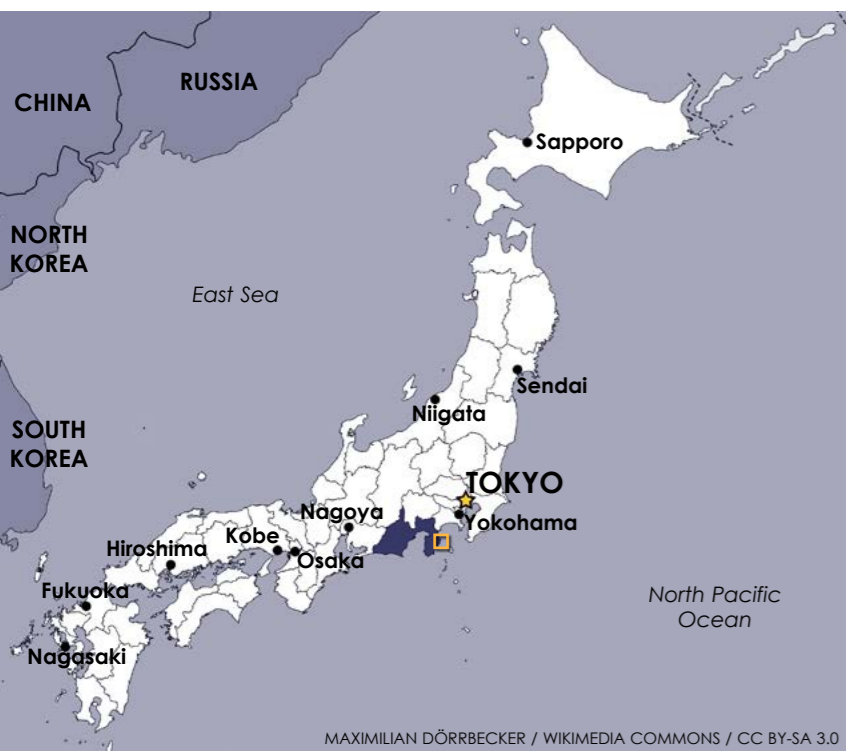
Way down at the bottom of

Their camouflage is so good that finding these two-meter-long sharks can be quite a

challenge for first-timers, but a methodical search of the sand within a few meters of the reef



Kidako moray eels are abundant on the reefs of southern Honshu.



Japanese wobbegongs are so well camouflaged that they are able to hide in plain sight (above); Location of Ito, near Tateyama in Chiba Prefecture on Japan's largest island of Honshu (left)

species—the cryptically-patterned Japanese wobbegong shark.

Like angelsharks, Japanese wobbegongs are ambush predators, which lay in wait for fish to swim within range of their impressive fanglike dentition. But unlike

ing on their complex camouflage to blend into the background—a strategy that is surprisingly effective.

Among the 12 species of wobbegongs that have been described so far, Japanese wobbegongs are the only ones that occur in the Northern Hemisphere. How they ended up in Japan is a mystery, but it is likely that they moved north millions of years ago, perhaps looking for a better food supply. Finding no competition on the lush reefs of southern Honshu, they flourished, and over time, evolved into a uniquely Japanese species.

Mikomoto's wobbegongs are very easy to spot during the winter months, but there are usually a few that remain throughout the sum-

angelsharks, wobbegongs do not bury themselves under the sand. They simply lounge on the reef, rely-

around the world. But Mikomoto Island is an excellent place to spot another of Japan's endemic shark

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In the early fall, schooling scalloped hammerheads can be seen at Mikomoto Island (left); Japanese spurdogs are related to spiny dogfish (below); Blotchy swell sharks are able to inflate their stomachs to appear more intimidating to predators (lower left)



Other endemic shark species

Although rarely seen, there are many more endemic shark species that divers occasionally run into in Japan. For example, when exploring Honshu's

mer—in case you prefer to go when conditions are more pleasant. The island also supports a healthy colony of angelsharks, albeit in deeper waters than those at Hatsushima Island.

deeper reefs, it is worth looking under overhangs for blotchy swell sharks. Like so many Japanese species, this secretive shark is easy to miss because of its subtle camouflage.

Swell sharks are so named because

they can inflate their stomachs with water in order to securely wedge themselves into crevices or simply to look bigger and scarier to would-be assailants.

Other rarities include the star-spotted smoothhound, a shy species that hunts over sandy areas for crustaceans and mollusks, and the Japanese spurdog, an Asian relative of the Atlantic spiny dogfish.

Whether you are a true shark fanatic or just an adventurous diver looking for an interesting new destination, Honshu is a wonderful island to explore and the perfect place to add a whole lot of new shark species to your life list. ■



Big Fish Expeditions runs a yearly Japanese shark diving safari in southern Honshu. For details, please visit: <https://bigfishexpeditions.com/trips/scuba-diving/japan-shark-safari/>

Andy Murch is an award-winning photographer, marine conservationist, author, journalist, explorer, dive instructor and submarine pilot based in British Columbia, Canada. He is the founder and a trip leader of Big Fish Expeditions at: bigfishexpeditions.com.



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shark tales



Guide to help endangered sharks and rays

James Cook University and the World Wide Fund for Nature (WWF) have launched the first-ever guide to design and manage Marine Protected Areas (MPAs) for maximum effect for sharks and rays.

A quarter of all species of sharks faces extinction, mostly because of overfishing. It stands to reason that designating ocean areas where fishing is controlled should be one of the most straightforward ways to tackle the overfishing of sharks and rays.

The degree to which these shark sanctuaries have been effective has been the subject of some debate by scientists, and is not helped by the many shark sanctuaries that do not have specific management objectives nor the monitoring regime necessary to assess whether such goals are being achieved.

"MPAs have become a popular tool to try and address some of the

conservation challenges that sharks and rays face. However, our research suggests that globally many are not providing positive benefits," said professor Colin Simpfendorfer of James Cook University.

A practical guide

To that effect, the WWF and the Centre for Sustainable Tropical Fisheries and Aquaculture (CSTFA) at James Cook University have launched *A Practical Guide to the Effective Design and Management of MPAs for Sharks and Rays*, showing in practical terms how to establish and maintain an MPA for maximum effect.

The guide provides science-based advice on developing and maintaining MPAs for these species. The

52-page guide helps maximise the impact of spatial protection by outlining how to ensure the areas are well designed, implemented, managed and enforced for the long term. The guide builds on the most comprehensive global analysis to date of the effectiveness of shark-focused MPAs, as well as a review of known information on the movement of sharks.

Besides fisheries managers, the MPA guide is aimed at authorities responsible for marine habitat and species protection, Regional Fishery Management Organisations, NGOs and other MPA practitioners working to conserve sharks and rays, as well as marine tourism operators. ■ SOURCE: JAMES COOK UNIVERSITY

Researchers believe they can use math to predict where sharks will show up

Temperature appears to be a relatively robust predictor for young great white sharks as their physiology is directly impacted by this variable.

The migratory habits of great white sharks have long been a mystery but, thanks to Long Beach State University researchers, there is now a way to better predict this apex predator's migratory habits.

Obviously, there are many factors that drive the distribution of the species, of which prey distributions are likely important and vary between populations and study areas.

Using data that took eight years to compile, shark scientists now believe they can accurately predict the likelihood that baby sharks will be near the shore in certain areas by using mathematical calculations that incorporate water temperature.

"Over time, you can predict where you can expect to see sharks in Southern California and in other parts of the world," said Connor White, the study's lead author who performed the

research while a graduate student at Long Beach State.

The researchers found that during El Niño years—when the winter water temperatures off Southern California are warmer—young sharks do not journey south to Baja California, and instead, stick around the Los Angeles area or even travel north up to Monterey Bay. Chris Lowe, director of the Long Beach State Shark Lab, said in a statement the research revealed young sharks prefer waters in the temperature range of 60-82°F (16-28°C)—and if it gets colder, he said, the sharks will congregate in another habitat. Much mystery still remains, however, about older, more aggressive, sharks.

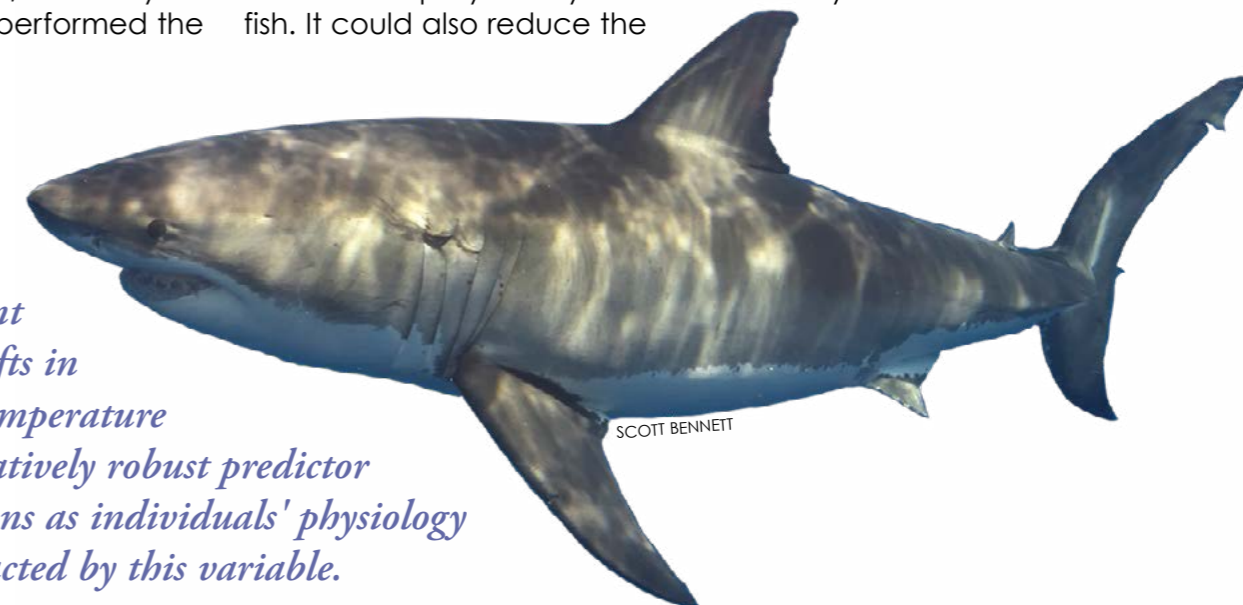
The research will help beachgoers and conservationists better understand when juvenile white sharks inhabit waters near the coastline to prey on rays and fish. It could also reduce the

number of white sharks accidentally caught by fisheries.

When habitat suitability was calculated globally, seven areas of coastline displayed high degrees of habitat suitability: Northeast Pacific, Northwest Pacific, Northwest Atlantic, Southwest Atlantic, Mediterranean/North Africa, South Africa, and Australia/New Zealand. Within each of these coastlines, there were hotspots with suitable habitat available for more than six months of the year.

For example, along the Northwest Atlantic, there were two large areas of high potential habitat suitability for juvenile white sharks, including areas off Cape Hatteras, North Carolina, which could be suitable for up to eight months of the year and Long Island Sound, New York, which may provide suitable habitat for six months of the year. ■ SOURCE: PLOS ONE

This study identified temperature as the predominant predictor of shifts in distribution; temperature should be a relatively robust predictor between locations as individuals' physiology is directly impacted by this variable.





MAURICIO HOYOS

Pregnant reef manta spotted off Cocos Island

First sighting of the reef manta ray, *Mobula alfredi*, in the eastern Pacific

An opportunistic sighting of a reef manta ray (*Mobula alfredi*) along the northeastern corner of Cocos Island, Costa Rica, represents the first sighting of this species nearly 6,000km from the nearest confirmed sighting location in the Marquesas Islands and the first record of this species on either side of the American continent. Given that this is not a common

aggregation area for manta rays, it is surprising to record the presence of *M. alfredi* at this location.

The single opportunistic encounter of *M. alfredi* at Cocos Island in the Eastern Pacific does not warrant an extension of the known range of this species. However, while Arauz et al., writing in *Marine Biodiversity Records*, cautiously



JAIN ET AL.

Archive photo of a reef manta (not taken in the Eastern Pacific) at a "cleaning station," maintaining a near stationary position atop a coral patch for several minutes while being cleaned by cleaner fishes

assume that this individual may have unintentionally migrated to this location, we cannot ignore the possibility that small populations of *M. alfredi* may in fact exist in the Eastern Pacific. Major aggregation areas for manta rays are still actively being discovered.

While considerable efforts have been made to identify critical habitats for manta rays in the Eastern Pacific, many areas have still not been comprehensively explored.

This reported encounter does offer tantalizing clues about the way this species may have successfully colonized much of its range. While current research suggests that physical barriers, and in particular, open expanses of sea typically deter individuals from undertaking regular long-distance migrations, we are now left to consider that *M. alfredi*, under certain circumstances, may occasionally undertake long-distance movements

How to ID a reef manta

Reef manta rays (*Mobula alfredi*) are similar in appearance to giant oceanic manta rays (*Mobula birostris*), and the two species may be confused as their distribution overlaps. However, there are distinguishing features. The giant oceanic manta ray is bigger than the reef manta ray, 4 to 5m (13–16ft) on average versus 3 to 3.5m (9.8–11.5ft) on average. However, if the observed rays are young, their size can easily bring confusion. Only the colour pattern remains a fast and effective way to distinguish them. The reef manta ray has a dark dorsal side with usually two lighter areas on top of the head. ■ SOURCES: MARINE BIODIVERSITY RECORDS, PLOS ONE



SIMON PIERCE / MARINE MEGAFUNA FOUNDATION / SIMONPIERCE.COM

Reef manta, Nusa Penida Island, Indonesia

Reef manta rays still a mystery within the Nusa Penida Marine Protected Area

Although manta rays are protected in Indonesia, essential information about their movements, habitat use and population dynamics are lacking.

The Nusa Penida Marine Protected Area (MPA), established in 2010 and located 18km southeast of Bali Island, encompasses the habitats for reef manta rays (*M. alfredi*). The MPA is located in a unique oceanographic region, with a shallow (200m) continental shelf adjacent to deep water basins of up to 4,200m depth. The waters are very productive with complex oceanographic conditions owing to their proximity to a major channel of the Indonesian Through Flow (ITF) current.

The ITF is an ocean current with importance for global climate since it provides a low-latitude

pathway for warm, fresh water to move from the Pacific to the Indian Ocean, and this serves as the upper branch of the global heat conveyor belt.

From photo-identification data logged by a group of researchers and trained observers (mantamatcher.org) between January 2012 and April 2018, investigators identified 624 reef manta rays from 5,913 sightings based on their unique ventral coloration patterns. A year of data was collected from two shallow sites: Manta Bay and Manta Point, both of which experience high tourism traffic. Analysis of the movement of manta rays

at these two sites showed that Manta Bay was a foraging ground primarily for juveniles and may even be a nursery, while Manta Point was used mostly for cleaning and courtship, which may indicate that it is an important social and reproductive site.

The researchers stated that regulation of boat traffic to these sites will be important in preventing further disturbance by tourism activities of this threatened species, especially during key reproductive periods. Entanglement in fishing gear was also found to threaten the reef manta rays. ■ SOURCES: MARINE MEGAFUNA, FRONTIERS IN MARINE SCIENCE





OLGA TORREY

Sand tiger sharks have unique patterns of brown spots on their skin, which can be used to identify individual sharks. This individual is photographed on the *Aeolus* shipwreck off North Carolina and might just have been one of specimens cited in the report.

Sand tiger sharks return to the same shipwrecks even months apart

It has been known for a while that white sharks (*Carcharodon carcharias*) and tiger sharks (*Galeocerdo cuvier*), exhibit a behaviour called *site fidelity*, where they return to specific areas over time. Now sand tiger sharks can be added to that list. Photos taken months and even years apart by underwater photographers have now shown that female sand tiger sharks keep returning to the same shipwrecks.

Using each shark's unique pattern of brown spots for identification, scientists found images of six female sharks returning to the same wrecks in visits up to 72 months apart.

Spot A Shark

In September 2016, an underwater photographer photographed an individual female sand tiger shark while diving off the coast of North Carolina on the *Aeolus* shipwreck, which was described in our feature, "North Carolina Wrecks and Sharks," published in issue 89. Ten months later, in July 2017, the same photographer returned to the same shipwreck (*Aeolus*) and captured another photograph of a female sand tiger shark. The two images of female sharks were uploaded to the citizen-science program Spot A Shark USA (spotasharkusa.com), which uses specialized software to ID the sharks. This led

researchers to look back into the image collection. Using each shark's unique pattern of brown spots for identification, they found images of six female sharks returning to the same wrecks between one and 72 months apart.

Comparing patterns

The software compares spot patterns across photographs to determine if any two images represent the same shark. One female shark was sighted on two occasions 11 months apart on a particular shipwreck—the *Spar*. Another female was spotted in two instances separated by one month on another specific shipwreck—the *Aeolus*. Several

females were also observed twice on shipwrecks positioned relatively close to each other. For example, a female shark was observed on two occasions 16 months apart on vessels spaced 0.25km from each other (the *Aeolus* and the *Spar*). The remaining two sharks were photographed 12 months apart and 72 months apart, respectively, on wrecks located 46.1km from each other (the *Atlas* and the *Aeolus*).

Knowing that the sand tiger sharks return to specific ships means conservationists can try to get a handle on their numbers and designate critical habitat among the wrecks. ■ SOURCES: ECOLOGY, DUKE UNIVERSITY



The largetooth sawfish possibly reaches up to 7.5m (25ft) in total length.

Largetooth sawfish protected in the Caribbean

Seventeen Caribbean countries have unanimously agreed to protect endangered largetooth sawfish, impose national protections for the species and cooperate regionally to recover populations.

Sawfishes, also known as carpenter sharks, are a family of rays, which should not be confused with sawsharks, which have a similar appearance.

The largetooth sawfish (*Pristis pristis*) is found worldwide in tropical and subtropical coastal regions, but also enters freshwater. All five sawfish species worldwide are classified as Endangered or Critically Endangered under the IUCN Red List.

Habitat loss

The main threat is overfishing, but it also suffers from habitat loss. Like other rays, low reproductive rates leave them exceptionally vulnerable to overfishing. Incidental catch is the main threat to sawfish; their tooth-studded snouts are easily entangled in nets.

Of the 75 countries where it has been recorded historically, the sawfish has disappeared from 28 and may have disappeared from

another 27, leaving only 20 countries where it is still present.

Iconic fish

"We are pleased that governments from across the Caribbean have seen the value of saving the iconic and irreplaceable largetooth sawfish," said Olga Koubrak, SeaLife Lawlegal advisor. "Sawfish are among the world's most endangered marine species and urgently need strict legal protections wherever they remain."

CITES listing

Sawfish have been listed by CITES since 2007, restricting international trade in the rays and their parts. They are also protected in Australia, the United States and several other countries, meaning that sawfish caught by accident have to be released and violations can be punished with hefty fines. ■

SOURCE: RESEARCHGATE

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Edited by
Rosemary E. Lunn

Equipment



Rock Hopper

Fourth Element has launched the Rock Hopper bootie for those times when you do not want to dive a bigger, bulkier boot in a balmy destination. Apparently this lightweight solution is comfy—it comes with an ergonomic footbed. Not all boots do. The 3mm stretch-neoprene bootie is lined with OceanPositive fabric, made from recycled plastic bottles, and it has a reinforced heel. The Rock Hopper also has a Smoothskin ankle seal, which minimizes water movement and helps to keep the shoe in place, whether you are walking, climbing or finning. FourthElement.com



SI Tech Släggö

SI Tech has launched three different dry glove systems—the Neva, Oberon and Liana—that will work with many varieties of dry gloves. The Swedish manufacturer states that all three systems are easy to mount to its large SLÄGGÖ Flex ring, and are “easy to use, no matter the diving environment”. Apparently, there are plans for this Flex ring to come in small and medium sizes.

[SITech](http://SITech.com)



Sunglasses from fishing nets

First it was rash guards and swimwear manufactured from recycled ghost fishing gear. Now, you can augment your outfit with a pair of sunglasses. Waterhaul, a Cornish social enterprise has launched a range of eyewear produced from 100% recycled fishing nets. The resulting eyewear—the Fitzroy and the Kynance—have been designed to suit both male and female faces. Each pair of glasses is fitted with Barberini mineral Platinum-Glass UV400 polarised recyclable lenses. Waterhaul is eager to prevent its sunglasses from ever ending up in landfill; hence, it operates a “circular economy” system. In the event that your glasses break, send them back to Waterhaul and the item will then be washed, sorted, shredded and recycled into a new pair of sunglasses. Waterhaul.co

Scubapro HUD

Closed circuit rebreather divers currently have a decent choice of HUDs (heads-up displays), scuba divers less so; hence, the latest computer from Scubapro is interesting. The Galileo HUD is designed to sit on the bridge of a framed mask, so that the full-colour micro-OLED display is not annoyingly “in your face,” but conveniently appears to float before your eyes. (And should you wish to, you can tilt the display up and out of the way). This computer has four dive modes: Scuba, Gauge, Apnea (freediving) and CCR. It is nitrox and trimix compatible, and the diver has a choice of two algorithms. Scubapro states that the single-knob menu is intuitive. Scubapro.com



One-hand lever

AP Diving has developed a lever that can be retrofitted to its bailout mouthpiece by the diver in seconds. The Open Circuit Bailout (OCB) lever was debuted at EUROTEK.2018. This simple device allows the diver to change the mouthpiece operation from closed circuit (CC) to open circuit (OC) with one hand. APD states, “The lever tabs have been spaced so as to be in the ideal position to suit any hand size.” The OCB lever is certainly a welcome safety development for CCR divers, because this GB£10 (US\$13) improvement appears to make the process of bailing-out in seconds far less stressful and fumble-free. APD has confirmed that this device is now fitted as standard to all new bailout mouthpieces. APDiving.com



Lego Diving Yacht

If you are struck for a fun present for a diver, it is worth checking out whether they used to “play well” with LEGO, because the Danish manufacturer now makes a diving yacht. LEGO states, “This awesome luxury diving yacht features a sun deck, removable roof and turning searchlight.” Also included is a sea floor scene complete with seaweed, an opening treasure chest with a gem, a buoy, a swordfish, a crab and two LEGO diver minifigures. This is suitable for those aged five and up, making it a perfect age-appropriate toy for any diver! shop.lego.com



Text by Mike Ange

Do manufacturers hype junk science to sell exposure protection? The short answer is yes!

You see the program from time to time at DEMA and other trade events, and you can read about it in the pages of nearly every dive magazine anytime. It typically goes something like this: Picture a big tank display with an “infrared” bulb (producing visible spectrum light) shining on a test tube, filled with water or a gel-like substance, floating in ice water. The display “demonstrates” that the finely ground “unicorn horn,” or earth minerals embedded in the neoprene, “produces heat” in the presence of infrared, which supposedly simulates your body’s metabolism.

This is where you should stop the recording. In the immortal words of Dick Rutkowski, “Science wins over BS every time.” In the words of your high school physics teacher, there is no such thing as a free lunch. No doubt an “infrared” bulb, even a fake one, produces heat, and as long as you have a good generator, a long power cord (with a GFCI breaker, hopefully) and a large infrared bulb affixed to your scuba tank, you might be able to simulate this “experiment” while diving—but even then, I doubt it.

Diving is, from time to time, rife with this type of junk science, typically from the

latest “Best Brand,” which, in the case of wetsuits, has reinvented the laws of thermal dynamics.

Why it does not work

Some of the tech-like, mineral-infused linings may have efficacy in surface applications. In fact, one technology,

trade-named Celliant, has met the rigorous testing standards imposed by the FDA for inclusion in medical devices to aid in rewarming the body during or after medical procedures. However, when we submerge these products and surround them with water, the physics are different.

Water has approximately 25 times the

capacity of air to absorb heat. Heat used to warm water does not magically come back to the body through some form of yet undetermined science. Any “reflection” of heat that might occur on the surface through 1 or 2mm of air will just be absorbed by the water, before it even reaches the reflective materials

and with no more warming of the water than you get with any other suit.

These same flawed arguments are used to promote metallic foils, metallic flecks... and the list goes on. It is just marketing at the expense of science, and unfortunately, a warmer dive.

Another flaw in the application of

Exposure Suit Myths

— Magic Seaweed, Nano Colors & Other Titanium Wetsuit Fabrications

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these technologies is the reversal of natural science. When we submerge the body in water, natural reflexes occur that shunt blood flow to the core of the body. This is Mother Nature's method of retaining heat.

The peripheral areas of the body have a much larger surface-area-to-mass ratio, allowing much more rapid loss of retained heat. If we defeat the reflex, the body's metabolic heat production cannot keep up with heat loss, even in waters approaching 88°F (31°C).

Many of the technologies used in surface tech are designed to, in part, increase peripheral blood flow, effectively defeating (or at least attempting to defeat) these common mammalian reflexes, and as a result, effectively accelerate heat loss. In short, you pay more to get significantly shorter and colder dives.

Actual heat-loss testing of neo-

prene rubbers and various inner-face linings clearly shows that the best insulation is the rubber alone. The science is simple: Rubber itself is an excellent insulator, and the less water we can flow into the suit, the less heat loss will occur.

Neoprene rubber and inner-face technologies

"Skin-in" rubber provides the most complete watertight seal to the diver's skin. However, skin-in/skin-out neoprene rubbers are also the weakest material, tearing, cutting and ripping very easily. (Skin-out reduces friction for the most efficient swimming).

Suits made of bare rubber are most popular with extreme freedivers and triathletes who are both willing to lube their bodies to don the suit, in order to avoid stress (stretch) tearing, and to accept a limited life span for their suits. This is not a trivial matter, consider-

ing that the average diver may expect three to five years from a wetsuit, versus just three or four dives with the skin-in/skin-out suits.

The "best" inner-face (inside the suit) technology, at least from a thermal protection perspective, is the thinnest material possible that also adequately protects the suit's primary insulator, which is the neoprene rubber. Actual thermal and abrasion testing shows several options in the form of very thin polyester or nylon threads woven into a broad weave inner face. Knitted material faces tend to be a bit thicker but not appreciably, so these are also reasonable substitutes, which may be a bit more abrasion-resistant.

Another category of

suitable protection consists of spray-on coatings that reduce the friction coefficient of the rubber, making it slick so that it slides on easily while providing at least some protection to the rubber. These coatings are far less effective in protecting the neoprene material, but they may decrease water flow depending on the technology.

If the coatings are so slick that they completely prevent the suit from "sticking" to the body, the flow of water will not be reduced and may be accelerated. Additionally, if the diver wears a rash guard, dive skin or other underlayers, he or she has defeated the benefits of the technology.

Why the hype and how did we get here?

In the 1990s, wetsuit manufacturers began moving toward what is called in the trade, "a better dressing room experience." Little thought was given to how the product would perform in open

water. Instead, the goal was to hook the sale in the showroom.

To accomplish that goal, stretchy neoprene rubbers became the norm. They slid on easily, stretched and felt much closer to wearing yoga wear than a good wetsuit. It is easy to see why a diver would buy the high-stretch fabrics.

This technology also had the added benefit of significantly increasing profits by minimizing the sizes required to fit most divers, with some suits capable of fitting a diver who would normally wear an XL suit, into a medium or medium-large suit "comfortably." Manufacturers that had as many as 25 sizes of proper rubber-insulation suits were now able to reduce to only six or seven sizes in high-stretch materials, without affecting how much of the market they could fit.

Stretchy rubber

The problem with stretchy rubber is, once again, that nasty set of



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laws we call physics. One major factor in the insulating capability of any substance is the mass of the material divided by the area that mass covers. In short, the thicker it is, the more it insulates. When we stretch the rubber, we spread the mass over a larger area, diminishing its insulating capacity.

Stretchy rubbers also tend to compress with water pressure more easily as well. Contrary to what many instructors teach, the suit does not compress to the body. The suit compresses toward the center of mass, so that the outside layer moves toward the center of the neoprene layer, as does the inside layer.

A suit made of these materials that is quite snug on the surface, may fit quite loosely at four atmospheres, resulting in a constant flow of water through the suit. The result of these changes was that divers were diving colder and colder on shorter dives in warmer waters.

Many instructors who taught over this period of transition, such as myself, found themselves buying 5mm or 7mm suits to do the same dives they used to do in 3mm suits. As a result, many brand manufacturers and original equipment manufacturers, which produce gear for other brands, saw an opportunity to fill the cold void with ineffective technology.

The technology may or may not have been real, but the bottom line was that it did not work while submerged, and in many cases, may have accelerated cooling. But there is no doubt that "nano-pink" whatsit-embedded rubber does sell suits.

So, what is a diver to do?

Go back to the basics of fit and material. It is amazing how many divers will pay huge sums for a custom-fit drysuit, where the fit (if it is safe and reasonable) has almost no impact on thermal protection,

but will take whatever wetsuit they can get off the rack.

The fit of your wetsuit is critical, even if you are buying a high-stretch rubber suit. Remember our earlier discussion: The more you stretch the rubber, the less thermal insulation it provides. If you must buy an off-the-rack wetsuit, go with the largest size that still provides good water-tight seals at the neck, wrist and ankles, with the least amount of stretch possible. Do not let an enterprising dealer convince you to take the size available. Get the best fit.

Better yet, see if you can find a suit still using good, L-quality or higher, foam neoprene. It will be more difficult to achieve a fit, but remember that at about one-third of an atmosphere (3m), the suit is already compressing, so the restrictive nature of the materials is a surface issue only. Just be sure you can

breathe comfortably and reasonably operate your equipment on the surface, because any suit that impedes either of those activities is unsafe to dive. If you can handle a little more difficulty suiting up, your dives will be a lot longer and warmer.

For the absolute best result, find an outfitter that will use high quality, compression-resistant foam in a custom-fitted wetsuit, made specifically to your measurements. Yes, the suit may cost a couple of hundred dollars more than the finely ground unicorn-horn suit you can get off the rack, but in the end, you will get that investment back in longer, more comfortable dives. Calculate what the average dive minute costs to see how quickly this added cost can be recovered. Plus, it is just not possible to put a price on the ease of suiting up in a properly fitting wetsuit, especially on a rocking dive boat in rough seas. ■

Mike Ange has worked in the dive industry for 29 years, 12 of those years in the senior management of exposure protection companies, including Huish, Waterproof, Harveys and Whites. His suit design modifications have won awards, and he designed the first commercially viable thermal testing process for wetsuit materials in conjunction with Simon Fraser University in Vancouver, Canada, in 2018. He has authored several books and manuals, including Diver Down: Real World SCUBA Accidents and How to Avoid Them published by McGraw Hill, Altitude Diving Manual published by SSI, TDI Advanced Wreck Diving Manual, and the SDI/TDI Diving Leadership Manual. Visit: mikeange.net.

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opinion

Text by Simon Pridmore

The following article is adapted from a chapter in Simon Pridmore's latest book, Scuba Exceptional: Become the Best Diver You Can Be.

The scene for this story is a live-aboard in Southeast Asia, which, on most of its itineraries, would offer guests four dives a day and imposed a 60-minute maximum dive time for each dive. Divers were also asked to stay together on a dive, and follow their guide. There were 12 divers and three guides, so each guide would usually be leading four divers.

On this particular trip, one of the divers, Brian, made it very clear that he did not like these policies. He would often swim some distance away from the group, complaining afterwards that their bubbles kept getting in his photographs. Sometimes, he would swim in completely the opposite direction from the group, on the basis, as he would subsequently explain, that the guide had been taking them all the "wrong" way. And, on every dive, he would just refuse to come up at the 60-minute time limit. When he

did eventually surface, he would boast about how much air he still had left.

He tried to cajole other divers to join him in his one-man protest action but was unsuccessful. They could all appreciate the safety advantages of staying

together and also understood how the 60-minute policy helped the liveaboard fit four dives, travel time between sites, three meals and tank filling into an all-too-short tropical day. They pointed out to Brian how his insistence on extending

his dive was causing them to fry in the sun on board the tender while they waited for him, but all he did was suggest hats and sunscreen.

The other divers eventually just shrugged their shoulders and nicknamed

Brian "the lone wolf." The liveaboard crew tried to reason with him, but he would just become aggressive and point out angrily that he had paid for his trip and so was entitled to dive in whatever way he wished. He threatened that he



The Lone Wolf

— *Dangers & Consequences*

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would give them a bad review if they tried to ban him from diving. They too eventually gave up arguing with him.

Rough seas

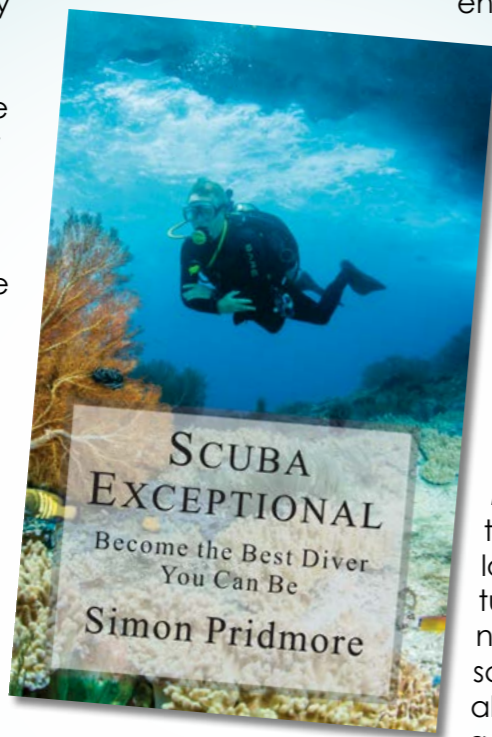
One afternoon, halfway through the trip, after a dive on a reef wall in relatively

rough seas, all the other divers surfaced and were back in the boat before 60 minutes were up, as the conditions had not been very comfortable underwater. Things were not much better on the surface either, with the tender buffeted by heavy waves. The lone wolf, as

A New Book for Scuba Divers!

Scuba Exceptional may be the fifth in Simon Pridmore's *Scuba* series, but it is actually the true follow-up to his first book, the best-selling *Scuba Confidential*.

The philosophy of safer diving through the acquisition of knowledge and skills is the same, although this time the themes are different. As before, Pridmore provides us with a whole host of extremely useful advice and techniques, illustrated by real-life experiences and cautionary tales. The focus this time, though, is more on issues that experienced divers face. There is more technical diving content, and Pridmore covers some relatively complex issues in his usual clear and easy-to-read style. In many cases, the issues that concern technical divers reflect those that affect scuba divers at every level. After all, as Pridmore writes, technical diving is on the same spectrum as conventional sport diving: It is just a differ-



ent frequency.

Scuba Exceptional also deals in more detail with the psychological approach to scuba diving, broaching familiar topics from new angles and borrowing techniques and procedures from other areas of human activity.

While most of *Scuba Exceptional* focuses on the diver, it also takes a look at the wider picture and highlights a number of areas where scuba diving professionals and the "industry" as a whole are letting divers down. As always, Prid-

more is realistic in his assessments. He may shine a little light on the dark side of the scuba diving world, but he does this in order to illuminate bad practices and encourage change, while offering solutions.

Scuba Exceptional: Become the Best Diver You Can Be by Simon Pridmore is available on: [Amazon.com](https://www.amazon.com).



usual, was not with them. Nobody was concerned, as this was normal. Brian would not be denied the diving time he deserved just because the conditions were poor. At least, the sun was not burning down upon them. The sky was grey and cloudy, just like the sea.

It was only after they had been rocked and rolled by the swell for almost half an hour that the boat crew sensed that something might not be well and that even the lone wolf should have surfaced by now. They began a search, but they did not find him. After a while, they abandoned the effort briefly to return the divers, some of whom had been seasick, to the mother boat. Then they went back out to search for him again. The lone wolf had become the boy who cried wolf, and the other divers wondered if they would ever see him again.

After almost two hours, just as darkness

was falling, a sharp-eyed crew member saw what looked like a small orange buoy in the fading light. As the tender approached, they saw it was a partially inflated safety sausage and, to their relief, there was a diver attached to it, waving frantically. Brian was unharmed but looked pale and scared as they helped him into the tender. Of course, by the time they got him back to the liveboard, he had recovered his usual bluster and was furious with the crew and his fellow divers for losing him in the first place and then not finding him more quickly.

During the remainder of the trip, however, he did dive much closer to the group and would surface with them on time every time.

The blame game

This sort of scenario is all too common in diving, and stories like this divide opinion.

Some might attach blame to the liveboard crew for not enforcing their policies more strictly. Some might feel that they had got their priorities twisted and that, no matter how objectionable Brian was, after having given him a number of warnings, they should have stopped him diving, let him off the boat at the nearest port and refunded the cost of his trip.

After all, he was causing his fellow divers inconvenience, and he was messing up the boat's schedule. For all his miraculously low air-consumption, he was not diving in what would conventionally be seen as a safe manner. Stopping him from diving would have meant a safer, more pleasant trip for everyone else on board, simply at the expense of a refund and the risk of a bad review.

Others might agree with Brian and might argue that he had paid for the trip and so should be able to dive any way



opinion



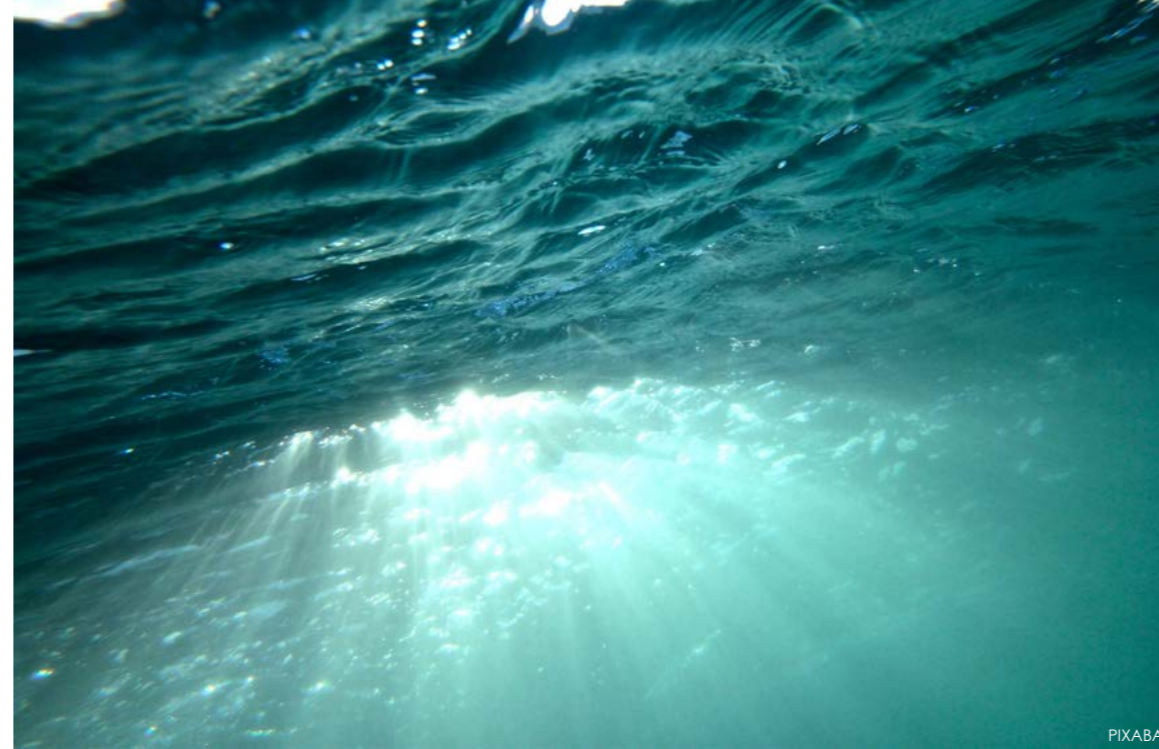
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he liked. "He is obviously a good diver and it's a free world," they might say.

What makes a good diver

One thing is indisputable. Brian is not a good diver. An attribute essential to being a good diver is concern for the well-being of others. This is a qual-

ity that all good divers either possess naturally or have learnt through experience. Whether you like to dive solo, with a buddy or with a group of divers, diving is a team sport. You are part of a team. Some of the team are underwater, some are on the surface, some are back on land, or in this case, the



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mother boat. The concept also extends to the diving world as a whole and to rescue teams who are called out to search for divers when they go missing at sea, in lakes or in caves.

Just as you hope that the people who take you diving have your best interests in mind, so should you, as a sport diver, keep their interests as well as those of your fellow divers in mind. You have a responsibility to others in the diving community to keep yourself safe so that they do not have to put themselves in harm's way, or even just put themselves out, to search for you or rescue you. Many of the most important dive safety rules, such as "one up, all up," are anchored in this idea.

For the sake of a few more minutes underwater, Brian felt that he was justified in flouting the dive operation's rules, ignoring their interests completely in favour of his own, putting the crew under pressure and making his fellow divers suffer while they waited for him.

Behaviour like this may sometimes seem harmless but, as in this case, it can lead to potentially disastrous sce-

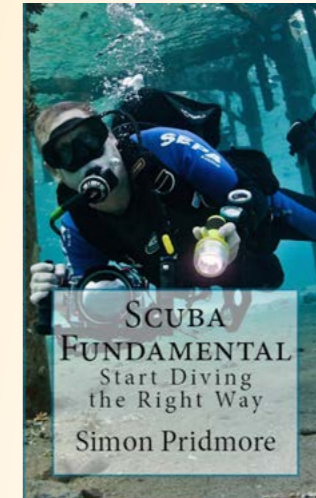
narios. When, at least partly because of his obstinacy, Brian got himself into difficulty, he was probably quite happy that the crew and his fellow divers nevertheless had his interests at heart and kept searching for him for as long as they did. Not that he would ever admit it, of course. ■

Simon Pridmore is the author of the international bestsellers Scuba Confidential: An Insider's Guide to Becoming a Better Diver, Scuba Professional: Insights into Sport Diver Training & Operations and Scuba Fundamental: Start Diving the Right Way. He is also the coauthor of Diving & Snorkeling Guide to Bali and Diving & Snorkeling Guide to Raja Ampat & Northeast Indonesia, and a new adventure travelogue called Under the Flight Path. His recently published books include Scuba Exceptional: Become the Best Diver You Can Be, Scuba Physiological: Think You Know All About Scuba Medicine? Think Again! and Diving with Divers: Tales from the Kitchen Table. For more information, see his website at: SimonPridmore.com.

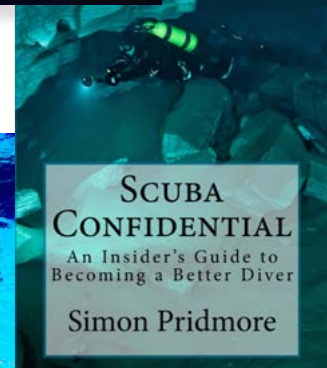
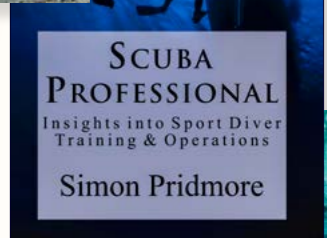
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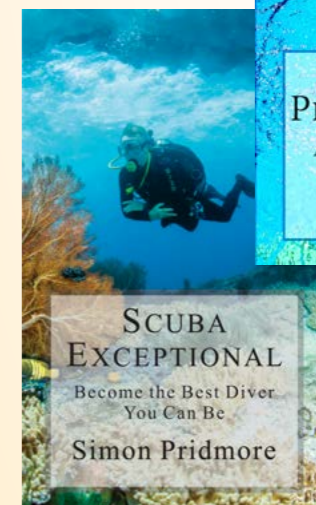
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VANISHING FISH

Shifting
Baselines
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Foreword by JENNIFER JACQUET

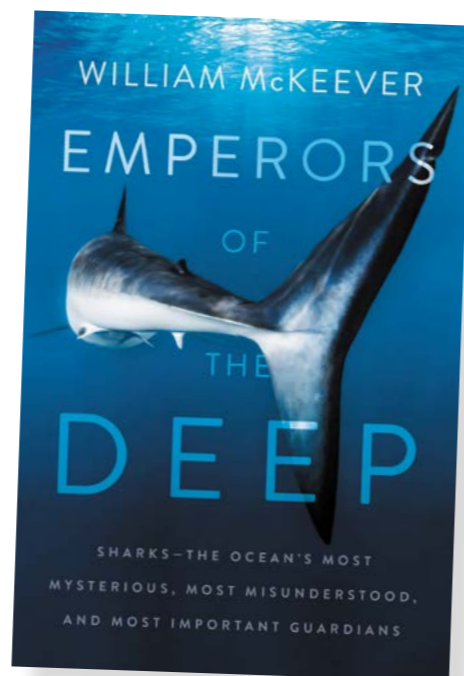
Where are all the fish?

Vanishing Fish: Shifting Baselines and the Future of Global Fisheries, by Daniel Pauly

The world's fisheries are in trouble. In a series of essays backed by decades of research, biologist Daniel Pauly describes

the current state of global fisheries—their rapid expansion and ensuing demise—while offering insights into how and why they have failed. Factors like globalisation, underreporting of catch numbers and the phenomenon of “shifting baselines” are covered. The book also provides practical recommendations for a future in which small-scale fisheries can supply the majority of the world's fish.

Hardcover: 304 pages
Publisher: Greystone Books
Date: 28 May 2019
ISBN-10: 1771643986
ISBN-13: 978-1771643986



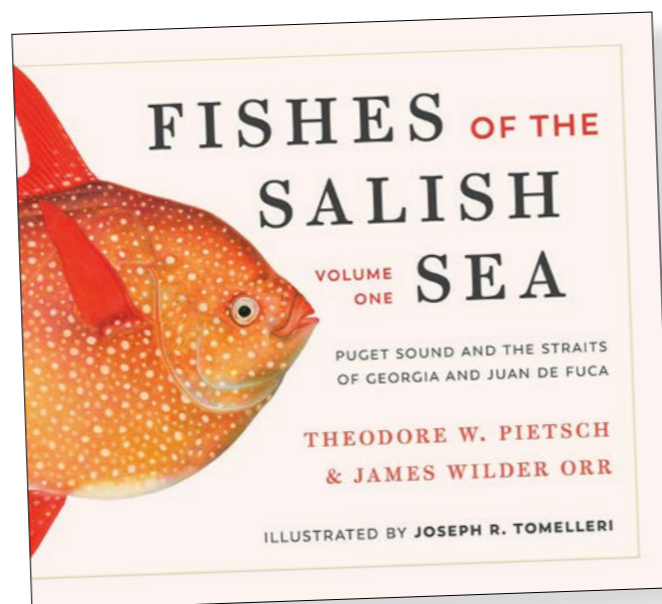
Sharks

Emperors of the Deep: Sharks – The Ocean's Most Mysterious, Most Misunderstood, and Most Important Guardians, by William McKeever

This book explores the secret lives of sharks, a unique species that have survived five extinction-level events, including the one that killed off the dinosaurs. Documentarian and conservationist William McKeever examines the shark's prehistoric background and how it became one of the world's most feared animals. Readers are taken on a global journey, from the frigid waters of the Arctic Circle to the coral reefs of the

Central Pacific. The book also emphasises the important role these evolutionary marvels play in maintaining a balanced and functioning ecosystem.

Hardcover: 320 pages
Publisher: HarperOne
Date: 25 June 2019
ISBN-10: 0062880322
ISBN-13: 978-0062880321

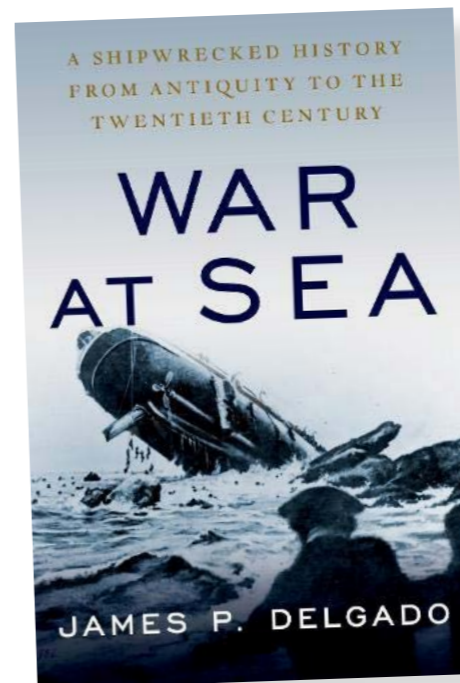


Fish ID

Fishes of the Salish Sea: Puget Sound and the Straits of Georgia and Juan de Fuca, by Theodore Wells Pietsch and James Wilder Orr, and illustrated by Joseph R. Tomelleri

Comprising three volumes, this guide presents the identification, ecology and life history of 260 marine and anadromous fish species of Washington State and British Columbia. Besides brilliant colour plates of all treated species, it also contains illustrated taxonomic keys to facilitate fast, accurate species identification. There is also an in-depth history of Salish Sea research and exploration as well as biographies of ichthyologists and other naturalists who have worked on the area.

Hardcover: 1074 pages
Publisher: University of Washington Press
Date: 4 July 2019
ISBN-10: 0295743743
ISBN-13: 978-0295743745



Wrecks

War at Sea: A Shipwrecked History from Antiquity to the Twentieth Century, by James P. Delgado

From the warships and battles of the ancient Egyptians, Phoenicians, Greeks, Romans and Chinese, to the wrecks of the Cold War, this book presents a global tour through time of humanity's naval heritage. Author James Delgado, a renowned maritime archaeologist, also describes how underwater exploration has managed to uncover these remains, adding to the reader's understanding of the past and providing intimate details of the experience of naval warfare.

Hardcover: 488 pages
Publisher: Oxford University Press
Date: 30 July 2019
ISBN-10: 0190888016
ISBN-13: 978-0190888015

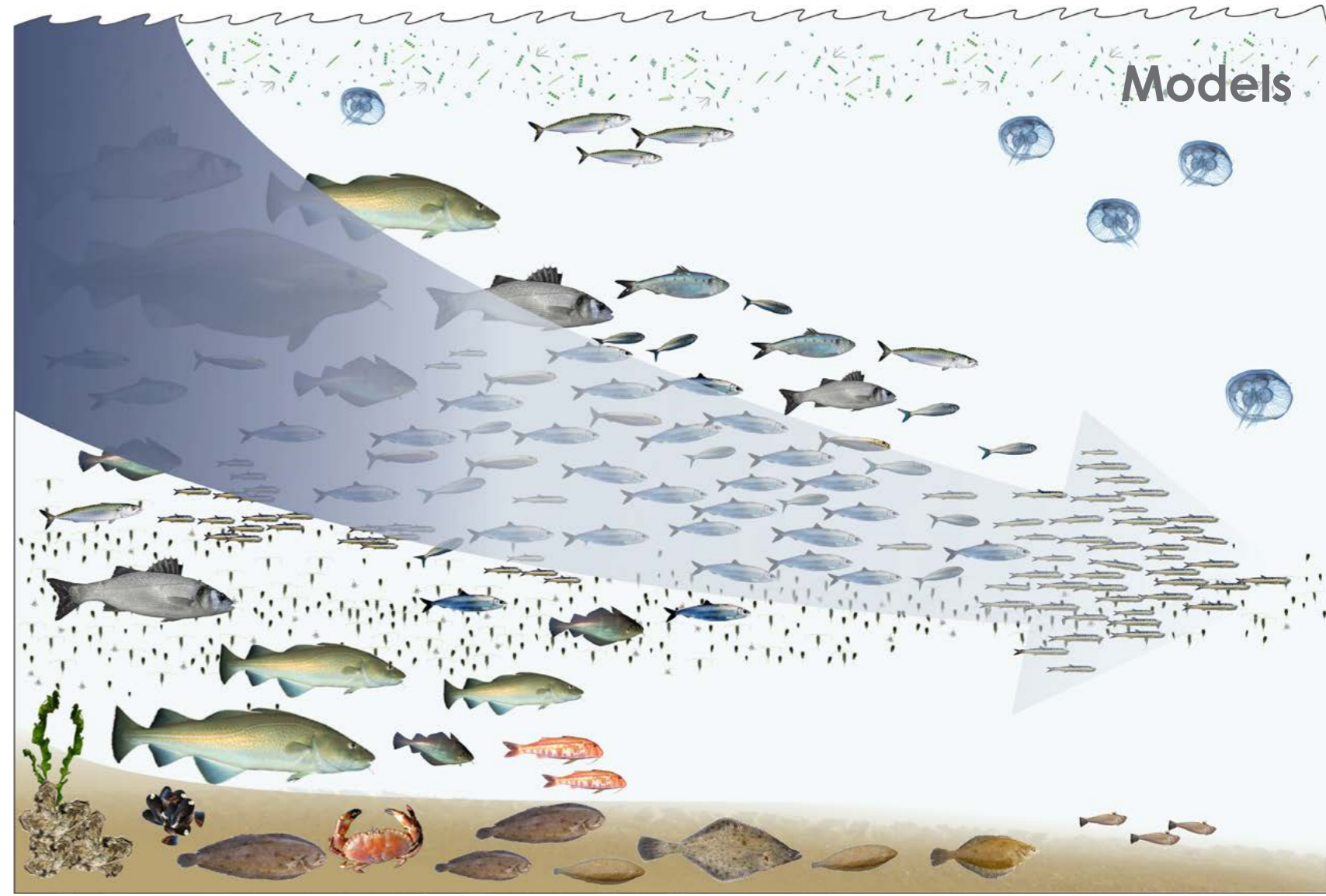
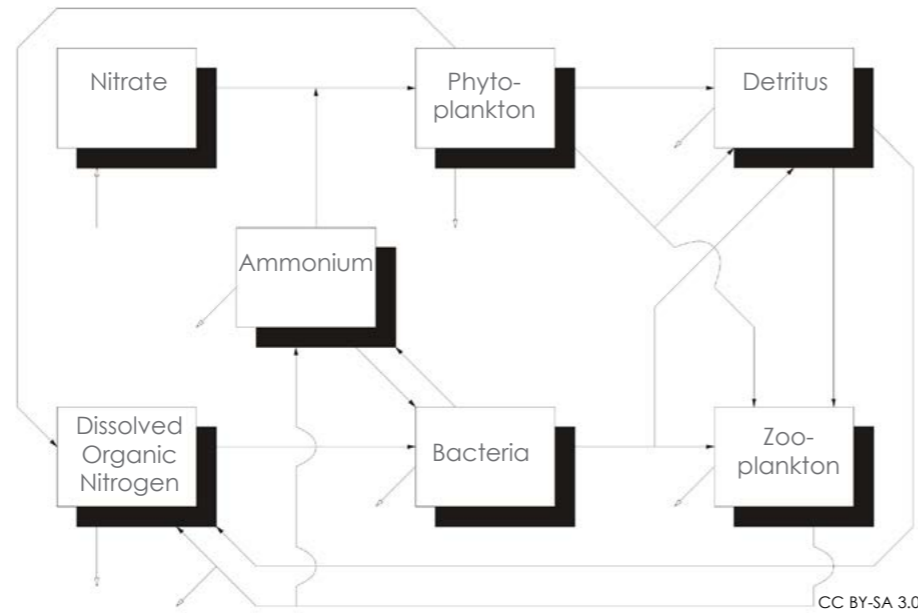
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Ecosystems can be viewed as systems of connected "compartments" between which matter or energy flows.

Figure 1. A diagram showing "A nitrogen-based model of plankton dynamics in the oceanic mixed layer" by Fasham, M. J. (et al, 1990). The connecting arrows indicate flows of material between these components, driven by processes such as primary production, grazing and remineralisation. Closed-headed arrows indicate flows of material that remain within the model ecosystem; open-headed arrows indicate flows of material out of the modelled domain—for instance, below the ocean's upper mixed layer.



used in decompression algorithms in dive computers are, for example, not real tissues but fictional representations with a simulated behaviour, which has been designed to resemble the on and off gassing that takes place inside and between the real tissues making up the organism of a diver. In order to make these calculations manageable, a number of simplifications and assumptions have to be made. The truth is that

nobody knows exactly what goes on at the microscopic level, the dynamics of which are still up for much discussion and a subject of ongoing research.

Close enough

The models (or mathematical representations) used in dive computers make predictions, which correlate closely enough with actual data and observations made during tests conducted by hyper-

baric researchers over many decades. We use and trust these instruments to keep us out of harm's way. For the most part, they do—many thousands of dives have been conducted safely and without any incidences.

However, a substantial proportion of occurrences of decompression illness (DCI) has happened to divers who stayed well within the limits and without any immediate explanation. It is a testament to the fact that dive computers, no matter how sophisticated they may have otherwise become over time, are not able to state what is actually going on in the body—only what is, in all likelihood, going on. They are simply predictors. Until some fancy technology comes around which can directly monitor gas loading in various tissues in real time as we dive, it is all they can do.

Why can't models be accurate?

In order to better illustrate the limitations of models, let us look into

how models are used elsewhere, say, in aquatic ecology—a field that should also have plenty of relevance to divers. Researchers and managers would typically like to know how an ecosystem behaves, or about its resilience to the impact of various human activities. It could be a matter of water quality, management of fisheries (such as setting sustainable quotas), the effect of marine protected areas, the effect of some major infrastructure (such as a bridge or dam), or the restoration of lakes, wetlands or seas.

In other words, models are about describing various changes to the overall system, along with the relative magnitude and significance of its constituent processes. In doing so, the most important processes and factors

are prioritised, as it is an understanding of the general behaviour of the system, and usually not the finer details, which is sought.

Models are very much about flows (i.e. of matter or energy) between compartments. For example gasses that moves between simulated human tissues or how carbon would flow through an ecosystem. Let's take a look at the mechanics.

Back to school

We can use a familiar elementary-school math example to demonstrate how flows are calculated:

Ben travels in a car between city A and town B, which are 100km apart, and he is driving at an average velocity of 50kph. Most of us can easily

figure out, without the use of a calculator, that it would take Ben two hours to get from A to B, or that in 30 minutes, he would have travelled 25km, and so on. Such calculations are trivial, and we perform them every time we leave the house to be somewhere else on time.

In a model, the two towns are the compartments and the car is the matter that "flows" between them at a certain rate (its velocity).

Timetables can be viewed as simple models. They predict with reasonable accuracy when a bus or train is going to make it to its destination, under the presumption that there are no major accidents holding us up. We will get back to the importance of underlying assumptions in a moment,



In order not to deplete the world's stocks of fish, one cannot take more than the "maximum sustainable yield" out of the ocean. Fishing quotas are calculated using complex population and ecosystem models.

Driving is a process whereby some object moves ("flows") at some rate ("velocity") from A to B. This process may run smoothly, or vary a lot due to many influences.



but if we leave extraordinary circumstances out of the picture for now, we do not need to precisely account for the effect of every traffic light or the number of potholes in the road along the route as these effects usually do not make a major difference in the end.

The above example assumes an average or even speed, an assumption or condition which is important to keep in mind going forward.

Dynamic systems

What if the speed was not even but fluctuated significantly? Say, if the subject (or "compartment," in model-speak) we are looking at is not a car or a bus travelling predictably along a road, but rather some volume of water flowing in the ocean, subject to tides and wind, passing through a strait or tumbling down a river?

The systems' behaviours we want to analyse—perhaps for the sake of making some forecast—are often highly dynamic, and the systems' constituent compartments can be simultaneously affected by many factors. Complex systems may even exhibit chaotic behaviours on various levels, such as weather, but let's ignore that complication for the time being.

Describing system dynamics

In order to understand the dynamics of systems and how they are described mathematically, we can stick with example of the car going from A to B and take a closer look at the relationship between location, velocity and acceleration:

Velocity (v) is the *rate* at which you change location and acceleration (a) is the *rate* at which you change your velocity. Or more formally (where Δ means the difference or change):

$$v(t) = \frac{\Delta \text{ distance}}{\Delta \text{ time}} \quad \text{and} \quad a(t) = \frac{\Delta \text{ velocity}}{\Delta \text{ time}}$$

These parameters are interlinked in a way so if you know your acceleration you can also calculate your speed and time of arrival and vice versa. From our physics classes, we may recall the classical law of motion as expressed in the following equation:

$$p = p_0 + vt + \frac{1}{2} at^2$$

In this equation, p is the position of the moving object, p_0 is the starting position, v is velocity, t is time and a is acceleration.

In terms of an everyday commute, it simply means that:

$$\text{Your current location} = \text{Starting point} + (\text{speed} \times \text{travel time}) + \frac{1}{2} (\text{acceleration} \times \text{time}^2)$$

If we sketch out such a typical commute on a graph (Figure 2), it should become apparent that the process of driving from A to B is the sum of three constituent processes. You set out by accelerating up to your cruising speed, coast along at a steady pace, and then decelerate at the end as you come to a stop.

The speed changes only in the beginning and the end of the journey, so this process of changing your location is fairly

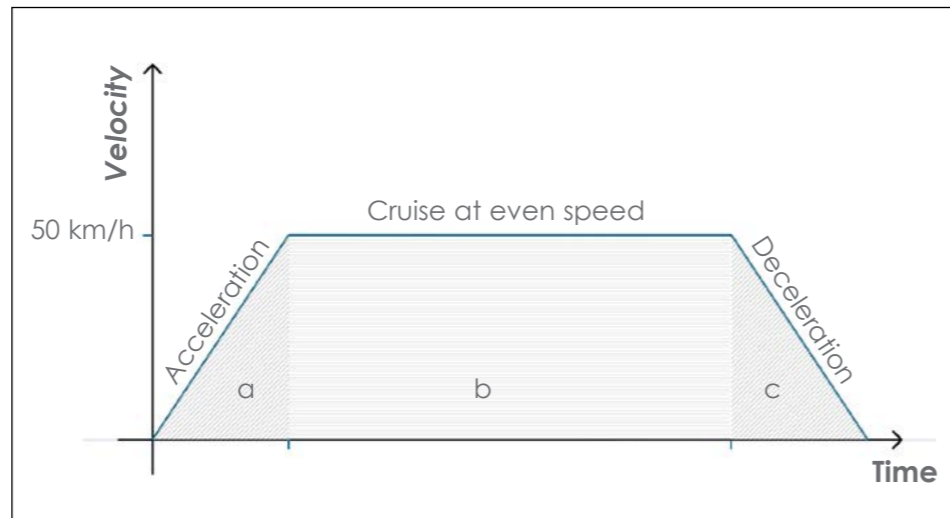


Figure 2. Graph of a typical commute in a car, driving from A to B. The areas under the curve ($a + b + c$) is the distance covered. Acceleration is change of speed. The slope of the graph shows acceleration (+/-), which in this case, is always linear (even) as the lines are straight.

simple to calculate. In fact, the distance travelled is simply the area under the curve. In this case, we just have to add up the three areas a , b and c .

In this simplified case, acceleration is always constant, corresponding to the slope of the curve, which comprises straight lines.

First, it has a positive but constant value; then, zero; and finally, it has a negative value, as the car is coming to a stop. All we have to do in order to calculate the distance covered is add up the area of the two triangles and the rectangle.

When processes fluctuate

But what if the process was far more uneven and the changes (in this case, in velocity) represented a complex curve? Say, if the car would constantly speed up and brake?

The next figure (right) shows an example where speed fluctuates—the slope of the gradient is the acceleration/deceleration.

Then, simple geometry or linear algebra would not be able to provide an immediate answer, and we would have



How long does it take for phosphorus to "travel" through a lake ecosystem? Phosphorus often enters aquatic ecosystems when fertilisers used in agriculture reach groundwater or are washed out with rain. Too much phosphorus in an otherwise clear lake may suffer "eutrophication," a state in which a lake becomes so fertilised that blooms of algae make the water turbid and vegetation rooted on the lakebed dies from being shadowed by algae.

to resort to integral calculus to precisely calculate the area under the curve, such as the yellow area on the curve below. (For those not familiar with integral calculus, you may think of it as summing up the areas of many infinitesimally thin vertical rectangles that can fit into the yellow area in Figure 3 below).

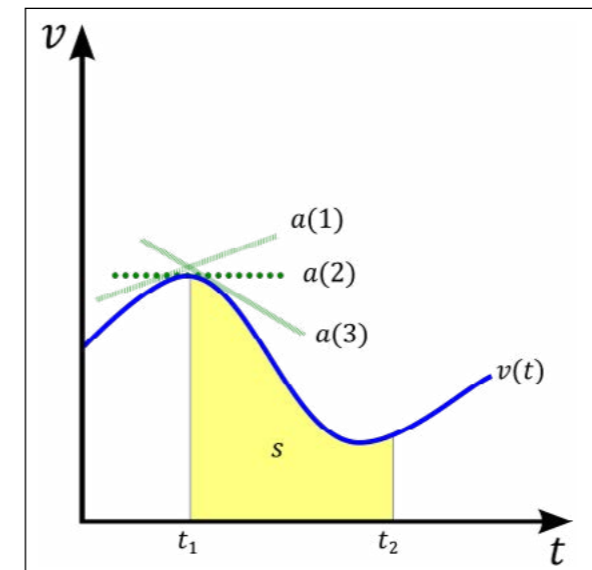


Figure 3. Example of a velocity vs. time graph, showing the relationship between (a changing) velocity v on the Y-axis, acceleration a (the three green tangent lines represent the values for acceleration at different points along the curve), and distance travelled s (the yellow area under the curve). Source: Wikipedia

This is all fine and dandy if it is possible to integrate the equation describing the motion—which, in the overall context of this article, should just be viewed as a stand-in, also representing processes in biology and physiology.

$$\text{Distance} = \int_{t_1}^{t_2} v(t)$$

The big rub

But here comes the big rub: It isn't always possible. In fact, once we deal with systems comprising many compartments and some complexity, it is rarely possible to integrate the resulting equation describing the system. That is, when we cannot solve the integral, made up of many functions each of which may be a differential equation representing some process influencing the total result:

$$x = \int a(t) + b(t) + c(t) + d(t) \dots$$

In modelling, we often have to describe a system of processes that are the combined result of many constituent subordinate processes. Each of these constituent processes may also exhibit dynamic com-

ecology

plex behaviour, and in turn, be affected by yet another underlying layer of processes. In such cases, we can end up with some very long and gnarly equations.

Do we need all the details?

Imagine describing the motion of a car by calculating the sum of influences of every single part of the engine, the transmission, the state of the road, the weather conditions, and so on. Of course, given the little variability or minimal impact of each of these many small factors and processes, we can usually ignore them and still end up with reasonably accurate estimate of how soon we will make it to work under normal conditions. That is, we presume that bridges we need to cross will not collapse, and so on.

On an aside, this also goes to demonstrate how simplifications and reductions of factors is a quite reasonable exercise regarding many daily scenarios. By ignoring the effects of every single traffic light as well as variable road and weather conditions, we may get a less accurate result but still perfectly usable and acceptable estimate. Only one has to accept that the price of simplicity and ease of calculation is some loss of accuracy, which may, or may not, have any practical significance in the end.

Sometimes details matter

But in other cases where the constituent processes play a more significant role in the forecast produced by our model, we can find ourselves forced to deal with the aforementioned long and gnarly equations that cannot be integrated—whereby a result can be computed from entering various variables into the resulting equation.

Simulation

Instead, one has to resort to a step-wise simulation. This is akin to calculating each of the rectangles under the curve and summing them all up, as opposed to calculating the area in one go, with an

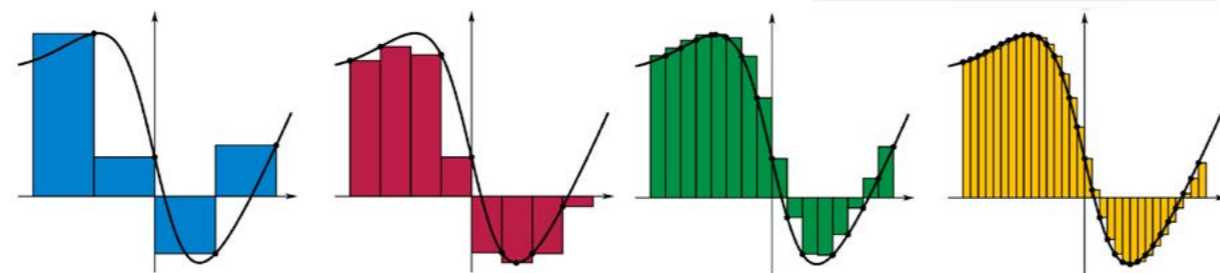


Simulations of complex systems comprising of interactive dynamic components are approximations solved with **numerical analysis**—a brute-force approach requiring massive supercomputers.

integral. In the example above with the moving car, that would equate to meticulously adding up the distance covered second by second, or whatever time interval is suitable.

Many calculations required

But there is a little snag. The more precisely this has to be done, the smaller intervals have to be applied, and as a result the more calculations have to be performed. The smaller intervals the closer the total area of the rectangles will resemble the area under the curve. Obviously, one has to find a compromise between computing time and accuracy.

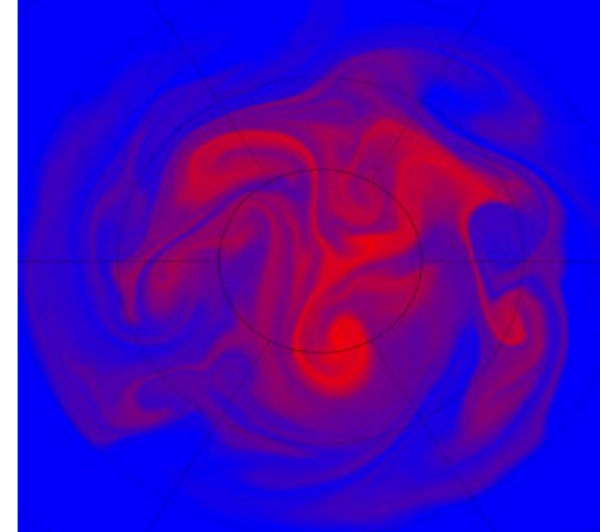


The entity we want to calculate is represented by the area under the curve. When we cannot use integral calculus to get a definite result in one calculation, we have to resort to a stepwise process and calculate the sum of rectangles. The smaller intervals, the greater the precision, but at a price of requiring still more calculations.

Brute force and supercomputers

Simulations of complex dynamic systems when performing a *numerical analysis* is a brute-force approach requiring immense computing power, which is why supercomputers are used to process weather and climate models.

Ecological systems, in particular, are composed of an enormous number of biotic and abiotic factors, which interact with each other in ways that are often unpredictable, or are so complex that ecosystem models—even when run on massive computers—still have to be simplified, say, to only include a limited number of components, which are well understood.



Perhaps the most salient point regarding modelling behaviour of complex systems such as weather, ecosystems or decompression models, is that various assumptions and simplifications have to be made in order to make models workable, so as to not leave computers to crunch numbers for an impractical long time.

Number of calculations skyrocket

The number of calculations required can grow very fast. Consider for example a volume of water in the ocean or a lake. When modelling aquatic ecosystems, we often have to resort to looking at the whole system as a three-dimensional grid of discrete blocks of water of some size. Say, we want to describe the flow of nutrients, upon which plankton live, through this body of water. We do this by looking into how many nutrients enter and exit each compartment as the matter flows from one volume to the next. Obviously, the smaller the volumes we consider, the more accurate we can resemble the smooth flow that happens in nature. But how small can we make these volumes?

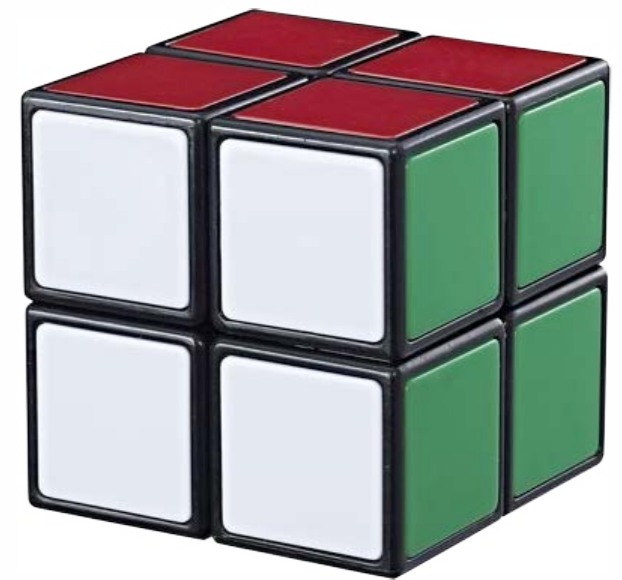
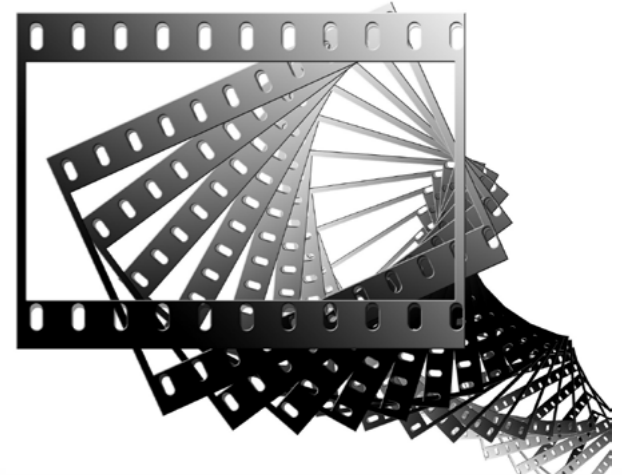
As is illustrated by this toy Rubik's cube, every time we double the resolution—that is, consider volumes half the length, breadth and height—we end up with eight times as many smaller cubes or volumes—and with it, eight times as many calculations. Thus, if you want to improve spatial resolution by a factor 10, you will need to perform $10^3 = 1000$ times as many calculations. That is the difference of sub-dividing the ocean into blocks of water with a side length of 10m rather than 100m.

A simulation of how two bodies of water with different properties (i.e. salinity or temperature) may mix. The model may comprise a fine grid of blocks, whose behaviour is calculated in small time intervals.

Models

Temporal resolution

But wait, there is more. A computer model simulating the behaviour of some complex natural system does so by calculating its state step-by-step in some intervals of time. One may liken it to taking a series of snapshots which together comprise a movie where movements become apparent. Question is how small the increments in time need to be in order for the model to render a reasonable realistic rendition of reality.

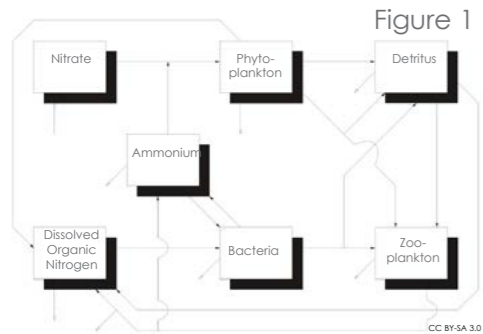


If we want to halve the sidelength of the volumes used in our models, we end up with eight times as many.



ecology

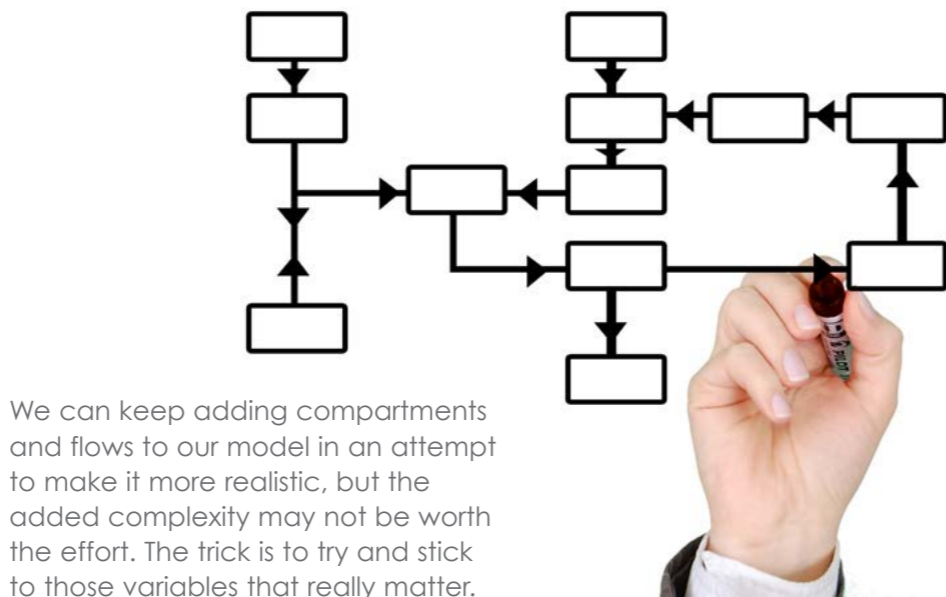
Consider again the flow diagram in Figure 1, representing how nitrogen flows through an aquatic ecosystem. Nitrogen and phosphorus are essential nutrients for plankton. As such, they are also termed “limiting” because the lack of either will keep plankton growth at bay—something that is often desired and virtually always in lake restoration.



Each of these boxes in the diagram represent compartments, which can hold the nutrient for some time. Some amount of nutrient will be bound in the biomass of phytoplankton (one compartment) for some time before it flows to another, i.e. the compartment representing zooplankton and so on.

At this point, it should hopefully be apparent how these flows are mathematically analogous to our example with the car travelling from A to B—only in this case, we are looking into the movements of nutrients between the compartments comprising the ecosystem.

Algae bloom in Lake Erie in 2010 caused by fertiliser being washed into the lake by torrential spring rains, promoting the growth of cyanobacteria blooms. During algae blooms, waters become turbid and oxygen levels will be depleted by the decay of algae accumulating on the lake bed.



We can keep adding compartments and flows to our model in an attempt to make it more realistic, but the added complexity may not be worth the effort. The trick is to try and stick to those variables that really matter.

Decide what is important

The flows between these compartments may have different magnitude and happen over different time scales, so they are not equally important.

We can keep adding compartments and flows to our model, which will make it more realistic but also more complex. We may also choose to do calculations in still smaller increments of time, which

will also add accuracy. Only, it should be obvious that every time we make our model more complex, adding more details or making the resolution finer, it often comes with a huge penalty in terms of computational power required.

Make some choices

To make models of any practical use, something has to give. This



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When building models, one must focus on which factors and processes are most important and which can be left out of the picture for simplicity and ease of computation.

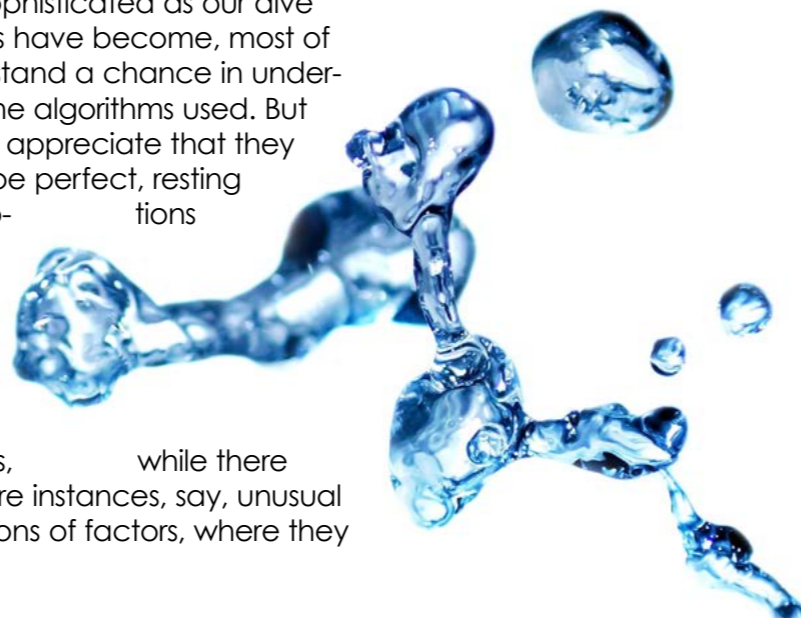
is where we start cutting out the less important factors, settling for a cruder but more practical picture. We comb over our models and weed out the more unlikely scenarios, or we simply restrict the model to only apply to certain circumstances. In other words, we choose not to run simulations for every possible combination of variables, as there would be too many scenarios to consider. So, we leave some out.

Mind the assumptions

This is where the concept of underlying assumptions comes into the picture. These assumptions are quite often ignored in debates or when models are criticised. But the limitations within which the model is operated are as important as how the model itself has been formulated. Models have some limited applicability and accuracy, which should always be taken into consideration.

When they are not, that is where and when things can go awry, if decisions are made on this basis. On a related note, this may go some way to explain why divers, on some occasions, end up getting bent, despite following protocol and staying well inside decompression limits. As sophisticated as our dive instruments have become, most of us do not stand a chance in understanding the algorithms used. But we can all appreciate that they will never be perfect, resting on assumptions and equations that hold true in most cases, while there may be rare instances, say, unusual combinations of factors, where they do not. ■

Various assumptions and simplifications have to be made in order to make models workable.



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Dolphins form friendships

Highly social animals, dolphins make friends with other like-minded dolphins, new research shows.

Bottlenose dolphins in the Indian River Lagoon (IRL) in Florida were studied by a group of scientists of the Harbor Branch Oceanographic Institute (HBOI) at Florida Atlantic University. Using intensive photo-ID surveys, the scientists discovered that the dolphins preferred to be with certain individuals, while avoiding others. They also formed "communities," which tended to stick to specific areas along the lagoon system.

"One of the more unique aspects of our study was the discovery that the physical dimensions of the habitat, the long, narrow lagoon system itself, influenced the spatial and temporal dynamics of dolphin association patterns," said HBOI research biologist Elizabeth Murdoch Titcomb, who was involved in the study. "For example, communities that occupy the narrowest stretches of the Indian River Lagoon have

the most compact social networks, similar to humans who live in small towns and have fewer people with whom to interact."

Common interests

Similar to us humans, dolphins are drawn together by common interests, according to researchers at the Universities of Bristol, Zurich and Western Australia.

The scientists studied Indo-Pacific bottlenose dolphins at Shark Bay, a World Heritage area in Western Australia—the only place in the world where dolphins have been seen using marine sponges as tools for foraging. This learned technique is passed down from generation to generation, helping the animals to locate food in deeper waters. It seems that dolphins who use the technique tend to associate more so with others who do too, establishing friendships that can last many years and are important in the mating success of male dolphins.



"Foraging with a sponge is a time-consuming and largely solitary activity, so it was long thought incompatible with the needs of male dolphins in Shark Bay—to invest time in forming close alliances with other males," said co-author of the study and senior research associate at Bristol's School of Biological Sciences Dr Simon Allen. "This study suggests that, like their female counterparts and indeed like humans, male dolphins form social bonds based on shared interests." ■ SOURCES: MARINE MAMMAL SCIENCE, PROCEEDINGS OF THE ROYAL SOCIETY B

River dolphin offers clues to marine mammal communication

Locally known as *botos*, the recently discovered Araguaian river dolphin of Brazil (*Inia araguaiaensis*), which was thought to be solitary, with limited social interaction, has been found to make hundreds of different sounds to communicate with others. The discovery could help researchers learn how communication evolved in marine mammals.

"We found that they do interact socially and are making more sounds than previously thought," said Laura May Collado, a biologist at the University of Vermont and co-author of the study, which was published in the journal *PeerJ*. "Their vocal repertoire is very diverse."

Individual botos are difficult to study, because they are shy animals and hard to find. However, the scientists found a fish market in Mocajuba, Brazil, where the botos showed up regularly to be fed by local shoppers. Using underwater cameras and microphones, the researchers identified 237 different types of sounds

made by the dolphins, which they believe is just a sample of their acoustic range. A two-part call made by baby dolphins to their mothers was the most common.

Compared to the acoustic characteristics of other cetacean species, the botos' vocalizations fell between the low-frequency calls made by baleen whales for long-distance communication and the high-frequency calls made by marine dolphins over short distances. It is thought that the river environment may play a part in shaping these characteristics. "There are a lot of obstacles like flooded forests and vegetation in their habitat,

so this signal could have evolved to avoid echoes from vegetation and improve the communication range of mothers and their calves," said Collado.

From an evolutionary perspective, river dolphins are relics from an earlier age, since they split off sooner from other cetaceans than other dolphin species. As such, they may offer clues as to how calls may have arisen and later evolved to the whistles and calls of marine dolphins. Further study may shed light on which types of signals evolved first and why. ■ SOURCES: EUREKALERT.ORG, MONGOBAY.COM, PEERJ.COM



The Araguaian river dolphin (*Inia araguaiaensis*) is found in Brazil.



marine mammals

Unique beluga-narwhal hybrid found in the Arctic

A chance find 30 years ago by an Inuit subsistence hunter in western Greenland has led to the discovery of the first-ever recorded hybrid of a beluga whale and narwhal.

Three of these strange cetaceans were shot, and one of the skulls was kept by the hunter. A few years later, the skull was spotted by a scientist who took it to the Natural History Museum of Denmark.

Through a translator, the hunter described the animals as having gray-colored bodies and strange teeth, with front fins like belugas and tails like narwhals.

Through genetic sequencing of the teeth found in the skull, scientists have now been able to prove that the specimen is indeed a hybrid beluga-narwhal. "We just have this one specimen," said Eline Lorenzen, the curator of mammals at the museum. "Nobody's heard about this before or since."

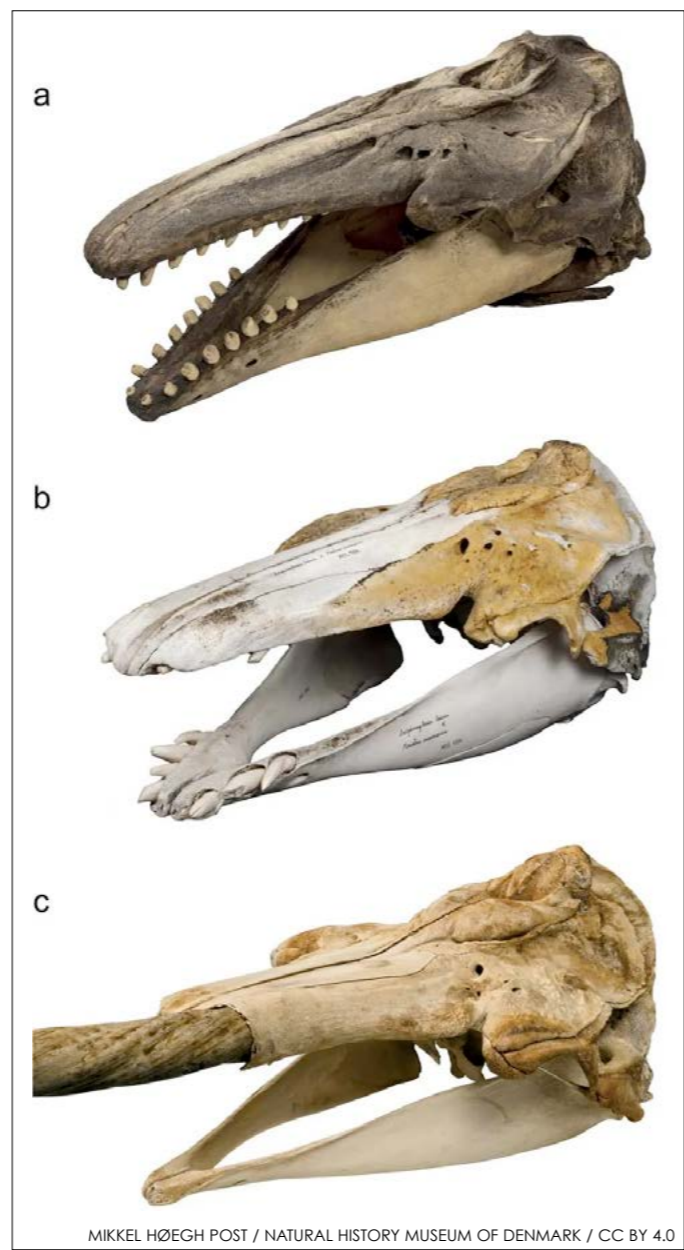
Through DNA analysis, the researchers were able to establish that the specimen was a first-generation, nearly 50-50 mixed hybrid male, with a narwhal mother and

a beluga father. It lacked the tusk of the typical male narwhal and had teeth on the lower jaw similar to belugas, but which jutted outwards like shovels.

Through isotope analysis of the skull's collagen, the scientists discovered that the specimen's diet differed from its parents'. Belugas hunt down to 500m, and narwhals hunt down to 800m. "We can just say that this carbon signature is quite like that of walrus and bearded seals, both of which forage at the bottom of the sea," Lorenzen said. It is thought that the hybrid's odd teeth may have played a role in how it hunted.

Are there more hybrids out there? It is impossible to say, according to Lorenzen, who said hybridization is most likely very uncommon, as belugas and narwhals diverged as separate species five million years ago, with no significant

hybridization for at least 1.25 million years. ■ SOURCES: LIVE SCIENCE, SCIENTIFIC REPORTS



The skull of a beluga whale (a), a narwhal (c) and the beluga-narwhal hybrid (b)

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Photo courtesy of Matthew Smith

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Gas Management 101

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It is almost impossible to overstate the importance of gas management—unless you have gills, running out of air will get you in big trouble underwater. Planning your dive around gas consumption is not difficult and should not take long, but both new and experienced divers continue to put themselves in harm's way by forgetting or forgoing this type of planning. Checking your air a few times during a dive and coming up as the gauge nears zero is not dive planning. Before you hit the water this summer, brush up on the basics of gas management—this will help keep you safe and might even extend your bottom time.

Stick to the plan

You would not want your pilot winging your next flight or your doctor playing your next visit by ear, so why do it while you dive? Take a minute to plan how you will manage your gas during your dive before you hit the water. Start by noting a few notable features of the dive site that will help keep you on track (e.g., the bow of the wreck or the edge of the reef), and use the rule of thirds to govern your gas management plan.

To do this, divide your initial tank pressure into thirds and plan as if you will use the first third during the descent and departure from your starting point, the second for return to the starting point and ascent, and treat the final third as a reserve in case of an emergency or deviation from the plan. This will not cover all your dives, but it is a good practice for making sure you will have enough gas for your dive—and it adds a level of conservatism that you would not otherwise have. Keep in mind that current, workload and depth changes can all make

the rule of thirds less relevant or insufficient, so make sure to double check your dive profile against your gas plan before you head in.

Check your gauge

Checking gauges should be second nature for every diver, but in light of the frequency of out-of-air incidents, it bears repeating. Monitoring your air, depth and dive time are essential for making sure you return to your entry

point without injury, but it can be easy to get distracted and forget to check your

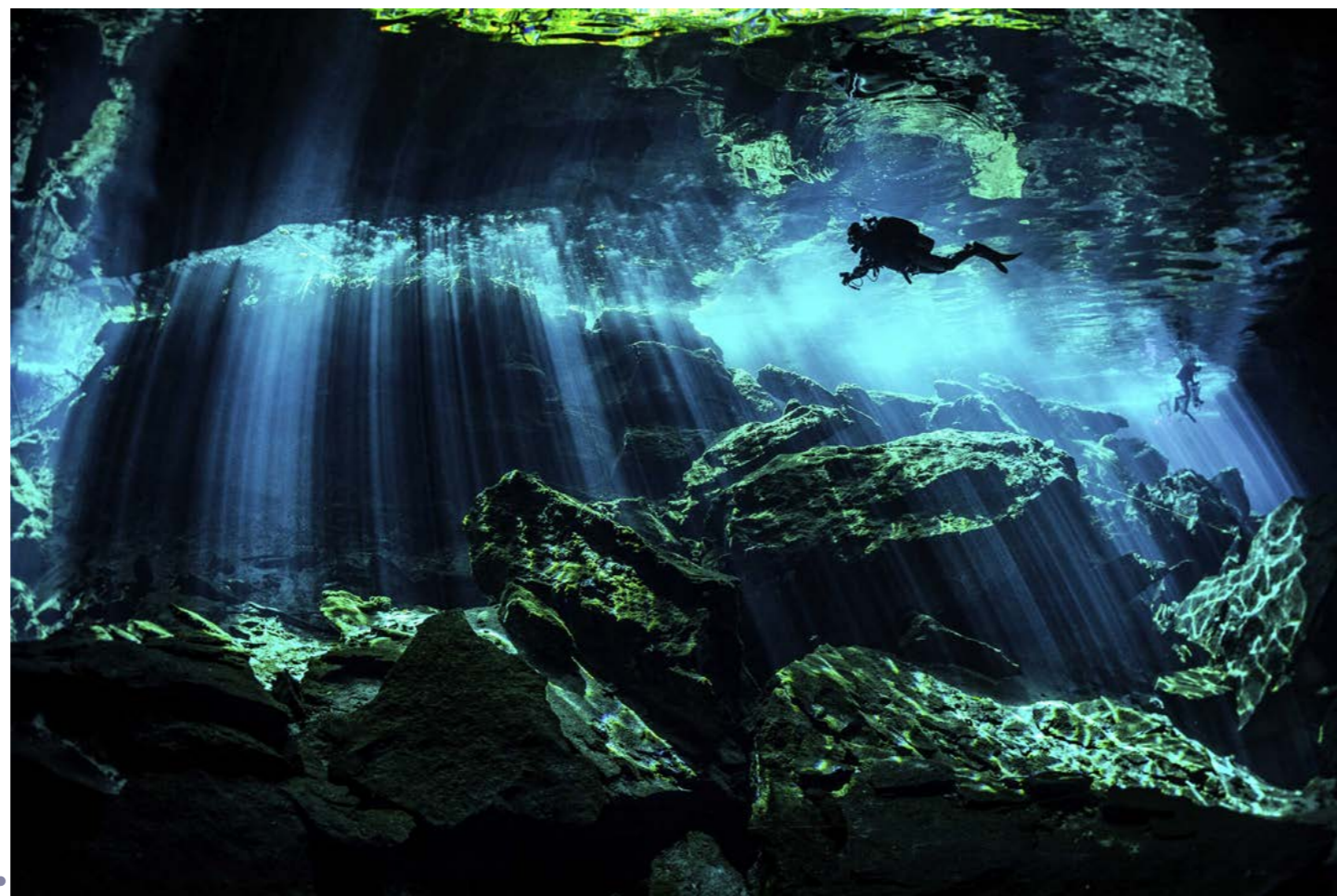
gauges. This is especially true if you are a new diver or if you are diving a new or exciting site. It is critical to remind yourself to check your gauges as frequently as possible. Whether you remind yourself to look at a gauge every minute or every few kick cycles or you keep it in your hand as a reminder during a particularly deep dive, take the initiative to monitor your air consumption regularly throughout a dive. Checking your pressure gauge regularly can also tell you if equipment is functioning properly. A slow leak may not be obvious on the surface, but an abnormally increased air consumption rate during a dive

can clue you in on a leak before it leads to a serious problem.

Consumption conundrums

There are many factors that increase your gas consumption on a dive, but the most common are depth, weighting, workload and personal fitness. As you dive deeper, work harder or carry more equipment, your gas consumption will increase regardless of your experience. If you are trying to improve your gas consumption, start by checking your weight before a dive and removing any excess lead. You can further reduce your consumption rate by fine-tuning your trim and buoyancy, improving your fitness and minimizing the amount of gear you bring on a dive. If possible, try to minimize your exertion, too. Factors such as wave action and current will work against you, but minimizing your exertion will help you extend your gas supply while also minimizing your risk of decompression sickness. ■

For more information, visit: DAN.org





Diver at the entrance to Viroit Cave, located in southern Albania, in a lake near the old town of Gjirokaster, which dates back to the early 14th century

Text and photos by Vic Verlinden

Diving at a location where only few have gone before is every diver's dream. Viroit Cave in southern Albania is such a place.

Located near the old town of Gjirokaster, Viroit Cave has been on my list of special dive locations I have wanted to visit for a long time. Unfortunately, there was not a lot of information available on the Internet about diving in this country. And regarding cave diving in Albania in particular, there was absolutely nothing. Even for a European country, it was a dark spot on the map.

My desire to dive at this unique location was stirred by a short film made by a Polish dive team. The film clearly showed the spectacular underwater landscape of the cave, with crystal-clear water. I decided to take a chance and put together a team of divers to go to Albania to dive and explore



this cave. After thorough preparation, the travel arrangements were made. We were ready to leave for Albania with our team of three divers and one non-diver.

Two days in the car

As we knew there were no local dive shops in the area, we decided to take along all of our dive and film equipment in a large paneled van. Karl van der

Auwera and I would dive with rebreathers, and Tom van Herp would make the dives on open circuit.

Our plan was to cross the distance from Belgium to Albania

in two days. In total, we had to travel approximately 2,400km. We planned our first stop in Croatia, where we arrived after a drive of more than 18 hours. The next day, we still had to drive another

800km. However, the roads were not as good on this stretch, so it took us another 15 hours to get to our destination. It was late in the evening when we arrived at our hotel in Gjirokaster. We had



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pre-booked our hotel rooms, so our check-in at the reception desk went smoothly. During our stay, the hotel owners were very accommodating, and the service was excellent.

Reconnaissance and the first dive

The next day, we were up early to reconnoitre the dive site at Viroit Lake. Before our arrival, I had received some information from a Polish diver about the location and where we should make our entry into the water. This was no trivial matter, as the lake was fairly large.

Upon arrival at the lake, it became apparent that we could not drive the car up to the water entry point. The road was blocked by a barrier, which was locked with a padlock. The distance from the parking area to the entry point was roughly 200m. It would have been a hellish job



CLOCKWISE FROM TOP LEFT: Diver at the surface of Viroit Lake; Aerial view of the lake taken by a drone; View of Gjirokaster and the Gjerë Mountains; Overview of the banks of Lake Viroit, taken by a drone; Divers descend to the entrance of Viroit Cave.



Diver at entrance to the shaft in Viroit Cave (left); Diver fixing the guideline in the cave (below)

Safety first!

After the first dive, our team held a meeting to discuss how we should swim into the cave. We decided to put a guideline inside, which would enable team members to pull themselves inside, along with their cameras. The task of laying the guideline and fixing it inside the cave was to be executed by Karl (my dive buddy of many years).

I myself would wait at the entrance, in case problems arose. However, it was only a short distance into the cave where the current was found to be the strongest. Karl had attached the guideline to a large boulder a short time later. The rest of the team could now swim into the cave fairly easily for further exploration. However, with a large camera in hand, it was still a chore for me to swim against the current. Yet, the sight of the beau-

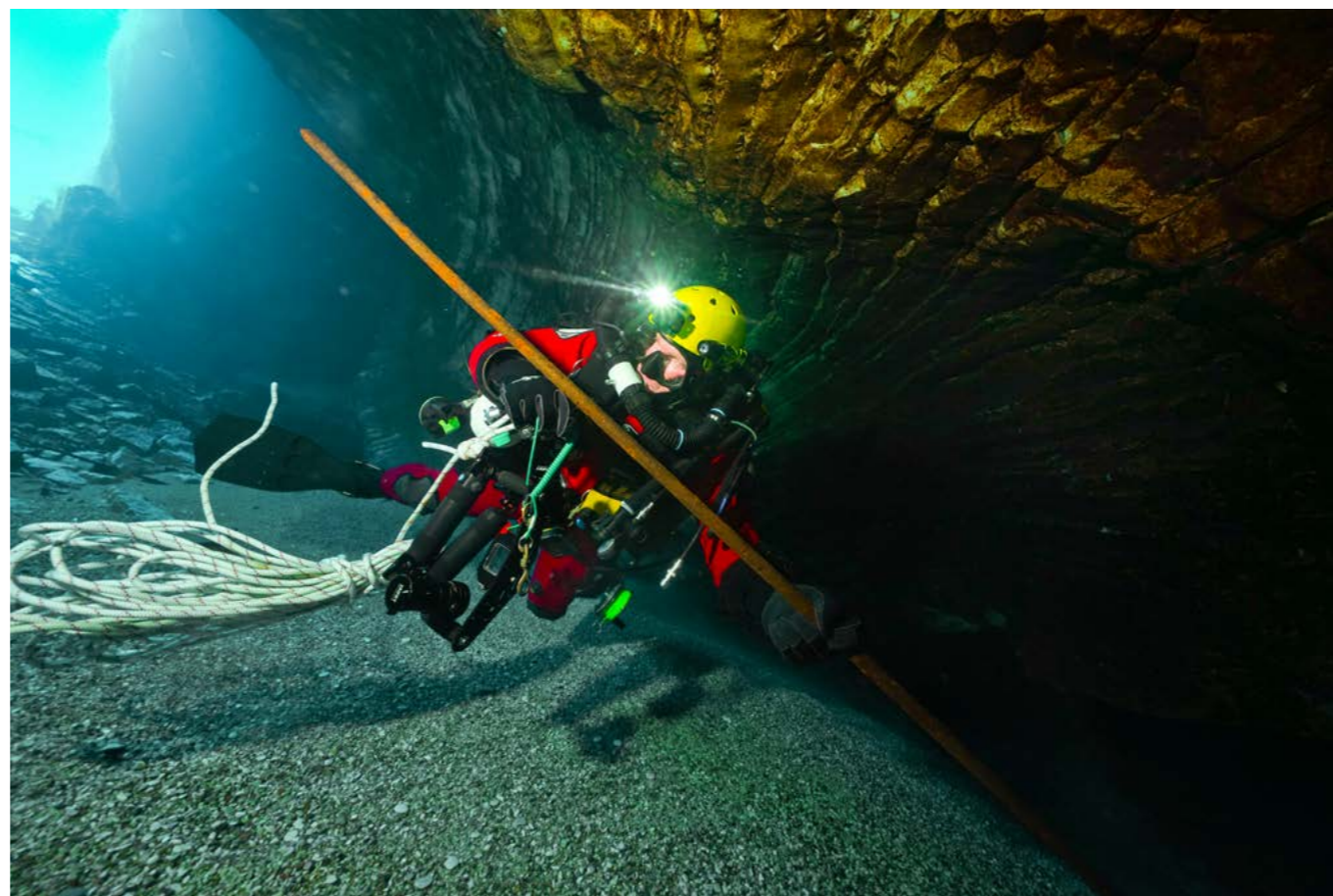
getting all the dive and film equipment to the entry point. After some negotiation with the local authorities, the barrier was opened for us.

At first sight, the conditions in the lake looked hopeful. However, the water flowing from the cave had a significant current. The visibility, on the other hand, was spectacular. One could see 30m straight into the depths. We quickly prepared ourselves for the first dive.

The banks and edges of the lake were densely overgrown with aquatic plants, but we quickly found a place where it was less so. The first one of our team to go down was me, and after I swam through the plants, I could see the sloping banks for the first time. It was an impressive sight. The water was crystal

clear, and the visibility was at least 40m. The sun's rays penetrated the smooth surface of the water and reached down to the lake bottom at 30m.

I immediately started filming, and when my buddies were ready, we descended together to the bottom of the lake. The entrance to the cave was at a depth of approximately 30m, but it soon became apparent that the current was too strong to enter without a guideline. We therefore immediately decided to continue our first dive outside the cave. Although we changed the initial plan, it turned out to be a fantastic experience. The dive site was really indescribable, with the swaths of vegetation and the unusual rock formations.



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Diver filming in the shaft in Viroit Cave (left); Divers in Viroit Lake at night (below); Divers descending down the deep shaft of the cave (bottom right); Divers explore a narrow corridor between the rock formations of the cave (lower left)



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tiful rock formations made up for the extra effort.

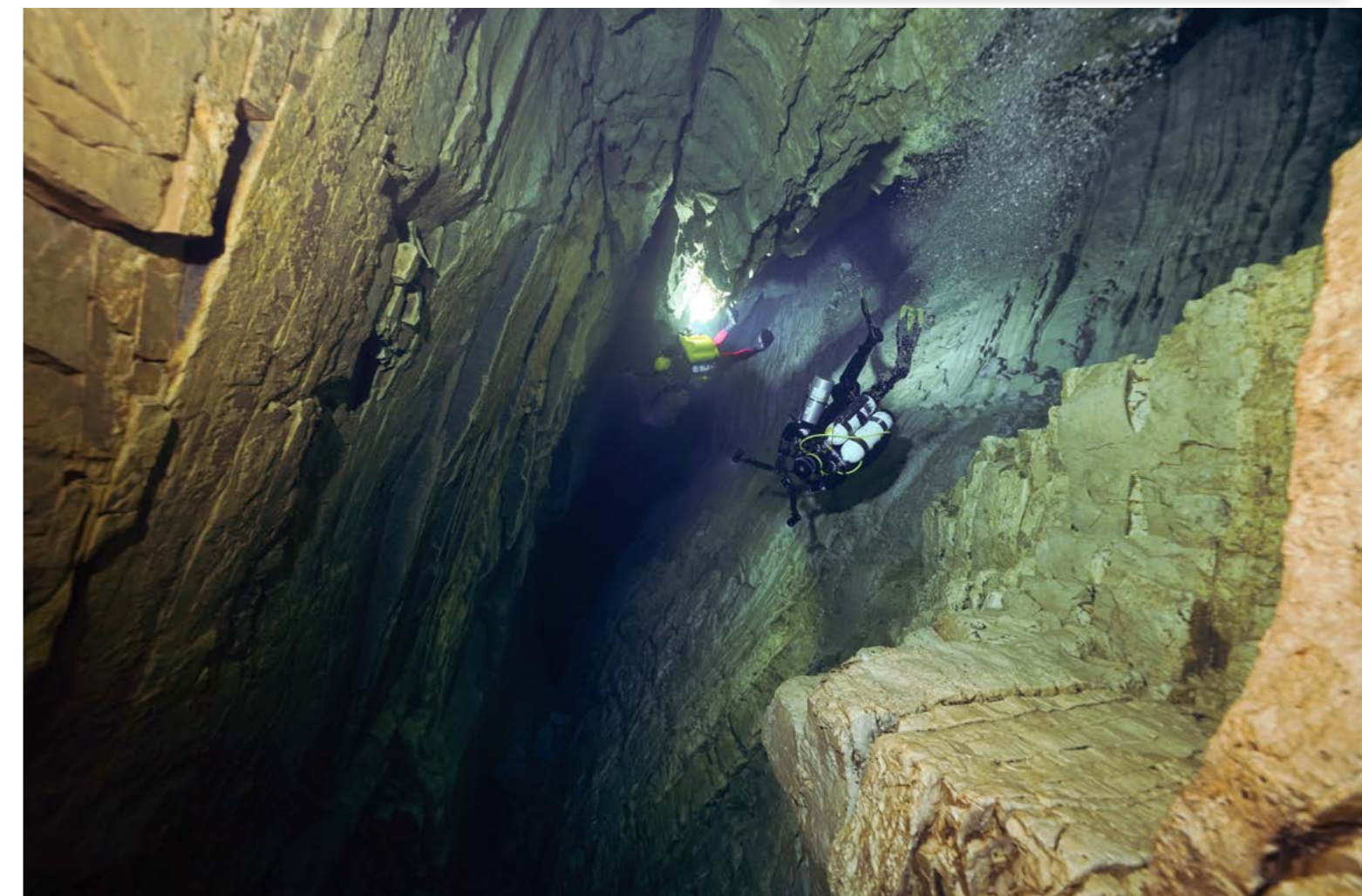
Once inside the cave, we had to swim a long way through a lengthy corridor to get to a larger chamber. Here, the corridor made a steep decline. It was a vertical descent for us, in very clear water. The color of the rock formations varied from dark brown to light yellow. With our powerful lamps, we were able to illuminate large parts of the cave, and this produced spectacular video images.

Our team descended to a maximum depth of 60m. In the area surrounding Viroit Cave, there were absolutely no facilities available to treat decompression incidents, so we wanted to stay on the safe side. We also limited our bottom times, as one of the team members was diving open circuit.



Diving in a photo studio
Truly, Viroit Cave was like a photo studio set up especially for the underwater photographer. We were

in luck with the conditions of the site. We had nice weather and lots of sunshine. On top of that, there was almost no wind, which allowed





Viroit

The valley of Gjirokaster (left); Gjirokastër Castle (lower left), a citadel dating from the 4th century, houses Gjirokastër Museum.

Having dived over 400 wrecks, Vic Verlinden is an avid, pioneering wreck diver, award-winning underwater photographer and dive guide from Belgium. His work has been published in dive magazines and technical diving publications in the United States, Russia,

France, Germany, Belgium, United Kingdom and the Netherlands. He is the organizer of the tekDive-Europe technical dive show. Please visit: tekdiver-europe.com.

SOURCES: WIKIPEDIA.COM, INTOALBANIA.COM

the sun's rays to easily penetrate the surface of the water.

During our subsequent dives, we explored some side corridors of the deep shaft. There was a portion of the vertical shaft that sloped upwards, where there was an air space. However, there was no time to explore all these areas.

The current inside the cave was not strong at all, which enabled us to swim around easily. We also got the sense that the current became less and less over the following days. Due to the constant flow, visibility in the cave was always optimal. But when we entered into the water, we had to be careful not to touch too many of the underwater plants. Any plants that were disturbed remained floating around in the water column, which was noticeable in the photos

we reviewed after each dive.

After our dives, we were interviewed by various Albanian television stations, which were interested in our activities. All of the people with whom we came into contact in order to complete our expedition were very helpful. In the days following our dives at Viroit Cave, we had the opportunity to see some sights and museums in the



area, which were definitely worth the visit. Albania will surely become one of the hotspots in Europe for diving in the coming years! ■



Karl van der Auwera filming (top left) and exploring the deeper parts of Viroit Cave (above)

Rebreather Meeting 2019 **Ponza**

Text by Peter Symes and Michael Menduno
Photos by Peter Symes and Marco Sieni





The sixth biannual international Rebreather Meeting took place 1-5 May 2019 on Ponza Island in Italy. Peter Symes and Michael Menduno report.

A More Pleasant Kind of Conference

Text by Peter Symes

Usually, when going to conferences, I would go the airport, jump on a plane, fly to some other country, go through customs and immigration, then hop in a taxi and check into some business hotel close to a conference or expo facility, usually placed in some nondescript business district some distance from a city centre and certainly not close to any water or diving. The next morning, I would then make my way to some conference centre where I would sit and listen to presentations all morning, have lunch and then listen to more presentations in the afternoon.

After a long day, I would typically go back to my

hotel room for a change of clothes and then attend a dinner or some other business event. The next day (or days), I would repeat the cycle until the end, after which I would check out of the hotel and go home. That is how the vast majority of the events and conferences I have attended over the past 25 years have unfolded—the same scheme, with some variations. But this one was pleasantly different.

First of all, the biannual rebreather meeting on the little and slightly remote but very picturesque Italian island of Ponza takes a little bit more effort to reach, but it is all very much worth the extra bother, which will become apparent in the following essay.

Getting there

It was one fine day in May when fellow colleague Michael Menduno and I flew down to Rome from our headquarters in Copenhagen on an early morning flight. The flight was uneventful, which was a positive. Once on the ground, we spent some residual time on an early lunch, comprising fresh salads, cheese and olives. Even in the airport, the snacks were made of fresh produce, unlike the mass-produced and factory-processed fast food from global brands you see in

most other places. Welcome to a classic foodie culture. That was a reassuring omen.

Soon enough, we easily found the train to the city centre, as the train station is connected to the terminal via some passageways. Once at Rome's main station, changing to the regional express train to Formia was quick and easy, as we just had to go around to another platform. No problemo.

After about an hour's train ride through the beautiful Italian countryside, we got off at Formia and made it from the station to the ferry terminal with all our bags in tow. The crossing took just about 1.5 hours before we set foot on the island of Ponza where we got



PETER SYMES



PETER SYMES



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On the dive boat, technical dive editor Michael Menduno chats with Dr Neal Pollock, research chair in hyperbaric and diving medicine at Université Laval (left)

Panorama of Ponza Island (top right) Delicious seafood (right) and desserts (above) were on the menu of social dinners held after conference presentations; The walkway around Ponza's colourful harbour (top left, far right and previous page)

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Ponza at night (above); Dr Simon Mitchell, professor of anaesthesiology, University of Auckland, New Zealand, gives his presentation at the conference (left)



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far from the frenzy and hustle and bustle of our everyday big city lives as well as the constant pressure of deadlines and expectations. Time seemed to flow differently here, in some undefined effortless and unhurried manner.

It is as if the island itself urges you to take a deep breath, reset your perspectives and reconsider your priorities in life. It is a place where you cannot help just enjoying your espresso, taking in its full flavour, there on the sunny terrace, or the whole meal, which easily takes all evening, without ever looking at your watch.

Diving

True to Italian form, Ponza Diving Centre's biannual Rebreather Meeting was unlike any other dive conference or event in which I have participated—and always one I thoroughly enjoy each time, for many good reasons. Let me explain.

First of all, on the agenda each morning was a boat dive, so the attendees get to dive together for a nice change, or at least enjoy some relaxed conversations on the spacious upper deck while travelling to and from the dive spots around the islands. Out on the boat, gastronomic speciali-

ties—tasters, snacks and dishes—are somehow continually being created in the diminutive galley and brought up on the sun deck where we tuck in while enjoying the vista over Mare Nostrum, or “our sea,” as the old Romans called the Mediterranean Sea.

During the transports to and from the dive locations, I found plenty of opportunities to have some proper and more in-depth conversations with various leading presenters. Many of them I already knew quite well from seeing them quite regularly at a number of other events—mostly technical diving conferences in the

View of Ponza Island landscape from hilltop (above); Audience members fill the presentation hall of the conference (right).

United States, Europe or Asia. But on these other occasions, there never seemed to be any proper opportunities for decent conversation, due to the packed schedules of these events and the flurry of other people competing for each tiny sliver of attention.

The conference

Once the dive boat was docked in the port of Ponza,



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we usually had an hour or more to relax or just walk about in the labyrinthine maze of pathways between the buildings of Ponza town—a village that seems smeared across the steep hillsides, with winding walkways and narrow passages akin to a maze in a computer game. It was great fun just to walk around, and great exercise too, as going up and down inclines and steep stairs surely burnt off some calories.

Each afternoon, some three or four presentations were con-

ducted in what I believe was the civic centre. We sat in a hall that was mostly underground, which is not all that unusual on Ponza. Even our own little apartment was largely windowless, as it appeared to be dug halfway into a cliff. It was a bit strange, but no matter. The beds were comfy enough, and we did not really spend much time there, as there was a lot of socialising—mostly around great food—to be done.

The long and timeless evenings in good company were one of the



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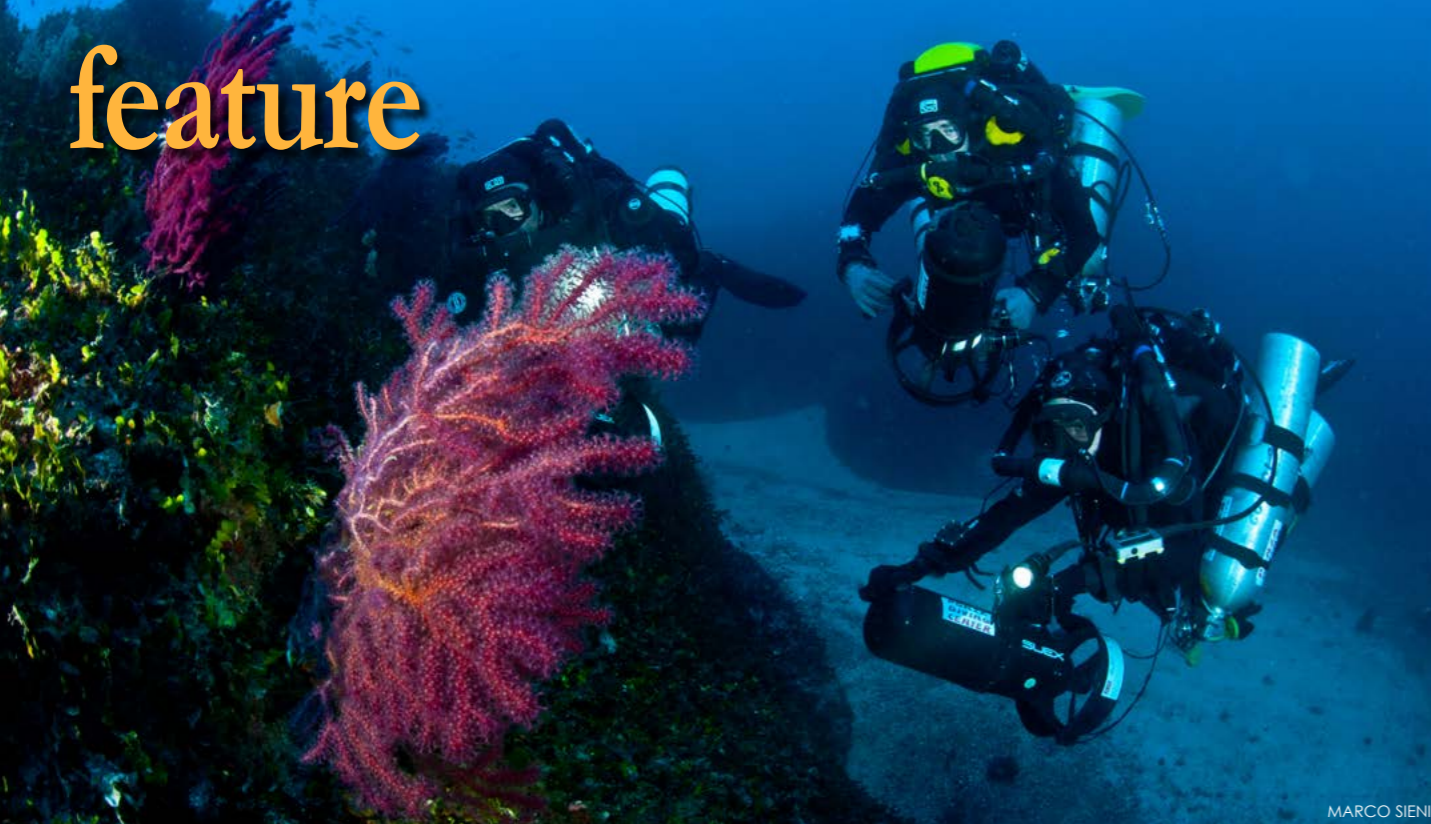
Dr Neal Pollock on Ponza Diving Center's dive boat

accommodated in a small apartment in one of the narrow streets just above Ponza Diving Centre.

Ponza Island

Ponza is simply beautiful and classic. The island just oozes of laid-back enjoyment of life, and a different and more meaningful pulse is almost tangible. The Mediterranean lifestyle, being firmly rooted in tradition and a very long history, is what seems to set the rhythm, at least to an outsider's point of view. Already in antiquity, some better-off Romans retreated to the island during summer.

Out here, we were pleasantly



MARCO SIENI



Ponza

MARCO SIENI



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Technical divers visited colorful reefs around Ponza (above and top right) before presentations began in the afternoon.

I have been to many places across the globe during my extensive tenure in the dive industry and attended literally hundreds of business events, but almost all of them are stiff and formal in comparison, and you never quite enjoy them. The relaxed dinners on Ponza, on the other hand, was a different matter altogether, because they were unpretentious and focused on socialising over some excellent food in the stimulating company of good colleagues.



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Could other events elsewhere replicate this pleasant combination of diving, presentations and socialising? Not quite, because it is so tied to this specific locale and culture, which can never be transplanted. It would probably not be possible either to conduct any large events according to this overall framework. Firstly, there is obviously a limit to how many people a dive boat can carry, even a spacious one, but I suppose more than one vessel could be used. Secondly, the Ponza event is relatively small in size and somewhat exclusive in attendance, which makes it possible to socialise in the described manner. But I would like to see other gatherings take the idea to heart. ■

highlights of this event. Every evening, the whole bunch of us were taken to some great restaurant, every night a new one, to dine together and enjoy some fine Italian cooking. An image says more than a thousand words, as the old and quite overused saying goes, but I will let the accompanying photographs speak for themselves.



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Ponza harbour at night (above); Conference participants enjoyed social dinners with fine wines (far left), delicious seafood (center) and fresh pasta dishes (left).



Ponza Island's picturesque harbor

Dive, Learn, Eat

Text by Michael Menduno

1 May 2019 — Nearly three dozen rebreather aficionados made the biannual trek to Ponza, Italy—a picturesque island in the Tyrrhenian Sea about a three-hour journey from Rome—for the sixth International Rebreather Meeting organized by Andrea Donato, owner of Ponza Diving Center, and his partner, Daniela Spaziani. The goal of the four-day meeting—which was sponsored by a number of manufacturers and organizations, including JJ CCR, Shearwater, DAN Europe, Società Italiana Medicina Subacquea ed Iperbarica (SIMSI), and the Italian rebreather users' association CCR Italia—was to provide the latest research and information to the

rebreather community.

"They're passionate tech divers, hungry for information," explained Dr Simon Mitchell, a professor of anesthesiology at the University of Auckland, New Zealand, who was one of the presenters. "That's what I love about these types of meetings. I am happy to be here and share what I know."

Taking a cue from the hyperbaric medical community, the meeting was organized to appeal to diver sensibilities: diving in the mornings (8:30 a.m.-2:00 p.m.), lectures and discussions in the afternoons (3:00-7:00 p.m.), followed by dinner and drinks (9:00-11:30 p.m.) in the evenings.

Dive right in

Donato and his crew did a masterful job of supporting more than 20 rebreather divers, bearing scooters, cameras and bailout bottles, along with

The biannual international Rebreather Meeting is organized by Andrea Donato (right), owner of Ponza Diving Center, and his partner, Daniela Spaziani (below)



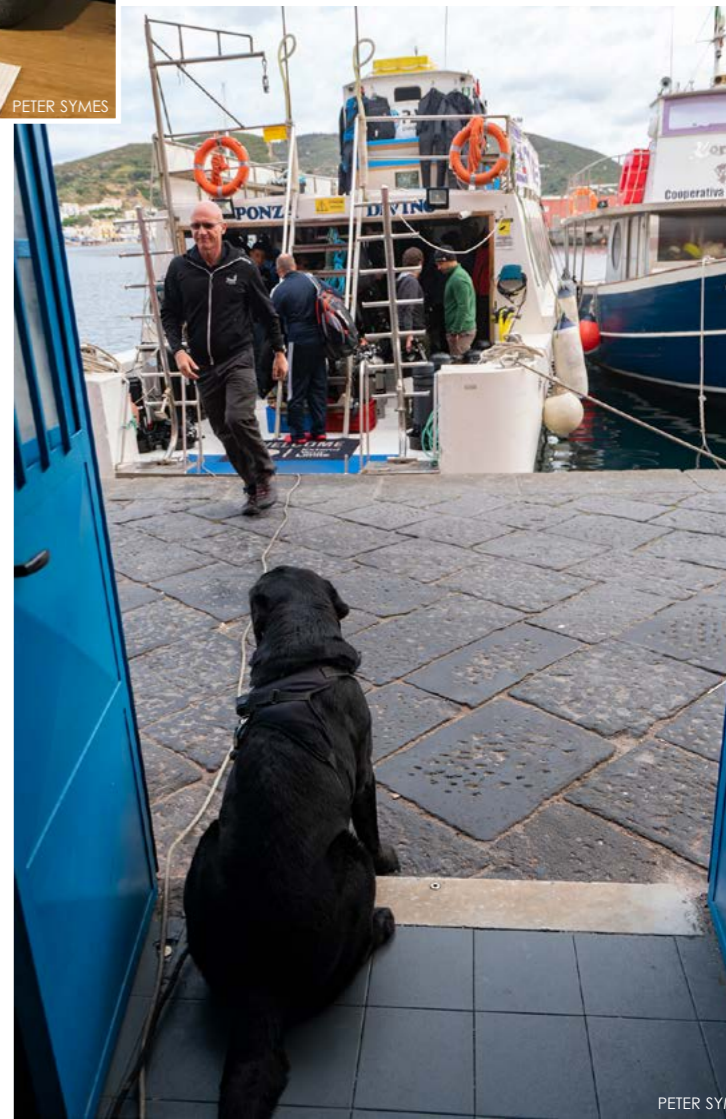
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a few open circuit divers, without incident. The operation felt both calm and relaxed, and ran flawlessly and safely, a testament to the team's skill and experience. They were helped by Ponza Diving's ubiquitous mascot, an amicable, large, black mastiff named Ugo.

The boat, which was docked just outside of the dive shop, headed out each morning around 8:30 a.m., as divers huddled over strong Italian coffee and fresh bread after prepping their rebreathers. Interestingly, as

we were loading up the boat on the first day there, Donato made a point of warning Peter Symes, publisher of *X-Ray Mag*, and myself to go easy on the espresso. "It can kill you," he said,



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Ponza Diving's amiable mascot—a large, black mastiff named Ugo (far right)—looks on as the dive boat is loaded up with gear for a dive trip in the morning before conference presentations take place in the afternoon; Gastronomic specialties—appetizers, snacks and dishes—are somehow continuously created in the dive boat's little galley and served up on the sun deck (right); Before and after presentations, dining and socializing events were arranged at selected Ponza restaurants (above).





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Technical divers on dives conducted during the conference (above and right)

citing an American diver who had a heart attack underwater after consuming too many coffees. The boat then made its way to one of the numerous submerged seamounts, covered in soft corals, surrounding the island, where it would anchor for the morning dive.

Our morning dives were typically 165-261ft/50-80m deep, with one- to two-hour run times. Visibility was 50-65ft/15-20m, and water temperature was about 58-60°F/15-16°C. Following each dive, we were treated to a multicourse lunch, which usually included soup, fish, cephalopods, rice, pasta, bread, salad and dessert, along with the requisite pitcher of wine and more espresso. After lunch, the boat headed back to port, where we prepped gear for the next day's dive.

Where's the manzo, err... beef?

While rebreather diving in Ponza was clearly the attraction that brought people together, the meat of the meeting was the presentations given by some of the technical diving community's leading scientists, engineers and practitioners. Our group met in an old stone chapel up the hill from the dive shop. Headphones were available for sequential English and Italian translations.



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One of the themes that emerged from the meeting was the role of human factors, i.e. the way we process and act on and/or fail to act on information, and its impact on diving safety. This is a deep body of knowledge that was developed in the aviation, healthcare and other fields, and is now being applied to diving largely through the efforts of pioneer Gareth Lock at The Human Diver (Thehumandiver.com). Several of us noted the fact that human factors being

discussed in the absence of the seemingly ubiquitous Lock was a sign that this important work was beginning to gain traction. Here are some of the highlights:

Training does not work

Technical Diving International (TDI) Rebreather Instructor, Instructor Trainer and author Mark Powell began with a list of ten improvements in rebreather diving that he would like to see from a community perspective, things like bet-

Technical dive equipment loads up the dive boat (above); Mark Powell and Michael Menduno prepare rebreather equipment (center); Andrea Donato checks medical equipment (top center)

ter buoyancy control, the increased use of checklists, more attention to bailout planning, etc. He then asked the question, "Why hasn't training made a difference?" That is, why hasn't training produced permanent observable changes in divers' behavior in these areas? The answer, documented by numerous studies, is that humans aren't very good at retaining information. The solution: deliberate practice of essential skills.

"People tend to practice things they like and are good at, which is not very helpful," Powell explained, noting that practicing things that are very difficult to do doesn't work either. "The sweet spot," he said, "is practicing things that are challenging." He recommended that divers practice something on every dive! Sounded very GUE to me.

In-water recompression (IWR)

The use of in-water recompression to treat divers at remote locations has long been controversial, and until recently, the hyperbaric medical community has failed to reach a conclusion regarding its efficacy. But as Dr Simon Mitchell explained, the situation has now

changed as a result of a new paper, "In-Water Recompression,"¹ he coauthored with Dr David Doolette, a decompression physiologist at the US Navy Experimental Diving Unit (and GUE diver). The two were able to find evidence not previously reported that answers two key questions:

- Does early recompression improve outcomes? (i.e. recompressing an injured diver within minutes vs hours)
- Is shallower, shorter recompression effective? (Note that IWR typically compresses the diver on 100% oxygen to 30ft/9m vs. a USN Table 6 to 60ft/18m.)

Based on US Navy data derived in part from early research on treatment protocols, Mitchell and Doolette were able to answer both questions strongly in the affirmative. The new recommendation: A diver should be treated with IWR if a chamber is more than two hours away

¹ [HTTPS://WWW.NCBI.NLM.NIH.GOV/PMC/ARTICLES/PMC6156824/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6156824/)





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TDI instructor trainer Mark Powell giving his presentation (top center); Dr Simon Mitchell, professor of anesthesiology at the University of Auckland in New Zealand, was one of the presenters (left); Conference participants attended presentations in the afternoons (above); Ponza's harbor (below)



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Participants wore headphones for simultaneous translation to English or Italian (above); A discussion takes place during a presentation by Shearwater founder, Bruce Partridge (top left).

and the team is set up to provide IWR (i.e. has proper equipment, e.g. full face mask and training, support, environmental conditions and appropriate patent status).

Defensive dive profiling: Concerns for aging divers

Dr Neal Pollock, research chair in hyperbaric and diving medicine at Université Laval, gave a pair of eye-opening lectures on the potential long-term impacts of decompression stress and what can be done, and the prospects for aging divers. Was he talking about us?

Pollock began by citing studies² that found lesions in the brain and spinal cord have been observed with higher frequency in individuals with a history of

² [HTTPS://WWW.UHMS.ORG/IMAGES/DCS-AND-AGE-JOURNAL-WATCH/ERDEM_CEREBRAL_WHITE-MATTER.PDF](https://www.uhms.org/images/dcs-and-age-journal-watch/erdem_cerebral_white-matter.pdf)

repeated decompression stress. Bone lesions have also been found in commercial divers. The factors shown to increase the risk of dysbaric osteonecrosis in commercial divers were: a history of inadequate or experimental decompression, diving deeper than 165ft/50m, and a history of decompression sickness (DCS). The conclusion: While dysbaric osteonecrosis has largely been eliminated in commercial diving due to procedural changes, decompression stress poses a potential long-term risk factor for technical divers! Divers need to think about immediate and long-term risk.

As a result, Pollock, who is known for doing extra deco, encouraged divers to do longer shallow decompression, adding, "It can't hurt. It can only help." Specifically, he recommended several ways of adding conservatism: using conservative gradient factors, primarily

reducing GF-high, buffering the dive by slowing down on the final ascent to the surface following the last high PO₂ stop, delaying exercise post-dive, extending surface intervals to add more time for recovery, using appropriate gasses (Yes, "air is for tires!"), choosing appropriate partners with similar risk tolerances and maintaining good physical fitness.

The bottom line for aging divers: There is no upper age limit, though there may come a point where you may need greater support. Be forewarned! Note, there were several post 65-year-old divers making the plunge at Ponza!

Human factors in rebreather diving

Mitchell began by noting that human factors were the most important but also the hardest path to improving safety in rebreather diving. He then posed the

question: Is there a safety problem with rebreather diving?

Mitchell began by reviewing what we know about rebreather safety based on the ground-breaking 2012 paper by Dr Andrew Fock, "Analyzing recreational rebreather deaths 1998-2010,"³ namely: There were approximately 20 deaths per year for 2000-2010 from a population, which was then estimated to be about 18,000 rebreather divers based on agency certifications. That means that the fatality rate for rebreather diving was esti-

³ [HTTPS://WWW.NCBI.NLM.NIH.GOV/PUB-MED/23813461](https://www.ncbi.nlm.nih.gov/pub-med/23813461)

mated to be about 133 deaths/100,000 divers/year compared to about 16 deaths/100,000 divers/year for open circuit diving. The conclusion: Rebreather diving was about 10 times more hazardous than open circuit scuba. Note, there is currently a follow-up study underway to determine if things have improved.

Mitchell broke down the causes of rebreather fatalities into three buckets:

- Hazards of advanced diving
 - Rebreather equipment failures
 - Diver error and violations
- Overwhelmingly, most incidents arose



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Conference participants enjoyed conversation and cuisine at selected restaurants around Ponza each day (below); Colorful villas (bottom right) perch on the steep hillsides around Ponza Island (top left)

don't make mistakes." Checklists can be supported by training, practice and engineering.

Interestingly, after the meeting, I asked one of the Italian rebreather divers if he used a checklist on our dives. "My instructor taught me to do it by memory," the diver told me, "So, that is what I do. I haven't had any problems." And

therein lies the problem!

Bruce Partridge, founder of Shearwater Research, and explorer Edoardo Pavia, owner of Sea Dweller Divers, also gave individual presentations focused on understanding human factors and changing divers' behaviors. Partridge noted that there were approximately 600 failure modes

possible on a rebreather. However, only 40 were equipment-related; the remainder involve diver error.

DCI Research/ Telemedicine
Massimo "Max" Pieri, research supervisor for DAN Europe, discussed DAN's

research focusing on preventing decompression illness⁵ (DCI) using DAN's diving database of some 66,000 dives, ranging in depth from 16 to 628ft/5 to 192m, with an average depth of 100ft/30m. Some of the factors DAN's researchers have considered include: gradient factors, hydration, genetic disposition and hematological parameters. They are also conducting a decompression study with a local (Italian) GUE group with the help of GUE instructor Mario Arena, examining the efficacy of so-called "deep stops" versus shallow decompression profiles (see Dr David Doolette's post, "Gradient Factors in a Post-Deep Stop World"⁶).

Next, DAN Europe president, Dr Alessandro Marroni, discussed his visionary program

⁵ [HTTPS://WWW.NCBI.NLM.NIH.GOV/PUB-MED/28974936](https://www.ncbi.nlm.nih.gov/pubmed/28974936)

⁶ [HTTPS://BLOG.GUE.COM/GRADIENT-FACTORS-IN-A-POST-DEEP-STOPS-WORLD/](https://blog.gue.com/gradient-factors-in-a-post-deep-stops-world/)



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from diver errors (i.e. trying to do the right thing but doing the wrong thing) and violations (i.e. knowingly creating unnecessary risk of harm to yourself and others, and expecting to get away with it). "I have made errors and violations in my rebreather diving," Mitchell offered to the assembled group of divers, "and I bet you have too."

What's to be done? Mitchell reviewed several fatalities involving violations, like diving with two-year-old oxygen sensors, or using a type of sorb not specified by the manufacturer. He said that we needed to remove the motivation for violations. This involves a culture change: Make safe choices be seen as a strength versus a weakness. Training, mentoring and role modeling are critical in this regard.

Typical errors might include forgetting to analyze one's gas, forgetting to turn on the rebreather or open the oxygen valve, or

leaving out an O-ring on the scrubber. In fact, each of these errors have resulted in multiple fatalities.

Mitchell said that pre-dive checklists are the primary means for preventing errors. As a testament to the power, he cited a study analyzing the impact of using checklists in surgical suites: Deaths were reduced by 50 percent after the introduction of checklists and, as Mitchell pointed out, these were among highly trained professionals. He then cited a DAN study⁴ of some 2,041 dives examining

⁴ [HTTPS://ACADEMIC.OUP.COM/IJE/ARTICLE/45/1/223/2363549](https://academic.oup.com/ije/article/45/1/223/2363549)

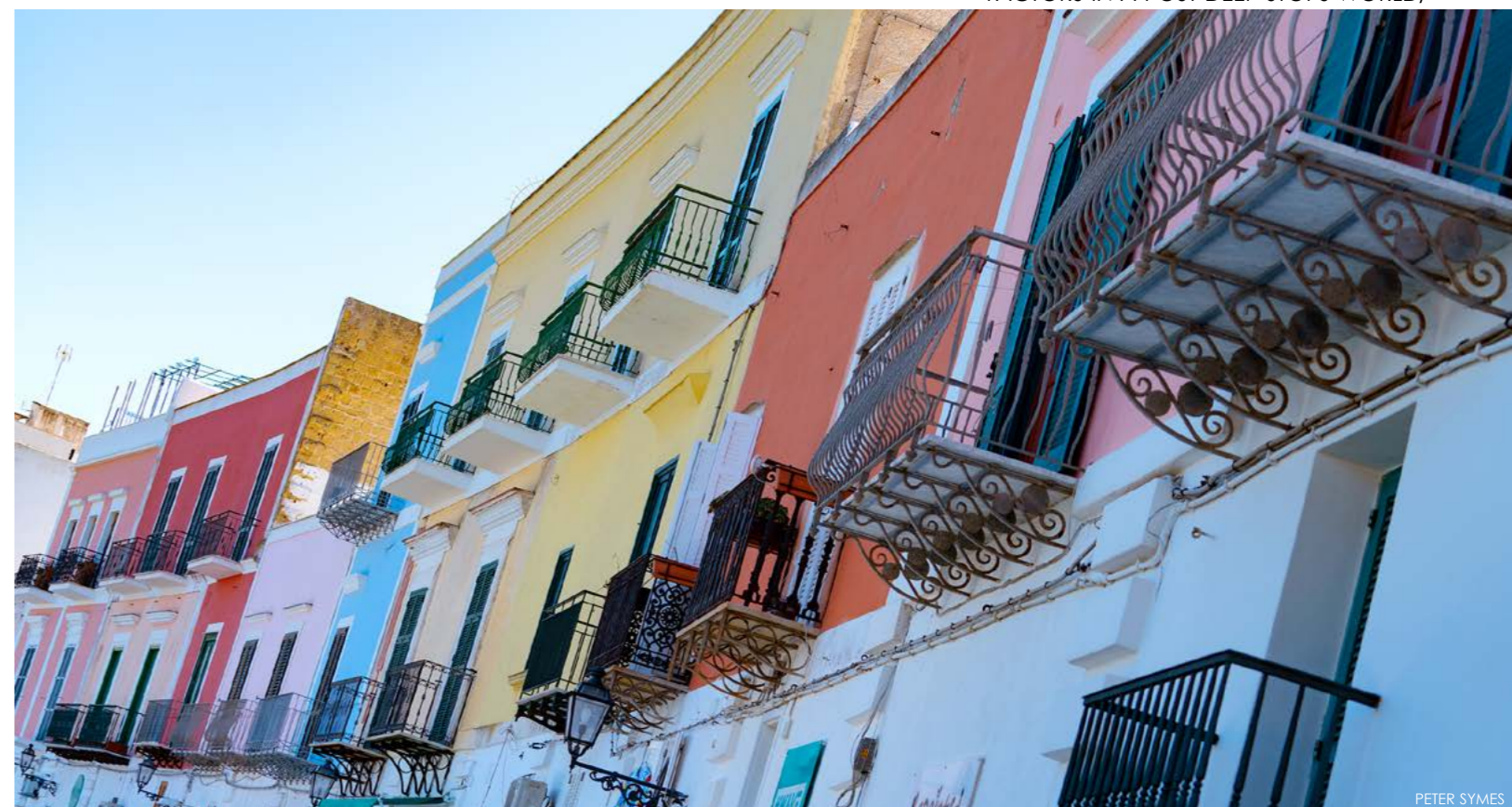


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the impact of pre-dive checklist use on scuba mishaps: Mishaps, including rapid ascents, low or out-of-air situations, etc., were reduced by 36 percent.

Barriers to using checklists

First, misunderstanding about their purpose: Checklists are not meant to replace a manual! Second, arrogance or ignorance: thinking "I can do it from memory," or "I



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THIS PAGE: Ponza at night when social events at local restaurants gave conference participants a chance to mingle and enjoy fine dining, excellent wines and traditional fare, including steamed mussels and, of course, fresh pasta.



think Fitbits on steroids! Marroni described his vision of a DAN doctor able to assess a diver who is still in the water, and communicate directly with that diver via an underwater communications system. In fact, they have already tried out a prototype.

Dott. Pasquale Longobardi, president of SIMSI, also presented SIMSI's research examining the biochemical mechanisms involved in decompression stress. He con-

cluded with a set of best practices, namely to run PO₂s at 1.3 bar or less, maintain PN₂s at 3.16 bar (the equivalent of breathing air at 100ft/30m) or less, and run PHE as high as possible; Longobardi stated that helium in the form of trimix protects divers from oxidative stress (inflammation) compared to diving air (kick those tires again!). A medical colleague in the audience told me he had questions about the supporting data.

Mangia, mangia!

Having gotten our daily dose of brain food, attendees retired to

their hotels and apartments to catch up on email, clean up, and later, walk to the ristorante du jour, which had been chosen for that evening. There, we were greeted by our attentive hosts, Andrea and Daniela (accompanied by Ugo), who had arranged for a family-style dinner and wine affair, and would ensure that everyone had enough to eat and drink. If you had trekked to the meeting for the food alone, you would have not been disappointed.

"Mangia," Dani told me, gesturing emphatically with her hands and pointing to my empty plate, after the second (or was it the third?) course. "Please, you must eat some more," she insisted, passing me a bowl of mussels. It felt like a family gathering—a small but

mighty band of passionate, geeky divers, who were there to celebrate and improve their underwater practice. And, the eating and drinking and sharing of stories continued into the night. ■

Michael Menduno is an award-winning reporter and technologist based in California, USA, who has written about diving and diving technology for over 25 years and coined the term "technical diving." He was the founder and publisher of aquaCORPS: The Journal for Technical Diving (1990-1996), which helped usher technical diving into the mainstream of sports diving, and organized the first Tek, EUROtek and AsiaTek conferences, as well as Rebreather Forums 1 and 2.

Rebreather Meeting Presenters: Dott. Pasquale Longobardi, president of SIMSI; Dott. Alessandro Marroni, president of DAN

Europe; Dr Simon Mitchell, professor of anesthesiology, University of Auckland, New Zealand; Shearwater founder Bruce Partridge; Edoardo Pavia, owner of Sea Dweller Divers; DAN Europe research supervisor Massimo Pieri; Dr Neal Pollock, research chair in hyperbaric and diving medicine at Université Laval; TDI instructor trainer Mark Powell; Tomasz Stachura, CEO of SANTI

For more information, visit: ponzadiving.com



photo & video

Usage of Rembrandt lighting is not limited to portraits. It creates a sense of drama and dimensionality even in small coral scenes.

Text and photos by Rico Besserdich

What is the difference between a snapshot and a masterpiece in photography? This is a question that is often asked but is often already answered. Even though some opinions may differ, there is one very correct statement: It is all about the light.



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The Large Self-Portrait (1652), by Rembrandt

Rembrandt Lighting

— *Creating Drama in Your Underwater Photography*

Master the light and you will master photography. Indeed, "drawing with light" is the meaning of the Greek origin of the word "photography."

However, if we want to work creatively with light, we need to think about shadows as well.

The good news is that we do not need to start from scratch. The old masters of art and painting developed specific lighting techniques hundreds of years before the first camera was even invented.

One of them was Rembrandt Harmenszoon van Rijn, the great Dutch artist who is known all over the world by his first name, Rembrandt. Rembrandt (1606-1669) was a draftsman, painter and printmaker, and is considered one of the

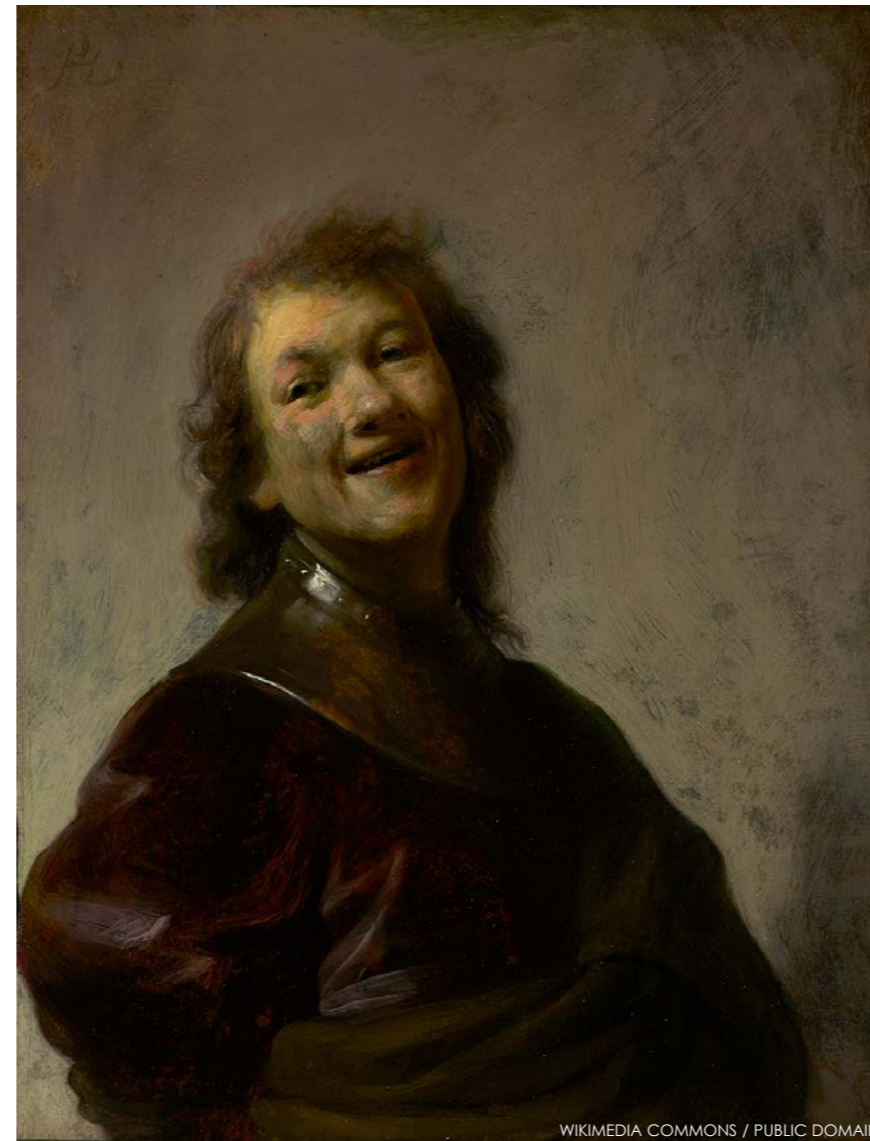
greatest and most influential artists of the Baroque Era. He is well remembered for his dramatic use of light and shadow, his versatility, and most importantly, for his portrait paintings. He was a true master of *chiaroscuro*, the artistic technique using



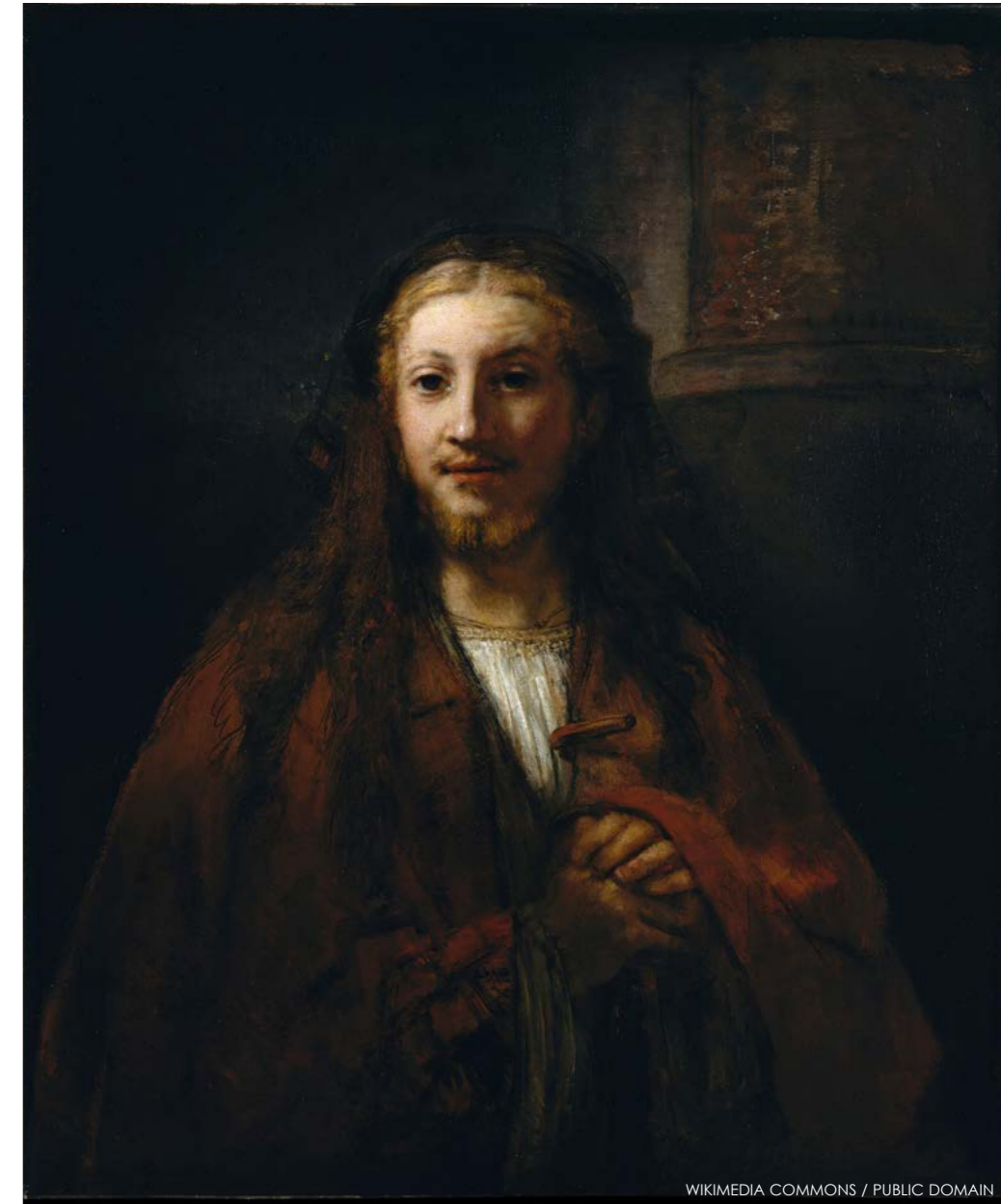
The Storm on the Sea of Galilee (1633) was created by Rembrandt many years before he became famous for his portrait paintings. Yet, this artwork shows his strong sense and dramatic use of light. Again, the light comes from the left, creating drama and contrast. Some of you may certainly agree that scuba diving is fun, but boat trips are not. Just look at the guy dressed in red. He does not seem to be enjoying the trip. Sadly, this masterwork of Rembrandt's is lost. It was stolen in 1990, and has not been seen since.

“Rembrandt goes so deep into the mysterious that he says things for which there are no words.”

— Vincent van Gogh



Rembrandt Laughing, self-portrait by Rembrandt. This very special painting might be the only one that shows Rembrandt happy and laughing. He loved to live life at its fullest, and this image also speaks to his sense of humor, painting himself with paint on his face, and wearing a rather strange costume. His special lighting technique had, at that time, not fully reached its greatest potential, but we can already see which direction it will go. Bare in mind, that when Rembrandt created this “funny” self-portrait, he was just 22 years old, but he already had his own workshop and atelier.



Christ with a Staff. This painting, created by Rembrandt in 1661, is a perfect example of “Rembrandt lighting,” as it is nowadays known and used in portrait photography. The light (in Rembrandt’s day, most likely from a window to the left) comes from a direction slightly above eye level (that is why some light touches the forehead as well), hits the face at a 45-degree angle, and creates the “Rembrandt triangle” below the eye, on the right side of the face.

light and dark values to create the illusion of three-dimensional volume on a flat surface, which is often represented in very strong contrasts.

Rembrandt’s legacy for image-makers (including photographers, of course) is the simple but unique lighting technique that carries the master’s name—Rembrandt lighting.

Light sources and angles

Its most common use is in portrait photography. It creates dramatic, high-contrast portraits, and was often used in a lot of old black-and-white Hollywood portraits. Instead of “flattening” a portrait by using several light sources (key light, fill light, hair light, background light and so on) from different directions (just think of commercial shots from the cosmetic industry),

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A single strobe in a roughly 45-degree angle from the right (Rembrandt mostly preferred the light coming from the left, but let's not split hairs), combined with a closed aperture ($f/16$), eliminates the ambient light and allows us to "draw with light" on the subject. Very common underwater photo subjects and motifs can be photographed very differently by using a touch of Rembrandt lighting.

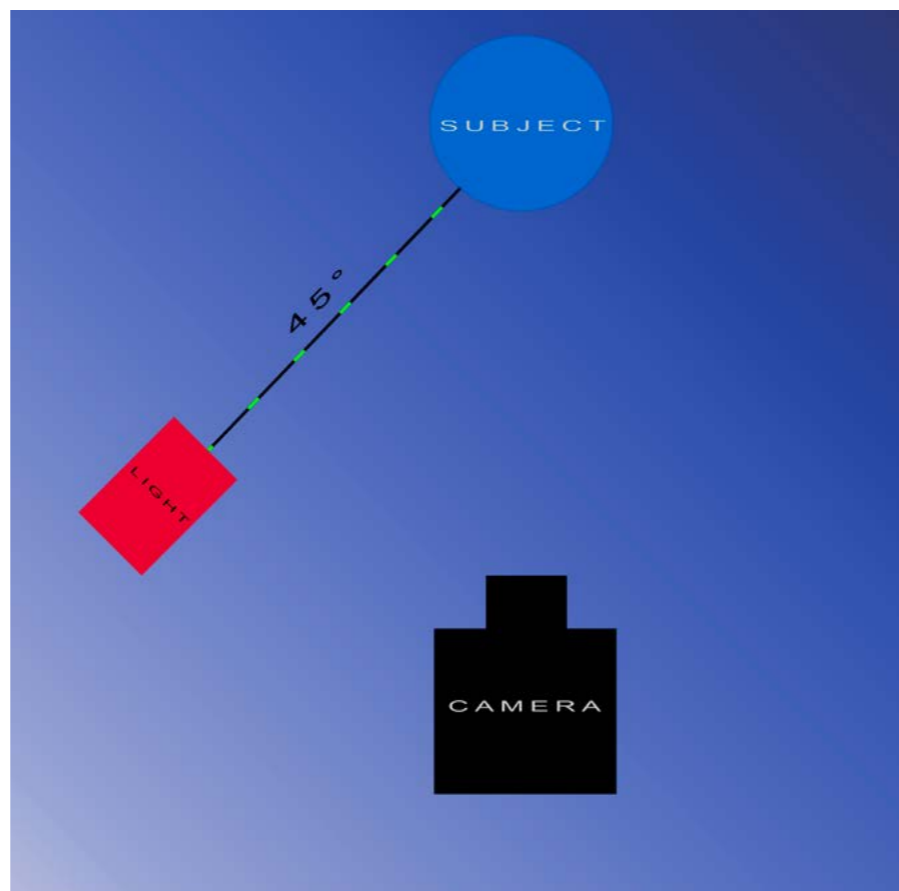
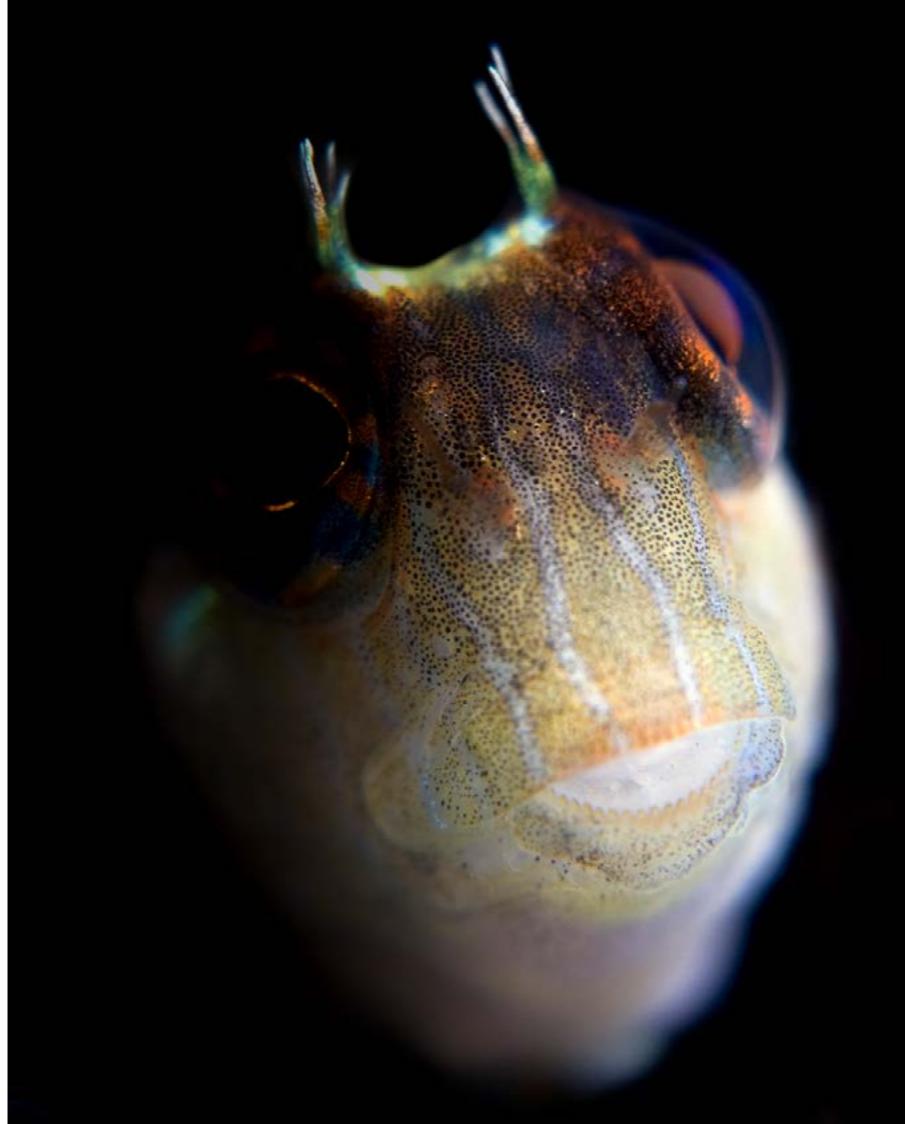
Marine species usually do not have a nose; otherwise, it would be possible to have the triangle of light visible on the darker side of this fish's face. However, Rembrandt lighting does not demand a "triangle." What is important is the direction of the light.

Rembrandt lighting works in its most basic form with just one light source.

In portrait photography, two characteristics define classic Rembrandt lighting. Firstly, there is light on one half of the subject's face; and secondly, there is a triangle of light on the shadowed side of the face.

At its most basic level, this lighting technique can be realized with a single light source offset approximately 45 degrees from the subject and a bit higher than eye level (please see graphic). The angle from which you take your photograph is not that important. What is important is the angle of the light source.

Furthermore, it is not that important whether your light source comes from the right or from the left. However, in the majority of Rembrandt's own works (especially the portraits), the light comes from the left side.



Creating visual impact

Now the question is, what does all this have to do with underwater photography? The answer is, Rembrandt lighting can add quite some drama, depth and dimensionality to underwater photographs. It works well with medium-size subjects, such as fish or corals, and any subject matter in macro photography.

The idea is to utilize shadows to create some more drama and visual impact.

Many underwater photographers tend to work with two (underwater) strobes to light up as much of the scene or subject as possible. This indeed brings back colors and detail, but it also often flattens the image, making it look two-dimensional, especially when both strobes are on the same power output setting, or even operating in TTL mode. This interpretation of "painting with light" might not deliver a result that differs

A Rembrandt lighting setup in its most simple form. It is very easy to adapt to underwater photography.

QUICK FACTS ABOUT REMBRANDT

- In the time of Rembrandt, cameras had not yet been invented. So, people who could afford the luxury had portraits painted of themselves and their families. For painters, this was quite a common business. Rembrandt gained a reputation as a great portrait artist, doing the job that nowadays is done by professional studio and portrait photographers. He created more than 600 verified paintings, including around 50 self-portraits.
- In addition to landscapes and portraits, Rembrandt produced mythological, biblical and allegorical scenes.
- Rembrandt loved dogs. One can often see dogs in his paintings.
- Rembrandt was known for his historical paintings and portraits commissioned by patrons, but he also pushed forward the genre of self-portraits. Indeed, he might be considered the "father of the selfie."
- Rembrandt always strived for uncompromising realism in his artwork. That led some critics to complain that he preferred ugliness over beauty.
- It is very likely that Rembrandt's most famous artwork, *The Night Watch* (1642) was "cropped." Large areas (almost 45 percent) of the original painting were cut away to make the painting fit into its second home, the Amsterdam Town Hall.
- Rembrandt's most expensive work, *Pendant portraits of Maerten Soolmans and Oopjen Coppit* (1634), was sold for US\$180 million in 2015. Rembrandt himself died in poverty.
- This year, 2019, is the "Year of Rembrandt," as it marks the 350th anniversary of his passing. ■



The usage of low-key photography techniques, combined with just one single light source (a strobe, in this example) creates a strong, dramatic chiaroscuro effect. A moray eel serves well as a “dramatic” photo model.

Sometimes, it is the things you do not see in an image that create a feeling of “old Hollywood,” even when the star is just a 3cm-high flamboyant cuttlefish.

“Choose only one master—Nature.”

— Rembrandt

from a snapshot. “The image is flashed to death,” as critics would say.

In contrast with topside photography, it may sometimes seem like shadows are undesirable in underwater photography. But in the areas of the scene not touched by light, it often makes a difference in the visual impact of photographs. Shadows (in images) add dimension, and thus, make them look more interesting and simply livelier. And this is where Rembrandt lighting comes in handy.

Don't worry, it is not the end of the world if the special “Rembrandt triangle” (a triangle-shaped area of light in the darker area of the image) is missed in your attempts to utilize this lighting technique in your underwater photography, as the creation of that triangle requires something that rarely can be found underwater: a nose.

This kind of lighting technique is absolutely not limited to fish (portraits) alone. The good news is that it requires only a very basic setup:

- A camera (plus underwater housing)
- An underwater strobe (or torch)
- Strobe arms (two segments with a total length of about 45cm is recommended)

The strobe arms are necessary to adjust the angle of the strobe (or torch). When pointed at the subject (from the side),

the strobe or torch should be angled at around 45 degrees. Built-in camera strobes are not suitable for this lighting technique, as we cannot achieve a 45-degree angle with them.

In case you always prefer to do your underwater photo dives with two strobes attached to your camera housing, just switch one strobe off. You can use your second strobe (in manual mode, on very low power) as a fill light to give a few more details to the shadows, softening the contrast. This then becomes a slightly

more advanced setup for Rembrandt lighting. However, a second light source or a reflector is not absolutely necessary.

In general, Rembrandt lighting is best used in low-key photography, as this is a necessary element in creating a chiaroscuro effect. This means we get into the dark. More shadows and darker areas in the image guide the viewer's eye almost automatically to the areas that are lit by the technique of Master Rembrandt—in other words, dark and dramatic. We still “paint with light,” but not the entire

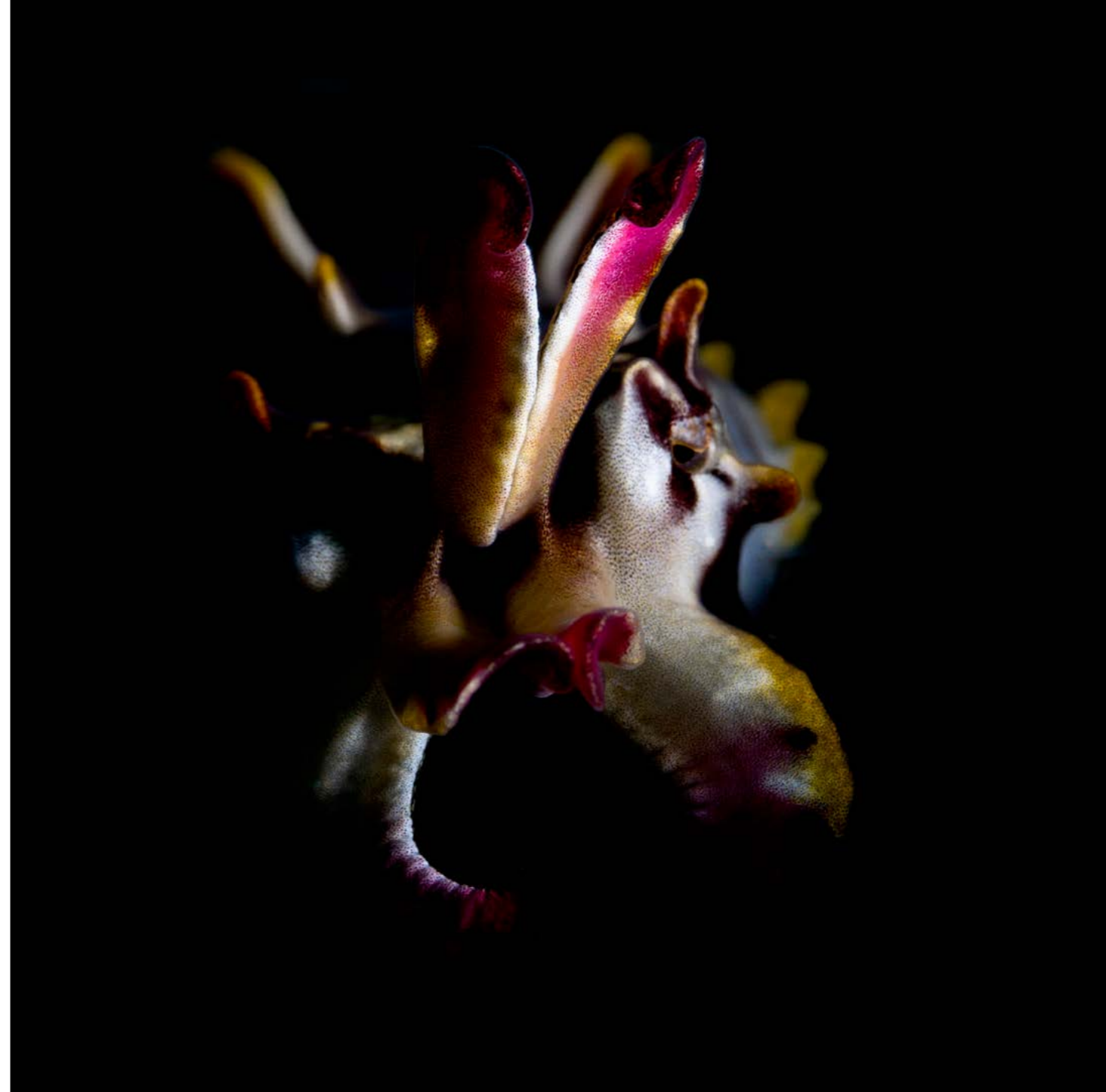




photo & video

Not as impressive as an aged Clint Eastwood, but the chiaroscuro effect (Rembrandt was a master of it) adds "character" even to sea turtles.

(image) frame.

To achieve maximum control over the lighting when working with a strobe or torch, it is of great help to eliminate all, or at least most, of the ambient light coming from the sun. The most classic way of doing this is to set the aperture to higher numbers such as *f/16* or even higher (depending on the light circumstances). This then keeps most of the

sunlight out and allows us to work entirely with the light of the strobe.

Often, this does not work well during dives under the midday sun or in shallow water, as the sunlight is simply too strong. Very early morning, late afternoon, or early evening (and, of course, at night) are often better choices when creating shots with Rembrandt lighting.



Give it a try—paint with light, play with shadows, be chiaroscuro, be dramatic.

As a matter of fact, many lighting techniques in photography have their roots in the paintings of the old masters. Taking a closer look at the old masters' artworks can provide lots of inspiration and ideas, not least for underwater photography. There is still so much more to discover.

Styles arise and disappear, or simply go out of fashion. Rembrandt himself saw his paintings lose popularity during his last years. At the age of 50, he had to file for bankruptcy. Fashion, however, does not really matter to an artist. Rembrandt is now univer-

sally considered one of the greatest painters who ever lived, and his unique way of "drawing with light" has become the gold standard, with which every image-maker simply has to be familiar. ■

Rico Besserdich is a widely published German photographer, journalist and artist based in Turkey. For more information, visit: Maviphoto.com. To see his latest book, go to: Songofsilence.com.

SOURCES:
ART-QUOTES.COM, BRITANNICA.COM, REMBRANDTRESEARCHPROJECT.ORG, SOTHEBYS.COM

Tip of the Day

by Don Silcock

Forgot something?

It is possibly one of the worst feelings in the underwater photography world. You spend all that money on the trip itself. Then, there is the considerable cost of getting to wherever you are going. And then, of course, there are all those last-minute "must-haves" that are going to make this upcoming trip so special! Finally, you arrive at the end location and are putting your gear together for the next day's diving, and the horrible realisation dawns on you that you have left something behind and not having it is probably going to ruin your trip.



before the trip. Two or three days before I depart, I carefully assemble everything and even draw a vacuum on the assembled housing to ensure that the light stays green.

I then test-fire the strobes at various power settings and double-check the camera's auto-focus system in the process; plus, I make sure that whatever zoom I am using can cover its full range. It is always a pain, as the closer you get to the departure date, the less time you have.

In the case of the Sardine Run trip, I was able to recover by asking my wife to deliver the oh-so-important O-ring to DHL in Bali and send it to Coffee Bay in South Africa. Not as straightforward as it sounds, but it eventually arrived, and I only missed a few days of bait-ball action! ■

Asia correspondent Don Silcock is based in Bali, Indonesia. For more information and extensive location guides, articles and images on some of the world's best diving locations, visit his website at: Indopacificimages.com.

I think we have all done it, and my worst case was last year when I realised two days before I left for two weeks on the Sardine Run in South Africa that the main O-ring for my Nauticam housing was in Bali—while I was in Sydney. Living in two locations (sounds ostentatious, I know, but I can assure you, it is not) and travelling a lot is a recipe for disaster!

So, you can kind of take me as a worst-case scenario—but my standard pre-trip routine, together with the assistance of my ever-supportive wife, saved me!

Assemble and test gear

For me, the only way to arrive at the end location with all my gear, is to completely assemble and test all my equipment

Rembrandt lightning adds a feeling of drama and dimensionality to images. Night dives are terrific for working with this lighting technique.



photo & video

MIDE 2019 Report & Lens Beyond Ocean Photo Contest Winners

The Malaysia International Dive Expo hit new heights in its 14th year, taking place at the Putra World Centre in Kuala Lumpur on 3-5 May 2019. This year, there was a 20 percent increase in visitors, totalling 12,656 from 50 countries.

There were 1,000 exhibitors from 12 countries, sharing their products, services and expertise with visitors. Overall sales generated over the three-day event was around US\$2.57 mil (RM10.7 mil), a 45 percent increase from last year.

New this year was the addition of watersports, which was warmly received, leading to many sales leads in the boating section. Interest was expressed by dive operators and holiday resorts regarding the various types and features of boats on display. The potential for this area to grow was evident.

Also new this year was the B2B matching platform, a MIDE meeting app that saw encouraging usage by both trade visitors and exhibitors, keen on networking during the show.

Lens Beyond Ocean Photo Contest

This year's Lens Beyond Ocean Underwater Photography Competition was another great success, with entries received from 25 countries. The winners for each category were:

Best of Show: Leonard Lim of Singapore and Peter De Maagt of the Netherlands.

Macro: 1st place, Navapan Janjarasskul of Thailand; 2nd place, Gaetano Gargiulo of Italy.

Wide-angle: 1st place, Gino Symus of Belgium; 2nd place, Miguel Ramirez of Reunion.

Portfolio: 1st place, Delbos Yannick of France; 2nd place, Tracey Jennings of the United Kingdom.

Compact: 1st place, Chong Wan Yong of Malaysia; 2nd place, Low Sook Wei of Malaysia.

Creative: 1st place, Pietro Cremone of Italy; 2nd place, Theresa Guise of the United States.



Best of Show (far right): *Sea Goddess (Tulamben, Bali)*, by Leonard Lim, Singapore

Macro – First Prize (right): *Coconut Octopus (Lembah Strait, Indonesia)*, by Navapan Janjarasskul, Thailand

Compact – First Prize (below): *Guardian in Lacy Palace (Bryozoan Goby with Eggs, Bubble Point, Ambon, Indonesia)*, by Chong Wan Yong, Malaysia



Creative – First Prize (above): *Sepia Nebula*, by Pietro Cremone, Italy



Wide-Angle – First Prize (above): *Mating Toads (Belgium)*, by Gino Symus, Belgium

Freediving – First Prize (far left): *Free Diver (Moalboal, Philippines)*, by Yen Wen Chih, Taiwan

Freediving: 1st place, Yen Wen Chih of Taiwan; 2nd place, Andrew Tsz On Lau of Hong Kong.

3-Minute Video: 1st place, Simone Piccoli of Italy; 2nd place, Ros Syafiqah Roslan of Malaysia.

Honourable mention: Rosni Hussin of Malaysia and Kang Qiu Jian of Malaysia.

Prizes included dive packages provided by Amun Ini Beach Resort and Spa, Aquatica Dive Resort, Atlantis Philippines,



photo & video

Atmosphere Resorts and Spa, Ceningan Divers, Cocotinos Hotels and Resorts, Fun and Sun Dive Travel, Mola Mola Liveaboard, Pura Vida Beach and Dive Resort, Scuba Seraya, Thalassa, Tiare Cruise and Waiwo Dive Resort Raja Ampat. Additional prizes were provided by Crest Diving and Enth Degree.

Forums and presenters

The much anticipated Ocean Rescue Forum brought experts from various fields together to discuss sustainable practices and educate visitors about what they can do to help the oceans and marine life, particularly regarding plastic pollution. The Cave Diving Forum featured cave diving experts discussing their experiences as well as the skills and training required. Various speakers gave presentations during the expo on topics such as marine conservation, dive medicine, underwater photography, technical diving, freediving, dive travel, dive training and blackwater diving.

Reaching out

There was a 15 percent increase in non-divers attending the expo, totaling 1,296, of which 36 tried scuba diving

for the first time in the on-site pool through the "Be a Diver" program and another 258 signed up for scuba diving courses. Dive Divas Fan Club welcomed 32 new female members to their community. In addition, 672 school children visited the show to learn about scuba diving from Neil Davidson of PADI, single-use plastics from Monica Chin of the Ara Dinawan Research, Education and Conservation Center (ADRECC), and sharks from Brendon Sing of Shark Guardian. There were 37 lucky draw winners of prizes with a combined worth of US\$10,816 (RM45,000), including dive holiday packages, dive gear, dive courses, underwater camera equipment and cash prizes.

Sponsors

MIDE is endorsed by the Malaysia External Trade Development Corporation

(MATRADE) and strongly supported by the Malaysia Convention and Exhibition Bureau (MyCEB), an agency under the Ministry of Tourism, Arts and Culture Malaysia. Other supporting associations include Malaysia Scuba Diving Association (MSDA), PADI, NAUI, TDI/SDI, SSI, Dive RAID, IANTD, DAN, ITDA, DDI and NDL. Media sponsors include X-Ray Mag, DiveLog, OZDiver, Action Asia, China Scuba Diving, Ocean Geographic Society, Underwater.com, Global Sports Mart, Malay Mail, Floatingasia.com and Travel Guide. ■

For more information about MIDE 2020, visit: mide.com.my. Email: info@mide.com.my.



Video Category – First Prize: *Whale Totem*, by Simone Piccoli of Italy (https://www.youtube.com/watch?time_continue=8&v=sYXRcav2_bE)



Portfolio Category – First Prize: *Delbos Yannick, France Fly on Air Turtle (Green Turtle, N'Gouja Beach, Mayotte Island), Infernal Spiral (Sardine Run, Moalboal, Philippines), Back to the Surface (Humpback Whales, Saint Paul, Reunion Island), The Ocean's Tears (Parrotfish, Etang Salé, Reunion Island)*

Best of Show (right): *Goby (on fluoro dive, Bari Reef, Bonaire)*, by Peter de Maagt, Netherlands



QUICK MIDE 2019 STATISTICS:

- 12,656 visitors
- US\$2.57 million (RM10.7 million) in sales
- 139 exhibiting companies
- 1,000 exhibitors attended
- 1,296 newbies attended
- 258 newbies signed up for dive training



Gerry Miles



P O R T F O L I O



Cruising the Kelp Forest (left), 80cm x 49cm; *Galapagos Fur Seals* (below), 88cm x 61cm; *Atlantic Spotted Dolphins* (bottom right), 92cm x 61cm; and *Dusky Grouper* (previous page), 81cm x 48.5cm—all oil on boards, by Gerry Miles



Text edited by Gunild Symes
All artwork by and photos
courtesy of Gerry Miles

British artist Gerry Miles paints marine life and reef scenes in brilliant colour and dynamic compositions, often with abstract backgrounds that capture the thrilling vitality and sublime ambience of the underwater world. X-Ray Mag interviewed the artist to find out more about his artwork and perspectives.

X-RAY MAG: Tell us about yourself, your background and how you became an artist.

GM: I was educated as a mechanical engineer, served a five-year student apprenticeship with an engineering company and became a management consultant specialising in logistics and materials handling.

I later became vice president of a large, Dutch multinational engineering company and retired in 2003.

I have been painting and drawing since I was a young boy and decided upon retirement to pursue a new career as an artist. I am self-taught and paint both landscapes and underwater subjects.

X-RAY MAG: Why marine life and underwater themes? How did you come to these themes and how did you develop your style of painting?

GM: I started sub-aqua diving with a friend in 1963. We lived in Hampshire,

England, and dived mainly along the southern coast. Our most popular diving venues were in Dorset, particularly Portland Bill, Swanage, Lulworth Cove, Chapman's pool and Durdle Door. We had no dive training, and armed with the BSAC Divers Handbook, we learnt to dive as we went along, without incurring any accidents or injuries.

I joined the British Sub-Aqua Club in 1973, eventually qualifying as an Advanced Diver. I had a keen interest in underwater photography from the beginning and built my own underwater housings from Perspex or aluminium, with brass control linkages for both still and cine cameras. My first films were in Super 8 (film format) on Kodak High Speed Ektachrome (film). Finally, I used an HD video system with LED lighting. The advancements in underwater technology

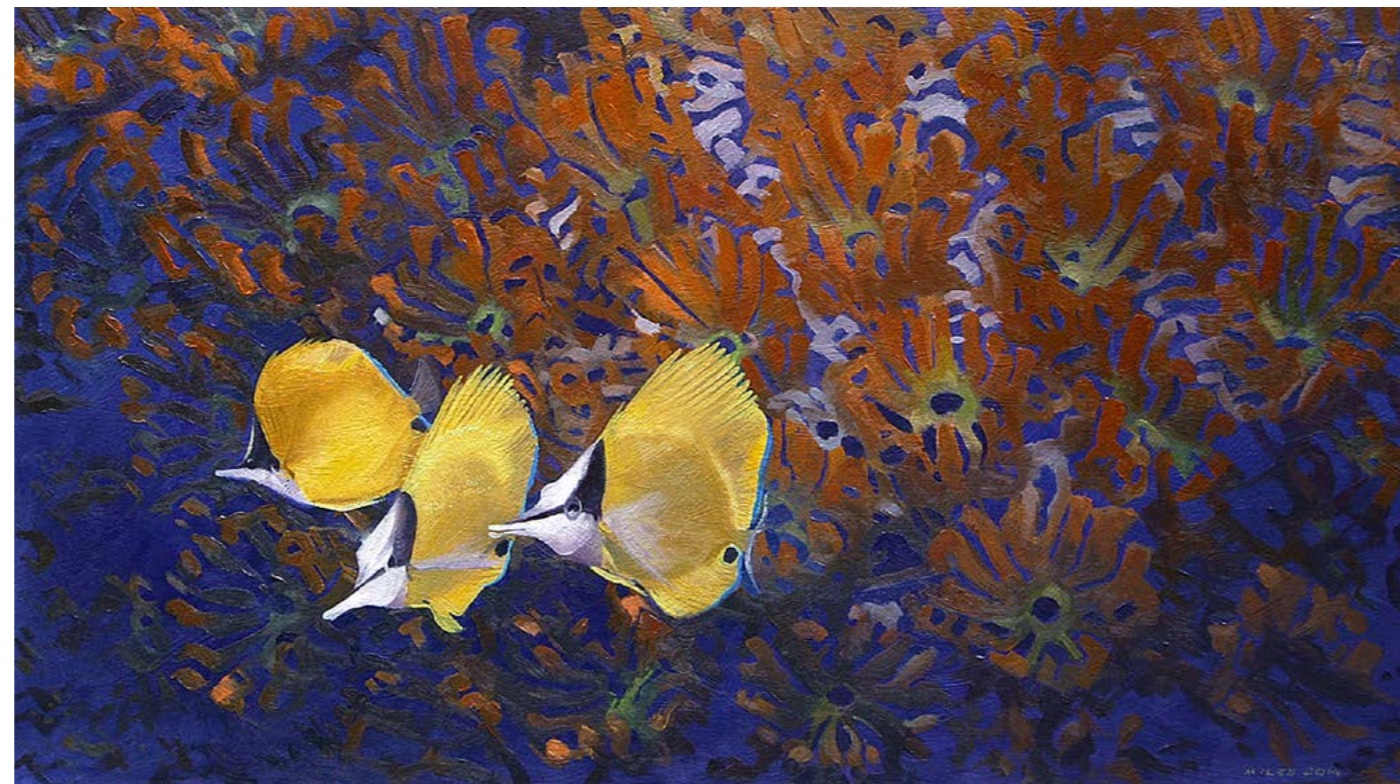
portfolio

Copper Banded Butterfly Fishes (right), 82cm x 61cm, oil on board; *Juvenile Spotted Drum* (below), 90cm x 51cm, oil on board; and *Long Nosed Butterfly Fishes* (bottom right), 80cm x 48cm, oil on board; and *Raccoon Butterfly Fishes & Soft Coral*, (bottom left) 66.5cm x 60.5cm, acrylic on board, by Gerry Miles

are mind-boggling, and underwater filming is now so much simpler.

I now have a considerable library of films that I have made over the years, and it is these images that I use to develop my paintings. I compile my compositions on a Wacom Intuos tablet using Adobe Photoshop, and once satisfied, scale up these designs to my painting boards.

I produce my own textured painting boards and paint with either acrylics or Cobra water-mixable oils. This technique is ideally suited for dry brush techniques.



X-RAY MAG: What is your artistic method or creative process?

GM: I specialise in the careful

application of contrast and tone in my paintings. This is the most critical element in creating mood and atmosphere. There are a

series of free art tutorial videos on my website and on my Facebook page that cover tone and contrast, colour mixing and colour

harmony, and there is also an underwater painting demo of my painting *Sailfin Tangs*. The introduction includes extracts from my

I work in layers and start with an underpainting using thinned colours. I am very careful even at this stage to establish the tonal range

underwater films.

The first step in my creative process is to have an idea upon which to build. This may be an expression of a diving experience that has left a memorable impression, or it may be triggered by my fascination with a particular type of sea creature. I may decide to render the whole painting as a realistic representation as would be experienced by a diver, or I may decide that the message would better be conveyed in a more abstract approach.

and contrast to create depth and to develop a colour harmony that suits the mood that I want to portray. Subsequent layers are applied using thicker paint, but much of the underpainting is allowed to show through.

The finished painting gets a coat of matt varnish to strengthen the surface against abrasion and add lustre to the colours.

X-RAY MAG: As a scuba diver, how have your experiences underwater influenced your art? In your relationship with reefs and the sea, where have you had your favourite experiences?

GM: Upon my retirement, my wife decided to take up diving and did the PADI open water and advanced courses. We spent 10 glorious years diving together around the world until age and ill health prevented us from continuing. During those 10 years, we

Gerry Miles

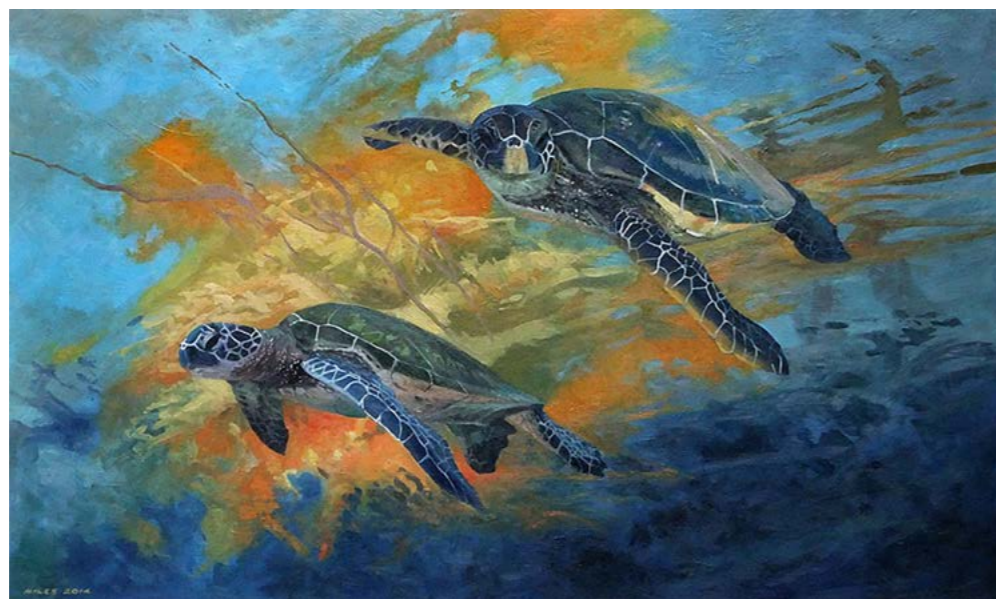
Running the Gauntlet (left), 70cm x 61cm, oil on board; *Sting Ray City* (below), 81cm x 52cm, oil on board; *The Bait Ball* (bottom right), 108cm x 61cm, oil on board; and *Green Turtles* (lower left), 85cm x 61cm, oil on board, by Gerry Miles



3m Galapagos shark came cruising down the reef and glided past us within reach.

Shallow, relaxed dives on coral gardens are also a particular favourite of mine—I enjoy the kaleidoscope of colours as the sunlight sparkles on the corals, the shoals of damselfish and multicoloured parrotfish going about their business, and the occasional hawksbill turtle making an appearance.

In the Maldives, I filmed a large manta ray at a cleaning station. It kept turning and pirouetting as the cleaner wrasse got to work, looking on the entire world like some flexible stealth bomber just above my head.



dived in the Maldives, Galápagos Islands, Cayman Islands, Indonesia, Great Barrier Reef, Ningaloo Reef, and did several trips to Egypt, diving sites such as the Brothers Islands.

My most memorable experience was diving with a 14m whale shark on Ningaloo Reef in northwestern Australia. It was immediately under the boat and swimming upside down. I have some unique footage as it did a barrel roll and headed straight towards me. I took a deep breath, and as I began

to rise, it slid underneath me, and I filmed across the breadth of its back. Luckily, the tail didn't clobber me as it

swam on.

On another occasion in the Galápagos Islands, we were decompressing at 5m when a



MILES 2017



Gerry Miles

Spotted Sweetlips (left), 101cm x 61cm, oil on board; and Yellow Crowned Butterfly Fish (below), 61cm x 37cm, oil on board, by Gerry Miles



melting of the ice caps is destroying the habitat of both predators and prey.

Coral reefs and mangro swamps are the nursery breeding grounds for a vast

diversity of species. Failure to preserve the delicate balance of these environments will lead to a dramatic reduction in breeding stocks and will eventually affect the fish-

ing industry.

My artwork can only be a tiny voice in the efforts to stop this madness. I hope that, in some small way, by bringing my interpretation of the beauty and majesty of the underwater world to the attention of people, that they may feel the same desperate need that I have to preserve it for future generations.

X-RAY MAG: What is the message or experience you want viewers of your artwork to have or understand?

GM: My underwater paintings are not intended as a crusade to save our seas, but more a matter of sharing my



I was filming a very large moray eel in a hole in a vertical wall in the Red Sea. I suddenly realised that his head was completely filling the screen and, attracted by his own reflection, had left the hole and stretched out to get a better view! My Egyptian divemaster proceeded to drape this creature around his neck. After the dive, I asked if he wanted a copy of the film. He said no. If his wife ever saw the footage, he would not be allowed to dive again.

During 40+ years of diving, I have never lost my fascination for being underwater and feel privileged to have lived in an age that made this possible. It seemed a natural progression for me to portray this magical world in my paintings, a unique opportunity for a scuba diver with artistic talent.

X-RAY MAG: What are your thoughts on ocean conservation and coral reef management and how does your artwork relate to these issues?

GM: Global warming is a fact! Plastic



pollution of the world's seas and oceans is a fact! Destruction of coral reefs through bleaching caused by rises in water temperature is a fact!

Further industrial exploitation of the mineral wealth at the depths of the oceans will lead to more pollution and destruction of species! Polar

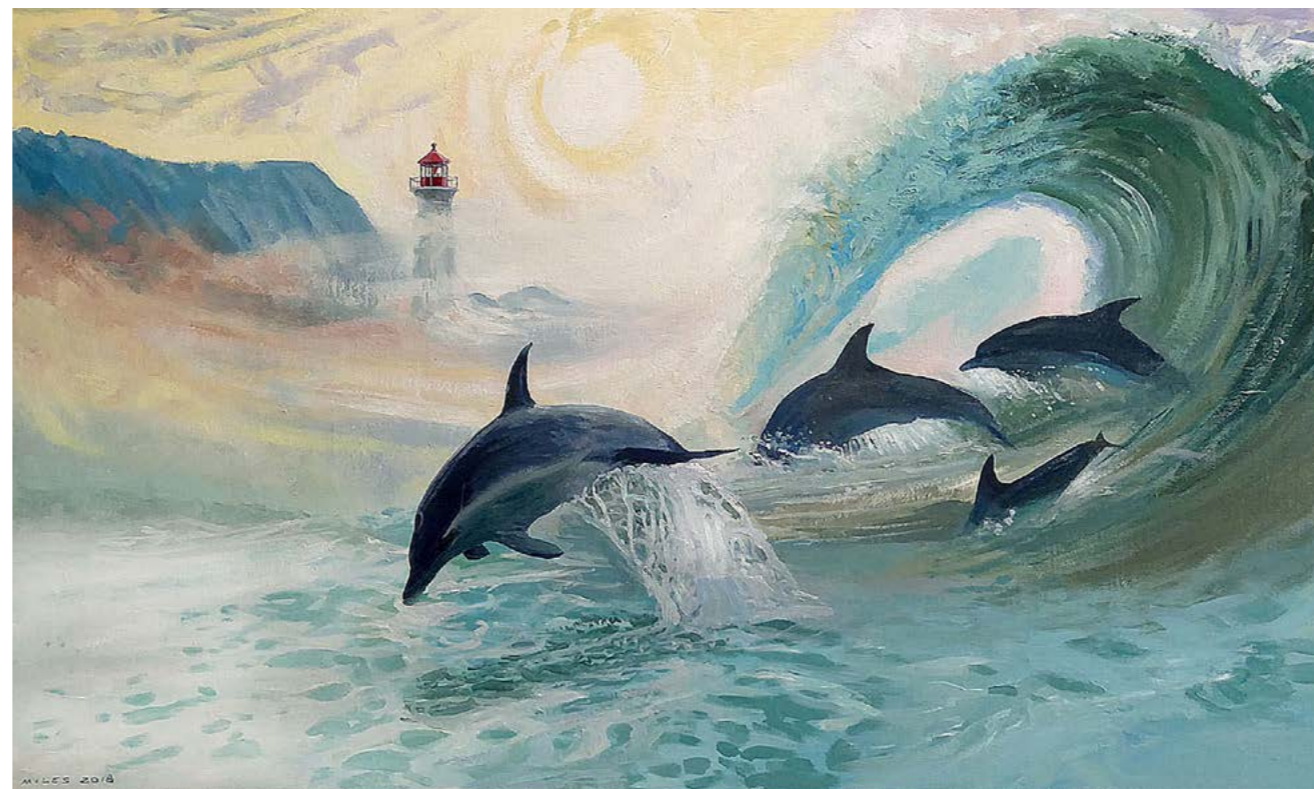


Sailfin Tangs (above), 85cm x 61cm, oil on board; and Seahorses (left), 79cm x 61cm, oil on board, by Gerry Miles



Gerry Miles

Under the Ice (left), 78cm x 61cm, oil on board; *Dolphins Gamboling in the Surf* (below), 90cm x 53.5cm, acrylic on board; *Under Thin Ice* (bottom right), 81cm x 57cm, oil on board; and *Manatees* (lower left), 78cm x 48cm, oil on board, by Gerry Miles



works. He sent me his final effort, and it was a very competent rendition.

X-RAY MAG: What are your upcoming projects, art courses or events?

GM: I am going to further explore the development of placing sea creatures in abstract settings and see where this leads me. I have several art tutorial videos in the pipeline that I will launch on my website and Facebook page. I will be exhibiting in the Netherlands in July together with a group of local artists. ■

For more information about art-work and tutorial videos, visit the artist's website at: gerrymiles.nl.

diving experiences in a personal and unique way. Hopefully, they will inspire others to take up diving.

X-RAY MAG: What are the challenges or benefits of being an artist in the world today? Any advice for aspiring artists?

GM: Recognition of uniqueness in art can be achieved by the development of style and technique, creating abstract forms with exciting dramatic colour or by painting and interpreting specialist subjects. I chose the latter.

My painting genre is realism, and although my landscape paintings are generally appreciated and considered to be competent, they will not stand out in a crowded gallery. Underwater paintings are still rare enough in the art world to make a statement alongside other works. My objective is to develop underwater paintings with realistic sea creatures portrayed within an abstract design with beautiful colour schemes to enhance their own exotic forms and shapes.



If you want to paint ocean subjects, get your head underwater and look around!

X-RAY MAG: How do people—adults and children—respond to your works?

GM: An art teacher in a college in Pennsylvania contacted me to say that she had given her class a special project to study and write an appreciation of my underwater paintings. Later, a student contacted me to ask if I would allow him to copy one of my

