Whale & Dolphin Watching in Madeira :: UW Photo Contributors' Picks – Signature Traits

X-Ray Mag

GLOBAL EDITION
August 2024
Number 127

Caribbean
Cuba

Portugal
Madeira

UW Photo
Sensors

Profile
Bill Acker

Papua New Guinea
Epaulette Sharks

Training
Dive Culture Confusion

MICRONESIA
Yap

COVER PHOTO BY DAVID FLEETHAM

DIRECTORY

X-RAY MAG is published by AquaScope Media ApS

Copenhagen, Denmark

xray-mag.com

PUBLISHER & EDITOR-IN-CHIEF
Peter Symes
Editor@xray-mag.com

PUBLISHER, MANAGING EDITOR & CREATIVE DIRECTOR
Gunild Symes
Gunild@xray-mag.com

LAYOUT ASSISTANCE
Sine Kristiansen

ASSOCIATE EDITORS
Scott Bennett, Toronto
Scott@xray-mag.com
Catherine GS Lim, Singapore
Cat@xray-mag.com
Matthew Meier, San Diego
Matt@xray-mag.com
Michael Menduno, Berkeley
Michael@xray-mag.com

Russia - Moscow
Andrey Bizyukin, PhD
Andrey@xray-mag.com
Svetlana Murashkina, PhD
Svetlana@xray-mag.com

Sweden
Lelle Malmström
Lelle@xray-mag.com

ASSISTANT EDITORS
Rosemary E. Lunn, London
Roz@xray-mag.com
Don Silcock, Sydney + Bali
Don@xray-mag.com

USA
Larry Cohen, New York City
Larry@xray-mag.com

ADVERTISING
ASIA-PACIFIC
Juliette Myers, Sydney
Juliette@xray-mag.com

UNITED KINGDOM
Rosemary E. Lunn, London
Roz@xray-mag.com

USA & INTERNATIONAL
Matthew Meier, San Diego
Matt@xray-mag.com

Contacts page: Xray-Mag.com

IN MEMORIAM
Michael Symes, M.Sc, Senior Editor
Barb Roy, Associate Editor

SECTION EDITORS
Andrey Bizyukin, PhD – *Features*
Larry Cohen – *Photo & Video*
Mats Gunnarsson – *Equipment*
Catherine GS Lim – *News, Books*
Michael Menduno – *Tech*
Ila France Porcher – *Sharks*

COLUMNISTS
Matt Jevon – *Opinions*
Steve Lewis – *Opinions*
Gareth Lock – *Training*
Ila France Porcher – *Shark Tales*
Mark Powell – *Tech Talk*
Simon Pridmore – *Opinions*
Lawson Wood – *UW Photo*

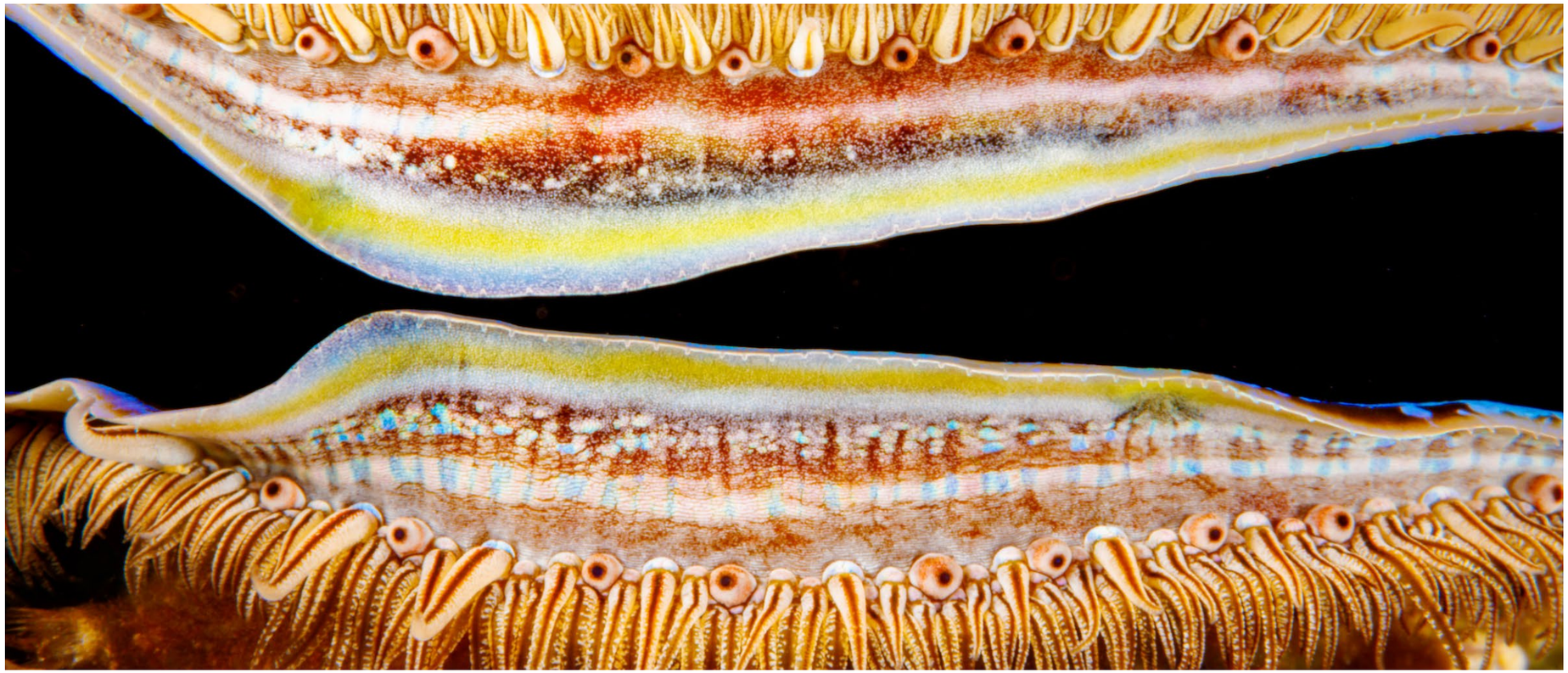
CONTRIBUTORS THIS ISSUE
Bill Acker
John A. Ares
Daniel Brinckmann
Sheryl Checkman
Larry Cohen
Pierre Constant
Lureen Ferretti
David Fleetham
Anita George-Ares, PhD
Mats Gunnarsson
Catherine GS Lim
Brandi Mueller
Svetlana Murashkina
Andy Murch
Ila France Porcher
Simon Pridmore
Gary Rose, MD
Michael Rothschild, MD
Don Silcock
Gunild Symes
Peter Symes
Olga Torrey

SUBSCRIPTION
X-RAY MAG International Edition in English is FREE
To subscribe, go to: **xray-mag.com/Subscription**

COVER PHOTO: Reef manta ray, *Mobula alfredi*, Yap, Micronesia
Photo by David Fleetham

contents

Coral-boring scallop, *Pedum spondyloideum*,Yap, Micronesia. Photo by David Fleetham



columns...

plus...

Make a Difference

I live and work in the heart of a European capital, which is also the most densely populated borough in the country. There are not many parks or green spaces in this area, yet we often see butterflies, bees and dragonflies paying us a brief visit.

The neighbourhood now has numerous flowerbeds, and former lawns have been replaced with wildflowers. The once-murky lakes nearby have been restored, resulting in the growth of rooted vegetation, fish and a thriving bird population.

It just demonstrates that restoration efforts are achievable and that a moderately diverse nature can coexist even in an urban environment. Even small 'islands' such as these flowerbeds can make a significant difference.

Nature simply requires some space and assistance. The examples given are all on a practical and economically feasible scale. However, as the scale increases to larger bodies of water such as lakes, estuaries or seas, the challenges and costs rise significantly.

The Baltic Sea once supported a significant fishing industry, particularly for herring, which was abundant and a major source of income in the Middle Ages. Unfortunately, last year, the guild of professional fishermen on the island of Bornholm closed down because there were no longer enough fish to support their operations.

Meanwhile, biologists have estimated that it will take about 400 years to restore the Baltic Sea to some degree, provided that the influx of nutrients from agricultural runoff is curbed. This would require a 30 percent reduction in agricultural land around the Baltic. I simply do not see this as a realistic plan.

What I do see happening offers a glimmer of hope. In various locations, groups of divers have now begun planting marine grasses in selected areas. This is something we can all do—with prepared seedlings that are plugged into the seabed at shallow depths.

The open sea is a vast area, so the impact of seagrass plantings is likely to be limited to local areas, if they are successful at all. However, their importance should not be underestimated, as even small 'islands' can have a significant impact. They are akin to flowerbeds in a city, serving to repopulate barren areas and act as dispersion corridors.

The lesson we have learned from various MPAs around the world is that they have a significant positive effect on the surrounding area, where diversity and populations also increase.

This is where we, as individuals, can make a difference and do something useful to bring about positive change. Each of our efforts may be small, but it all adds up. To paraphrase John F. Kennedy, let's ask not what the natural environment can do for us—but what we can do for the environment.

— Peter Symes
Publisher & Editor-in-Chief

Atolls Can Adapt to Rising Seas

The main threat to these islands is not their low elevation but rather the damage caused to their natural growth processes. Measures to maintain the natural processes of sediment production and transport can enable atolls to keep pace with rising sea levels.

The commonly held belief that atoll islands are static and doomed landforms due to rising sea levels is a misunderstanding. In reality, these islands have the ability to adapt and grow vertically. This natural capacity for vertical accretion enables them to keep pace with gradual sea level changes, challenging the idea of inevitable loss.

Natural processes

Atolls are unique island formations made up of a variety of materials, including sand and boulder-sized debris, which come from the surrounding coral reefs. These materials are brought to the atoll rims by ocean currents and waves. Atolls continuously change in shape, size, and height in response to environmental factors. Typically, these islands are situated at elevations ranging from 1 to 5 metres above sea level and have the ability to naturally increase in height at rates that correspond to the projected sea-level rise of 3 to 10mm per year.

The main threat to these islands is not their low elevation, but rather the damage caused to their natural growth processes. Both global impacts, such as coral reef degradation from marine heatwaves and acidification, and local impacts, like sediment disruption from coastal development, significantly hinder their ability to grow and maintain their surface above the water.

Empowering local action

Contrary to the fatalistic view of atoll "drowning", current advancements in atoll geoscience and ecology offer hope. Promoting the notion that atolls are irreversibly sinking underestimates the power of place-based solutions and diminishes the role of local communities and Indigenous knowledge systems in conservation efforts.

To ensure the survival and health of atoll islands, it is crucial to maintain the natural processes of sediment production on coral reefs and ensure unobstructed sediment transport from the reefs to the islands. Effective conservation must involve both reducing global greenhouse emissions and locally restoring and preserving these accretion processes.

Nature-based solutions

Practical measures to enhance atoll resilience involve managing marine protected areas to support key species as parrotfish. These species play a vital role in producing the sand-grade sediment required for island formation. Additionally, innovative techniques like coral out-planting show potential for restoring essential sediment production necessary for island stability.

Local conservation actions can greatly improve the coral reef "sediment factory", contributing to a steady supply of building material for atoll growth. For example, community-driven initiatives can directly improve the health of the reef and, in turn, the island's resilience to sea level rise.


JONNYBELVEDERE / PIXABAY

Rather than atoll islands' low elevation per se, it is the impairment of natural accretion processes that is jeopardising their persistence.

Substantial potential

The future of atoll islands hinges on understanding and supporting their natural growth mechanisms. By integrating ecological knowledge with geophysical processes and community involvement, there is substantial potential to not only preserve but also enhance the resilience of these unique ecosystems against the challenges posed by climate change. ■

SOURCE: TRENDS IN ECOLOGY & EVOLUTION

news

Edited by
Peter Symes

NOAA

US Rolls Out First National Ocean Biodiversity Strategy

The US government has recently launched its National Ocean Biodiversity Strategy to safeguard the rich biodiversity of the nation's oceans, coasts and Great Lakes.

This strategy outlines a holistic approach to understanding and preserving marine ecosystems, crucial for maintaining the country's economic, environmental and cultural prosperity.

President Biden has emphasised the ocean's critical role in sustaining life on Earth, highlighting its contributions to jobs, food supply, climate moderation and cultural identity. The Biden-Harris Administration is committed to conserving at least 30 percent of US waters by 2030, addressing the escalating threats of warming, overfishing and biodiversity loss.

Innovative approaches

The National Ocean Biodiversity Strategy aims to harness cutting-edge technologies and scientific advances to enhance the monitoring and understanding of marine life. Innovations in genomics, big data and artificial intelligence are set to revolutionise how biodiversity is studied, providing detailed insights into the over two million species believed to inhabit these waters, of which only about 240,000 have been scientifically described.

Three overarching goals

Knowledge delivery: Develop and implement a national-scale strategy to enhance biodiversity knowledge, establish a coordinated management system and identify gaps in understanding ocean biodiversity's benefits.

Tools and institutional strengthening: Build robust systems for data management and biodiversity monitoring that extend from coastal areas to the deep sea, and invest in human capital and infrastructure vital for sustaining foundational biodiversity science.

Conservation and sustainable use: Use the acquired biodiversity knowledge to inform and implement conservation, restoration and sustainable use policies. This includes fostering partnerships across various sectors and engaging the public in conservation efforts.

Implementation

The National Ocean Biodiversity Strategy sets a new standard for environmental stewardship, aiming to protect and enhance the United States' marine environments. Through comprehensive planning, innovative technology and community involvement, it seeks to ensure the longevity and health of the nation's ocean biodiversity for future generations.

Achieving the strategy's goals will require broad societal engagement, including new investments from federal and private sectors and collaboration across stakeholders to address climate impacts and equity. The approach also recognises the importance of incorporating Indigenous knowledge and involving community leaders in decision-making processes. ■

SOURCE: US GOVERNMENT

PETER SYMES/MIDJOURNEY

The office is set to play a crucial role in promoting recreational diving.

Florida Opens Office of Ocean Economy

The Office of Ocean Economy will develop the state's blue economy sectors, including maritime industries, aquaculture and tourism, with a strong emphasis on expanding and improving the recreational dive industry.

Strategic objectives

The Office of Ocean Economy is committed to integrating academic research with commercial maritime activities in order to promote sustainable practices and unlock new business opportunities. This integration is expected to drive significant advancements in ocean-related technologies and services, leading to job creation and regional economic growth.

Enhancing diving tourism

Florida is the second-largest state in the United States for certifying new open water divers, according to DEMA's Certification Census. The Office of Ocean Economy is strategically positioned to strengthen Florida's status as a top diving destination. The office will focus on promoting recreational diving and ensuring the sustainability and accessibility of Florida's dive sites. This initiative aligns with Florida's environmental goals and its commitment to preserving vibrant marine ecosystems that attract divers and support local economies.

Collaboration

The office aims to promote collaboration among state universities, colleges and local businesses to accelerate the commercialization of innovative marine technologies.

This cooperative approach is intended to tackle economic challenges, boost job growth, and address labour shortages within the blue economy, especially in sectors related to marine tourism and recreational diving.

Global promotion

The office is responsible for producing annual reports that will provide guidance to policymakers and attract investors, thereby helping to drive further advancements in the blue economy. Additionally, the office will engage in promotional activities aimed at positioning Florida as a leading global hub for blue economy investments and diving tourism. ■

SOURCE: US GOVERNMENT

PETER SYMES/MIDJOURNEY

Through RNA editing, the cephalopods appear to have found a unique way of tweaking their own physiology to adapt to environmental temperature changes.

Octopuses Adjust to Cold by Editing Their RNA

Innovative research reveals how octopuses adapt to frigid waters by editing their RNA, a finding that could have broad implications for biology and biotechnology.

A recent study has unveiled a fascinating aspect of octopus biology: their ability to adapt to cold ocean temperatures by making precise edits to their RNA.

RNA editing is a molecular process through which cells can modify nucleotide sequences in RNA, resulting in proteins that differ from those directly encoded by DNA. This ability is particularly enhanced in octopuses, who use it to fine-tune the functions of their nervous system at low temperatures.

Cold-water adaptation

The study focused on the adaptations of octopuses that inhabit drastically varying thermal environments. Researchers found that cold-water octopuses have developed the capacity to edit their RNA to an extent much more significant than their warm-water counterparts. This editing primarily affects proteins involved in nerve cell function, crucial for maintaining agility and coordination in cold waters.

Importance

This discovery not only deepens our understanding of octopus biology but also opens new avenues for biotechnological applications. By studying these mechanisms, scientists may develop methods to enhance cold tolerance in other organisms, potentially leading to breakthroughs in agriculture and medicine, particularly in enhancing the cold resistance of crops or creating new treatments for neurological disorders. ■ SOURCE: CELL JOURNAL

wreck news

Edited by
Peter Symes

THE LOST 52 PROJECT

4D photogrammetry model of USS *Harder* (SS 257) wreck site by the Lost 52 Project

Legendary US World War II Submarine USS Harder Located off Philippines

The wreck of USS *Harder*, a United States submarine renowned for its heroic actions during World War II, has been located off the coast of the Philippines. It is lying at a depth of 3,000ft. This find marks a poignant moment in naval history, bringing closure to a chapter that has remained open since the submarine was lost in 1944.

USS *Harder* was known for its aggressive tactics and remarkable service record, including six war patrols that earned it a formidable reputation. It was found by the Lost 52 project, which aims to find the 52 US submarines lost during World War II. The discovery was confirmed through sonar imaging and underwater drones that captured clear images of the wreck, which still shows the submarine's intact hull and significant battle damage.

Crucial role

Launched in 1942, USS *Harder* played a crucial role in the Pacific Theatre, famously sinking six enemy ships. Its tactical prowess and the bravery of its crew made it a legend. However, its final mission ended tragically when it was destroyed by depth charges from a Japanese escort vessel. This recent discovery sheds light on the final moments of the USS *Harder* and provides a tangible connection to the stories of valor and sacrifice synonymous with its history.

The finding of USS *Harder* is not just a triumph of marine archaeology but also a solemn reminder of the perils of war. The US Navy has expressed its intention to treat the site with the reverence it deserves, recognising it as a war grave where 79 sailors lost their lives.

Efforts will be made to document the site thoroughly while ensuring that it remains undisturbed, preserving its integrity as a solemn memorial. ■

SOURCE: US NAVAL HISTORY AND HERITAGE COMMAND

Magnificent Finds From 500-Year-Old China Shipwrecks

Recent underwater excavations off the southern coast of China have revealed two 500-year-old Ming Dynasty shipwrecks, providing a fascinating glimpse into China's vibrant maritime trade during the early 16th century.

These wrecks are significant for the wealth of artefacts recovered, including beautifully crafted porcelain, gold coins and intricate metalwork. These findings underscore China's pivotal role in the global trade networks of the era, showcasing its exports of porcelain and silk and imports of spices and precious metals from distant regions like Africa and the Middle East.

The recovery process employed remotely operated vehicles with robotic arms, ensuring the delicate preservation of artefacts and enhancing safety during excavation. These excavations serve as cultural time capsules, shedding light on Ming Dynasty craftsmanship, artistic practices and daily life. They also highlight the advanced shipbuilding and navigational capabilities of ancient Chinese mariners. The artefacts recovered are set to contribute significantly to ongoing archaeological research, offering invaluable insights into Asia's maritime history. Plans are underway for extensive study and preservation of these historical treasures, with expectations of future exhibitions in museums across China and potentially internationally.

These exhibitions, eagerly anticipated, will allow the public to engage directly with these Ming Dynasty shipwrecks' rich heritage and historical significance, deepening our understanding of China's past global influence. ■

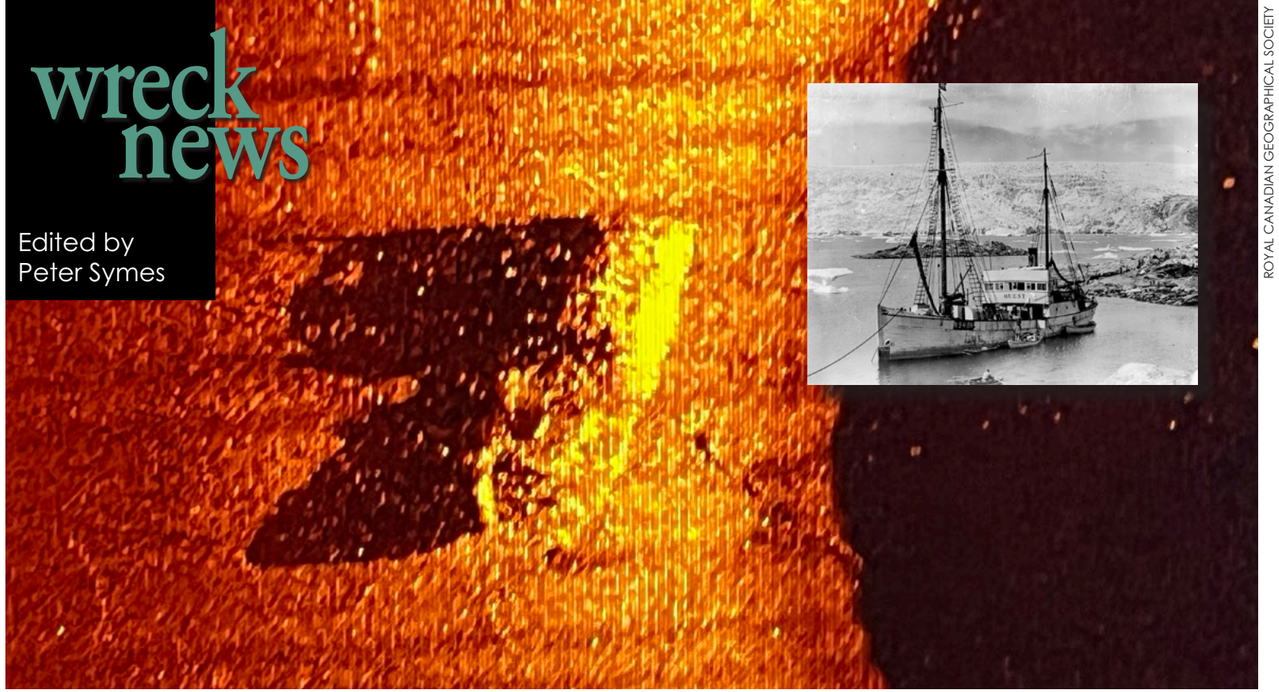
SOURCE: NATIONAL CULTURAL HERITAGE ADMINISTRATION OF CHINA (NCHA)

NATIONAL CULTURAL HERITAGE ADMINISTRATION OF CHINA (NCHA)

Artefacts from one of the recently discovered 500-year-old shipwrecks in the South China Sea

wreck news

Edited by Peter Symes



Sonar image of the *Quest*, the legendary vessel from Sir Ernest Shackleton's final expedition, located off the coast of Newfoundland

Wreck of Sir Ernest Shackleton's last ship, found in Labrador Sea

In a significant maritime discovery, the wreck of the *Quest*, Sir Ernest Shackleton's final expedition ship, was found off Newfoundland's coast, confirmed by the Royal Canadian Geographical Society (RCGS). This discovery is crucial to understanding Shackleton's enduring legacy in polar exploration.

Built in Norway in 1917 as a wooden-hulled former sealer, the *Quest* was the vessel for Shackleton's last expedition, the Shackleton-Rowett Expedition of 1921-1922. Despite Shackleton's early death during the voyage, the *Quest* played a pivotal role in early polar exploration.

Post-World War II, the Quest was used as a Caribbean minesweeper before returning to seal hunting in the Labrador Sea. In May 1962, the ship struck ice and sank during one such mission, though all crew members were rescued.

400m deep

The wreck of the *Quest*, found nearly 400m deep on the seabed, is a remarkable discovery. The subsequent scans and remotely operated vehicles not only confirmed the *Quest*'s identity but also revealed it to be remarkably intact, with its steam engine and hull structure preserved, a rare find in maritime history.

Search Director David Mearns said, "The masts are knocked down, which is expected, but the whole remains intact." The team's plan to photograph the wreck later this year adds an element of anticipation to this significant discovery.

Beyond its role as a scientific vessel, the *Quest* symbolises human resilience. Its discovery illuminates Shackleton and his crew's challenges during their ambitious voyages. Those who sailed it described it as "small and uncomfortable," but the *Quest*'s story is preserved at the South Georgia Museum. ■

SOURCE: ROYAL CANADIAN GEOGRAPHICAL SOCIETY

ROYAL CANADIAN GEOGRAPHICAL SOCIETY

EMIL ALADJEM, ISRAEL ANTIQUITIES AUTHORITY / PRESS RELEASE

Jacob Sharvit from the Israel Antiquities Authority's marine unit (left) and Dr Karnit Bahartan, environmental lead at Energean (right), with the ancient Canaanite jars found at the wreck site

World's Oldest Shipwreck Discovered off Israel's Coast

The shipwreck, which is approximately 3,300 years old and dates to the Bronze Age, was discovered at a depth of 1,800m, about 90km from shore during a survey by the natural gas company Energean.

This find is believed to be from a period characterised by significant cultural and trade exchanges across the region. Artefacts recovered from the site, such as pottery, weapons and tools, indicate that the ship was part of extensive trade routes connecting ancient civilisations in the Middle East, Egypt and potentially beyond.

Jugs, pottery and scarabs

Among the recovered artefacts are Canaanite wine jugs, Cypriot pottery and Egyptian scarabs, illustrating a vibrant trade system and providing insights into the relationships between different ancient cultures and economies. The variety and preservation of these artefacts offer a rare glimpse into commercial activities and cultural exchanges during the Late Bronze Age.

Advanced underwater archaeological methods have provided new insights into the ship's construction, offering clues about the evolution of maritime technology and how ships were adapted for long voyages across the open sea.

Long-distance trade

The recent discovery has significantly enhanced our understanding of ancient maritime practices, suggesting that seafaring and long-distance trade were more advanced than previously believed. This find not only contributes to the history of naval architecture but also aids historians in reconstructing the economic and cultural landscapes of the ancient world.

International teams are continuously studying the shipwreck site with the goal of preserving the artefacts and conducting further excavations. This ongoing research is expected to reveal more about the ancient world and possibly reshape historical narratives about the age and sophistication of early maritime expeditions. ■

SOURCE: ISRAEL ANTIQUITIES AUTHORITY

New Type of Amphora Found in Roman Shipwreck

Researchers have identified a new type of amphora in a Roman shipwreck dating back to the 4th century.

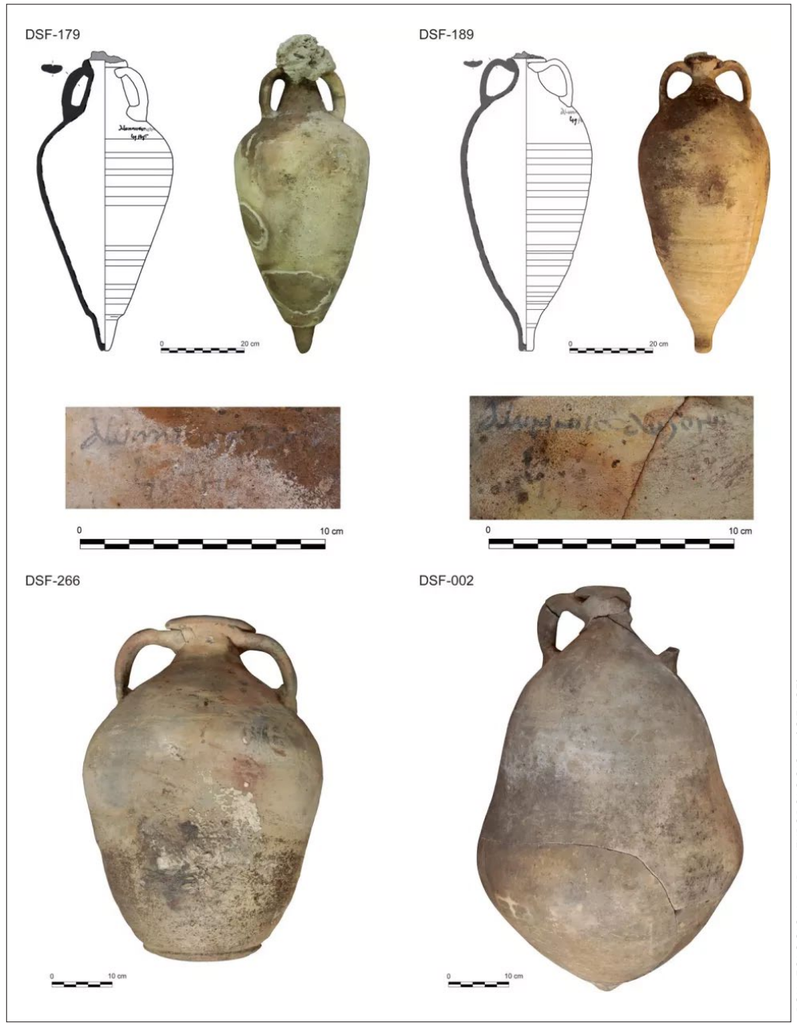
The shipwreck of Ses Fontanelles took place near Mallorca, Spain, and was discovered in 2019. The newly discovered amphora, named Ses Fontanelles I, was used to transport plant oil and was larger and heavier than the other amphorae found on the ship.

The wreck also contained three other types of amphorae: Almagro 51c (used for anchovy sauce), flat-bottomed amphorae (containing solid residues, including what appeared to be olive pits), and the Keay XIX amphorae (of which only three units were recovered).

The amphorae found in the wreck were labelled with "Alunnius et Ausonius", indicating the owner. Additionally, grape leaves were used as padding material to protect the amphorae during the ship's journey.

This discovery is significant not only because of the new type of amphora but also because the ship's voyage provided valuable information about commercial activities in the Western Mediterranean during that time. The well-preserved inscriptions found on the amphorae have been invaluable to researchers studying the artefacts. ■

SOURCE: ARCHAEOLOGICAL AND ANTHROPOLOGICAL SCIENCES



ARCHAEOLOGICAL AND ANTHROPOLOGICAL SCIENCES

The different types of amphorae found in the ancient Roman wreck. The top two are the Almagro 51c type while the bottom ones are (from left) the flat-bottom and the Ses Fontanelles I.

Madeira

Atlantic Island of Adventure

Text and photos by Brandi Mueller

Beautiful wildflowers at Pico do Areeiro (above); Atlantic chromis by the boiler at the wreck site of the steamship *Forerunner* at Badajeira (top right); Tuna with passion fruit sauce and vegetables (right); Northern coast of Madeira, including Monte Mar Palace Hotel (previous page)

The Atlantic island of Madeira, located off the northwestern coast of Africa, is an oasis of rugged natural beauty both above and below the waves. With a rich cultural heritage and unique traditional cuisine, it has much to offer visitors. Brandi Mueller shares her adventure there.

My first glimpse of Madeira from the plane was of jagged cliffs and lush green terrain against a dark blue backdrop. Although my knowledge of this Portuguese island was limited, I could not wait to explore it.

Located 967km (600m) southwest of Lisbon, the flight to the island took just under two hours, and we were now closer to Africa than Europe. The archipelago includes the islands of Madeira, Porto Santo, the Desertas, and the separate archipelago of the Savage Islands in the Atlantic Ocean. The island of Madeira is 740 sq km (286 sq mi) and has a population of just over 250,000 people.

These islands were first discovered in 1418 by two Portuguese captains exploring the coast of Africa, who were blown off course by a storm but safely landed on what they named Porto Santo (Holy Harbor) because of their safe arrival. It was revisited

Pool and ocean view at Monte Mar Palace Hotel (right); Charcuterie board (below)

View from plane arriving in Madeira

the following year, officially claimed by Portugal and settled after 1420. Then sailors noticed "a heavy black cloud" southwest of Porto Santo and soon discovered the larger, verdant island of Madeira. The islands are historically significant because they were the first territorial discovery during the Age of Exploration (from the 15th to the 17th centuries). However, it is generally accepted that the islands were known and visited long before Portuguese settlement.

When they settled the islands, the Madeirenses began subsistence farming and soon exported wheat and later sugar cane to the mainland. The capital city of Funchal also became a popular port of call on European trade routes, and tourism became popular among European aristocrats in the 18th and 19th centuries (and still is today). Many visited because the climate was said to have therapeutic effects. Madeira was also famous for its fortified wine.

When we landed, our driver was waiting to whisk us away to the northeastern side of the island to the Monte Mar Palace Hotel, where we would spend our first two nights. The drive took an hour and gave us a glimpse of the beautiful island. About halfway through the drive, it really struck me how nice the roads were, and there were multiple long tunnels that we drove through. I did not expect such an efficient and advanced infrastructure on such a small island. When I asked the driver about it, he told me that we were on a new highway that was completed in 2017. The ten-year project connected the island, allowing one to drive around the entire island and cut through the middle, making it much faster and more convenient to get around. What used to take hours can now be done in much less time.

Then we talked about the airport runway, which used to be one of the shortest in the world. It was extended in the 1980s and again in 2000. The latest extension involved a platform built partly over the sea with over a hundred 70m (230ft) high columns to support the runway.

Airport runway extension pillars as seen from the dive boat (above); Scenic view during lunch at Quinta do Furão (left)

Viewpoint on the Levada do Rei walk (above); Delicious mushroom risotto (top center) and steak with fresh salad and chips (left) at Quinta do Furão

Arriving at the Monte Mar Palace Hotel, I checked in and joined my fellow travelers on this adventure arranged by Portugal Dive for an Aperol spritz and charcuterie board of local meats and cheeses before dinner overlooking the ocean. We called it an early night to get ready for our first full day in Madeira.

Levadas

We started the morning with a jeep tour of the island that took us off-road into the forest. To help earn our lunch, we stopped for a short hike at the Levada do Rei. A *levada* is an aqueduct, and the island has a massive system throughout the entire island.

Farming was essential to the first settlers, and the island had very different climates in different parts. The northwest was very wet, but the southeast was very dry. The settlers needed to get water from the northwest to the southeast, so they built an intricate aqueduct system to carry water for agricultural needs.

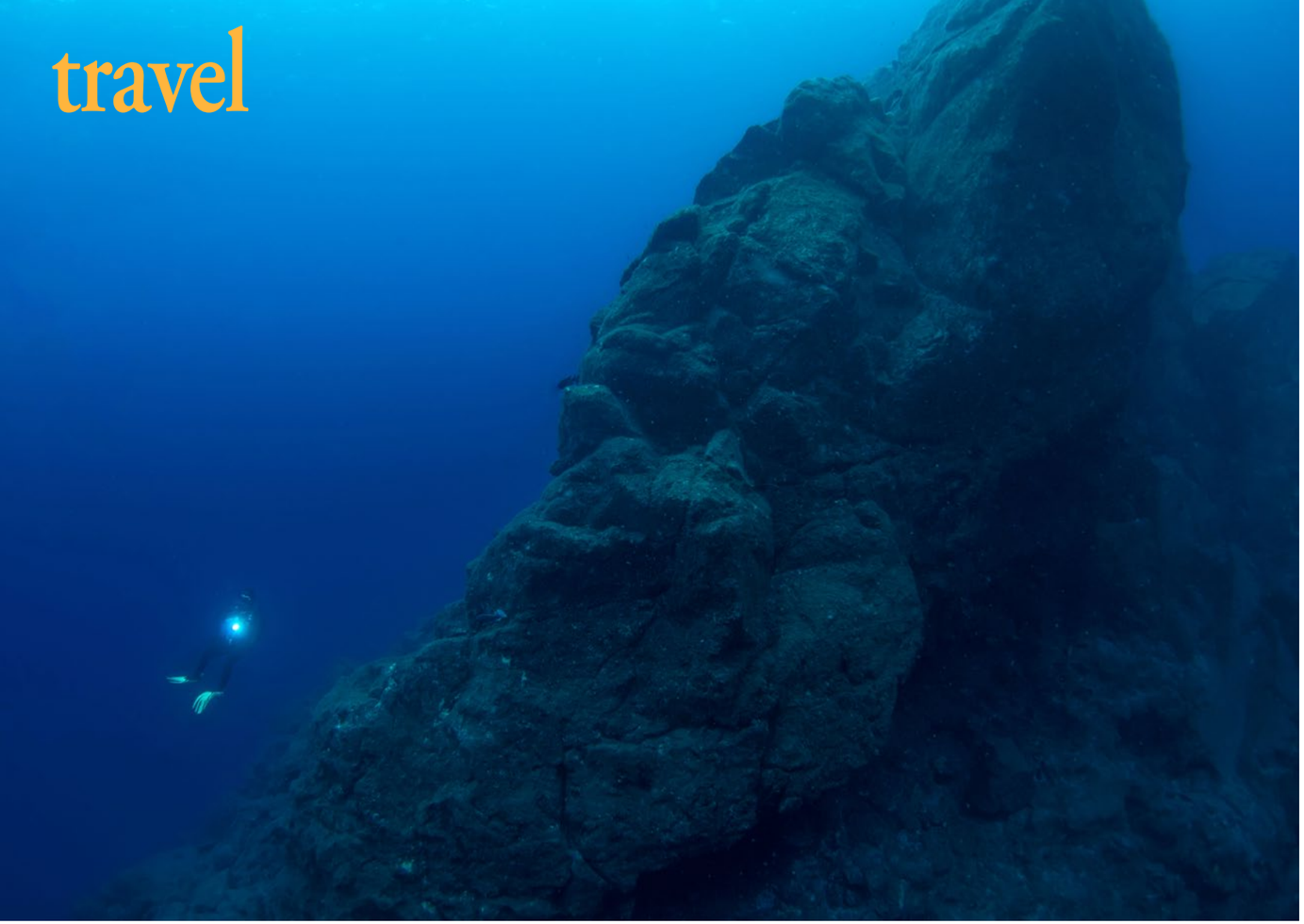
Many levadas were cut into the mountains. The settlers also made tunnels; over 40km (25mi) of tunnels were cut. These are still in use today, supplying water to the southwestern parts of the island and providing hydroelectric power, but they are most popular for hiking.

Walkways were also built alongside the levadas so that people could access them and ensure that the aqueducts were kept clean and the water was flowing. These trails are still maintained today. While some are easy and relaxing walks, others are death-defying, narrow, steep paths that can even be dangerous in some areas. Since 2011, many improvements have been made to make these paths safer and to support the island's popular hiking culture.

Levada do Rei was mostly flat and had a wide path (although it had a lot of puddles due to the recent rain). It took us deep into a green forest and, at the end, revealed an amazing view of the ocean. This sparked my interest in the hiking trails around the island, and further research revealed that Madeira was quite the place for hiking.

Feeling fit and energized, we headed to Quinta do Furão, a restaurant with one of the most spectacular views I have ever experienced while dining. Overlooking sheer cliffs and the ocean, we enjoyed a fantastic meal. We sampled mushroom risotto and steak, and I just had to try the maracujá (passion fruit) mousse, which was excellent.

Back at the hotel, over dinner, we raved about the island's beauty and



Diver next to rock formation (far left) and scorpionfish (left) at Baixa da Cruz

Madeira

Diving

Baixa da Cruz. With only a short distance to go to the first dive site, Baixa da Cruz, we geared up on the boat and backrolled into the clear blue water. The temperature definitely woke me up; it was around 18°C (65°F). But I was mostly cozy in a 7mm wetsuit, hood and gloves. Looking down towards the seafloor, the first thing I saw was a massive rock structure that started at about 6m (20ft), looked like a mini mountain with a pointed top, and gradually spread out down to the sandy seafloor at about 40m (130ft). We swam around the rock, gradually descending deeper, looking at starfish attached to the rocks and hidden scorpionfish that were camouflaged

discussed our next day's plans for diving.

Dive center

Arriving at Scorpio Madeira dive center, I was happy to see Pedro Gomes again, whom I had met at the Diving Talks conference a few years ago. We had long conversations about the friendly groupers and whales of Madeira, and it was he who inspired me to want to dive in Madeira.

The dive shop was perfectly outfitted for everything we needed, with an outdoor area to wash and dry gear, a large room for showers and changing, and rental gear for anyone who needed it. We got our gear ready and carried it a short walk down to the dock to the dive boat that was waiting for us.

Divers begin their dive at Baixa da Cruz.

Diver by rock formation at Baixa da Cruz

until I flashed them with my camera strobe to reveal their deep red color. Occasionally, schools of smaller fish swam by, and a group of barracudas lingered just off in the distance.

Moving away from the large rock, we crossed a sand channel and ended up in a smaller rocky area with more fish and marine life. We then returned to where we started, completing our dive at the top of the mountain peak.

Badajeira. For our second dive, we went to Badajeira, the site of two shipwrecks from the 1800s. The steamship *Forerunner* was lost in 1854, and the steamship *Newton* in 1881. Not much remains intact, but the seafloor is covered with the wreckage of the ships. The *Forerunner*'s large boiler still stands out as an identifiable part of the ship.

We jumped in, and the visibility was crystal clear as far as I could see. There was a slight current (I had heard that this site could have a lot of current during certain tidal changes), and we made our way over a rocky ledge to a crack in the rocks. Below us, at about 20m (60ft), was the boiler. I got closer. Around and inside the boiler were tons of rusty-orange Atlantic chromis.

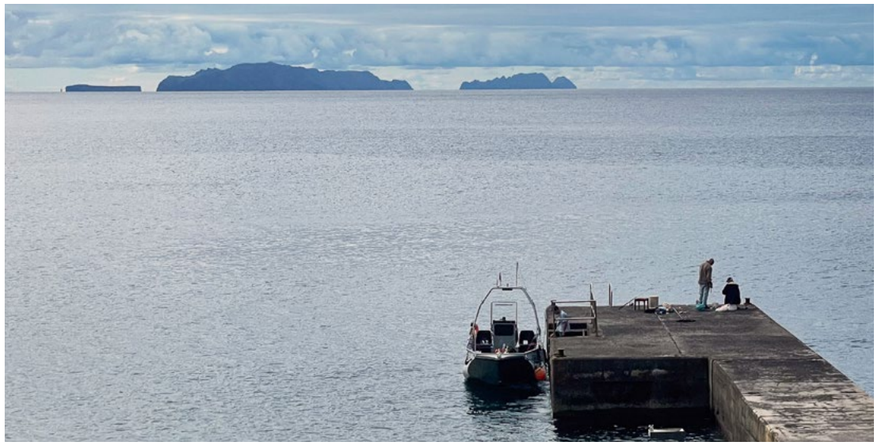
I was enjoying trying to photograph the many fish against the dark boiler with the crystal-clear blue water in the background when I looked up and saw our dive guide pointing adamantly at something behind me. His body language indicated that there was something incredible there. But what could it be? As I turned around, I was almost paralyzed with shock. There was a Mediterranean monk seal heading straight towards me.

It is hard to describe the feelings I had at that moment. I knew that Madeira was home to a very small population of this highly endangered seal. But they mostly live around the Desertas Islands, which are a designated nature reserve that does not allow visitation of any kind without very hard to obtain permits. I never thought in a million years that we would see one of the monk seals—especially not underwater.

I also have a history with monk seals.

Melodie Trevino captures the action from above, as divers begin a dive (above). Rare Mediterranean monk seal spotted at Badajeira (top right). Atlantic chromis by the boiler at the wreck site of the steamship *Forerunner* at Badajeira (top left).

Diver over wreckage at Badajeira (above); Loading the dive boat at the dock of Scorpio Madeira (right)



Having lived in Hawaii for many years, I was lucky to see their distant cousin, the Hawaiian monk seal (also endangered), both on land and underwater. They hold a special place in my heart, and I have always hoped to someday see a Mediterranean monk seal. A third species of monk seal, the Caribbean monk seal, is extinct.

Still in shock, I finally remembered to put up my camera and snap some photos. I only managed to get four shots as it flew by me. When it was too far away for good photos, I switched to video and got 40 seconds of the seal circling Arlindo Serrão, our host from Portugal Dive, before it swam away, never to be seen again.

We might as well have just ended the dive there. What could possibly top that? Still, my head was on a swivel for the next 30 minutes, looking up to the surface and below, behind and all around me, just in case it came back for another look at us. Continuing on, we swam over the ship wreckage and debris on the seafloor, flattened over the years by waves and currents.

Back on the boat, we were awestruck and giddy with excitement. Those remaining on the boat had also seen the monk seal at the surface for a few seconds as it came up for a breath of air.

Mediterranean monk seal at Badajeira is one of only four adult males in the Madeira population, according to Cláudia Ribeiro of IFCN.

Conservation

Back on land, we headed to a new hotel, the Sé Boutique Hotel, in Funchal. We did not have much time to spare, however, as we were meeting with Cláudia Ribeiro of the IFCN (Instituto das Florestas e Conservação/ Institute of Forests and Nature Conservation). This amazing woman is at the forefront of environmental conservation and research in Madeira. She told us about some of the exciting projects taking place in the Madeira Archipelago and her immense experience in the island's environmental efforts. Plus, our meeting was perfectly timed as she is involved in monk seal research and protection, and she answered all of our questions about our new favorite island resident.

It was evident that the monk seals were very near and dear to her heart. She told us that monk seals and bats were the islands' only original mammalian residents. The seals were hunted to near extinction for commercial purposes in ancient times and, more recently, killed by fishermen in competition for fish. They sometimes got trapped in fishing nets, destroying them in their struggle to get free, which made them unpopular with the fishermen.

Today, the small population is fiercely protected. They are one of the most endangered pinnipeds in the world, with only around 700 individuals remaining today. They are found only in the Mediterranean Sea off Greece, Turkey and Croatia, around the Madeira archipelago and off Mauritania. The Madeira population has only 34 monk seals in total.

Cláudia knew the monk seal we saw by name, identifying it from my video. It was called Trinca-botes (Bites Boats) due to its habit of biting propellers as a juvenile.

It was the monk seal that inspired some of the first efforts to establish a protected marine park around Madeira, and the monk seals were preserved even before the marine park was created. Talking to Cláudia was fascinating. Originally from Madeira, you could sense her passion for her home and her endless hard work to preserve it.

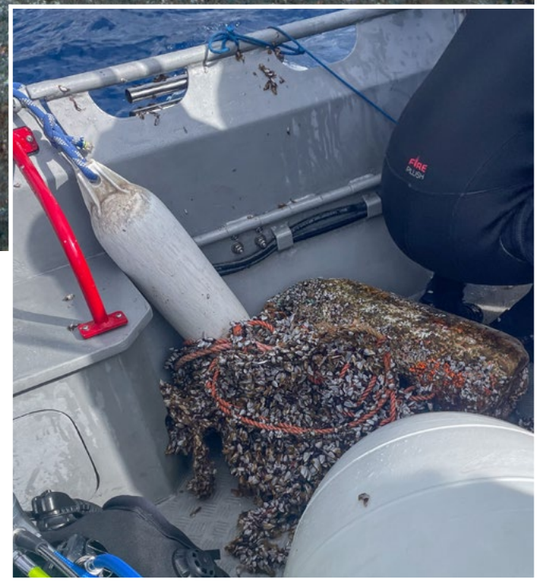
Cláudia knew the monk seal we saw by name, identifying it from my video. It was called Trinca-botes (Bites Boats) due to its habit of biting propellers as a juvenile. This male monk seal is one of only four adult males in the Madeira population. Yes, you read that right. There are only four males of breeding age in the entire population. I asked if other populations had ever intermingled. Apparently not. Genetic studies have shown that there is no interaction of monk seals from the other colonies, such as Mauritania, to the south. The monk seals do not travel that far.

This male monk seal is one of only four adult males in the Madeira population. Yes, you read that right. There are only four males of breeding age in the entire population.

Monk seals do not make it easy for themselves, either. Pregnant females like to give birth in inaccessible sea caves in late fall, when the seas are usually rough, meaning that large swells and waves could easily smash a newborn pup against the jagged rock walls inside the caves. They also return to the same caves to give birth, and the offspring will return to the same place to give birth to their young. So, from generation to generation, they continue to breed under these difficult conditions. It has been documented that only 29 percent of pups survive if born between September and January.

Luckily, today, the monk seal is highly protected and is a symbol of pride in Madeira. They grace the logos of many businesses around the islands, including the Porto Santo Line ferry, and they are featured on the Madeira coat of arms.

One topic we discussed at length was monk seals and tourism in Madeira. Obviously, the chance to see such an endangered animal could be used to sell tourism, but Cláudia made it clear that



using monk seals to sell tourism is a very bad idea. First of all, because sightings are so rare, it is very unlikely that anyone visiting the island will actually see one. Most individuals spend all their time around the Desertas Islands, which are off-limits to all but a few park rangers and authorized individuals with permits. But most importantly, because they are such a small and extremely vulnerable population, the last thing anyone wants is tourists trying to get selfies with monk seals.

And who knows what could happen if a disease is introduced or even one seal is harmed due to a bad decision by a tourist. Every monk seal in Madeira needs the utmost protection.

She also told us that the monk seals have sometimes fought back against tourists invading their space. With sharp teeth, the seals have, on several occasions, bitten people who were in their territory. One incident she described was of a monk seal sleeping in a cavern-like area with only one entrance and exit. Divers came in to take photos while blocking the exit. Imagine taking a nap in your own home, and suddenly, bright lights are flashing, and you cannot see through to your exit. It is understandable that the monk seal defended itself, as it felt threatened. Perhaps this is one of the reasons why these few animals continue to exist today.

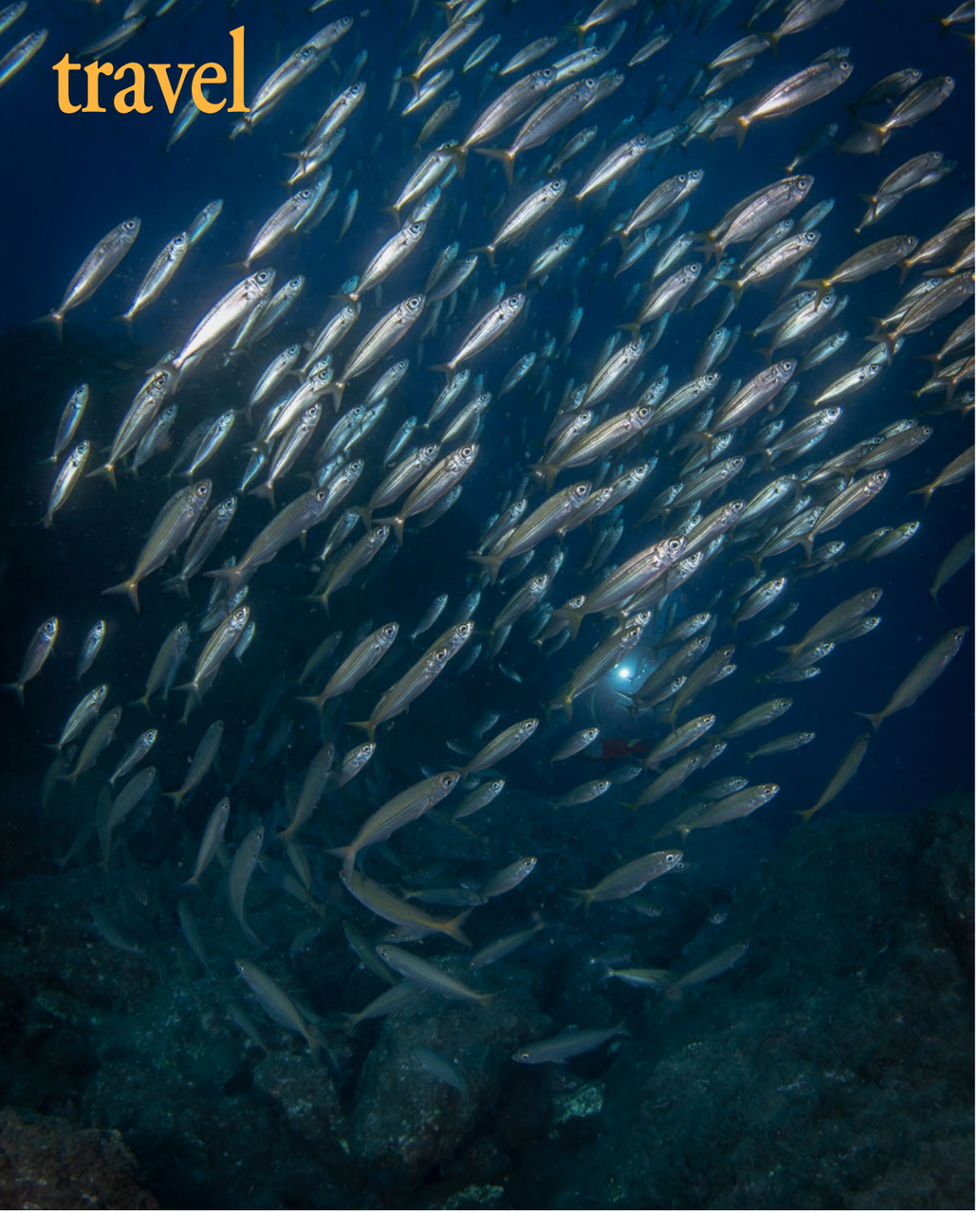
For me, the experience of meeting the monk seal was moving, even if it was only for a minute. I felt so privileged to see one of these rare, endangered animals.

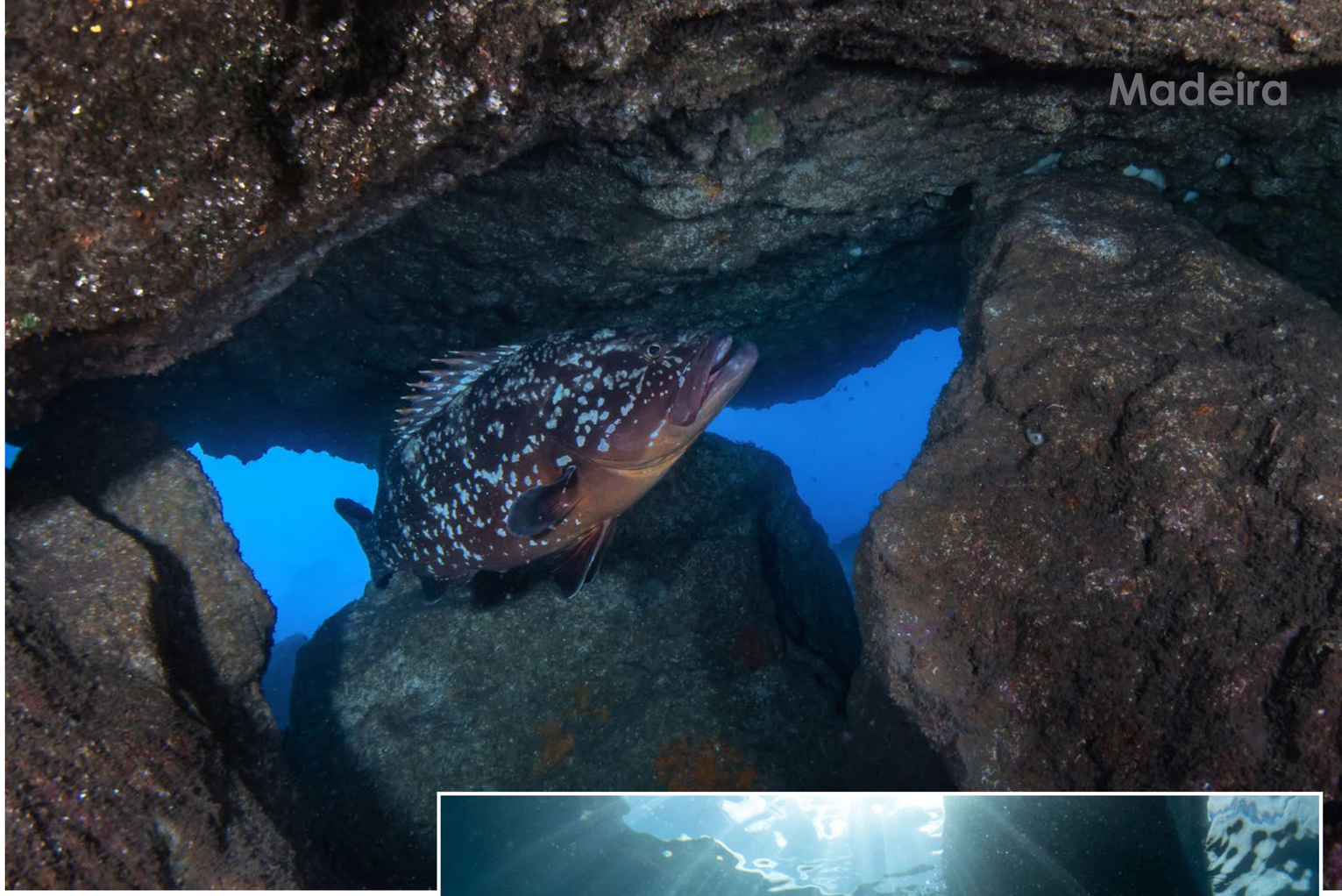
Garajau

The next day, we departed from the pier and headed west to dive a site called Garajau, known for its friendly giant grou-

Madeira

Parrotfish (left), grouper (far left) and school of fusiliers (below) at Garajau; Line with buoy and discarded fishing net was found floating and taken out of the water, so marine life would not continue to be caught and trapped in it (center).



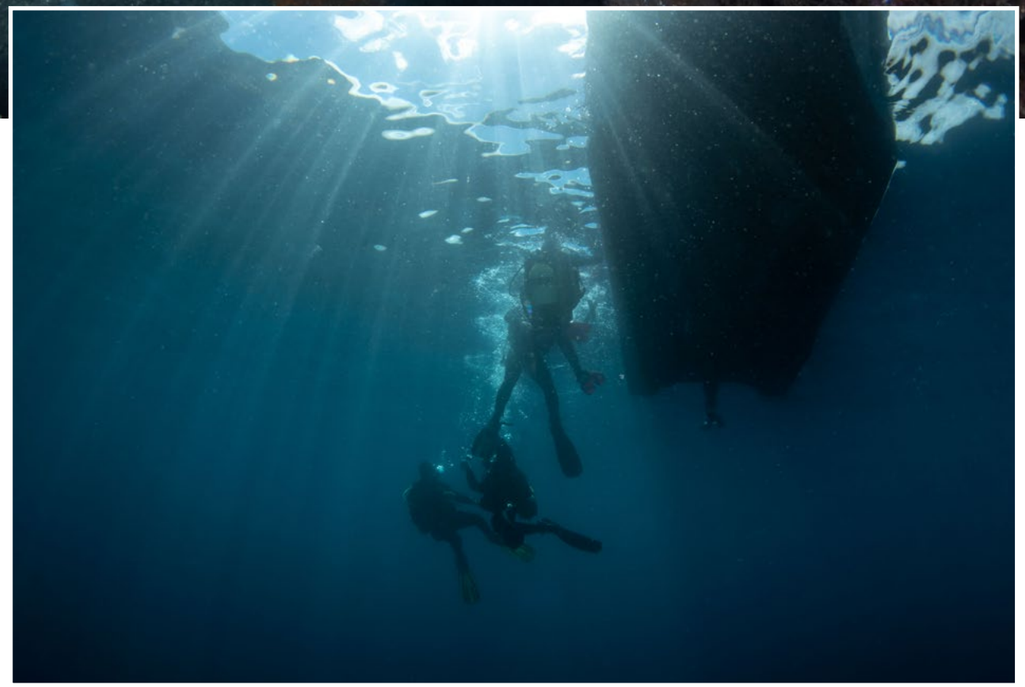


Large school of fusiliers (left) and grouper (above) at Garajau

pers. About 15 minutes into the boat ride, I noticed that we had veered away from land. Looking at Pedro and our dive guide, Luciano, I could see that their eyes were fixed on something offshore in the distance. Looking in the same direction, I saw a white buoy. But we were in the middle of deep water.

As we got closer, the boat stopped next to it, and Luciano reached in. It was a buoy with a lot of fishing line and net attached to it. Probably something from a fishing boat that had been broken or improperly discarded. The line and net could easily entangle marine life (or boat propellers), so Luciano began to heave the line up into the boat. It was covered in barnacles, and then we noticed little crabs scurrying everywhere. We tried to save as many as we could, catching them and throwing them back overboard. I was glad that Pedro and Luciano had spotted the net and had taken the time to retrieve it.

Continuing on our way, we soon reached the dive site, and the wind had picked up a little. It was the beginning of May and still very early in the diving season, which peaks in the summer in the northern hemisphere. Diving can be done year-round under ideal conditions, but summer has less wind, warmer water and often better visibility.



Divers ascending at Garajau

Preparing gear at the dock of Scorpio Madeira (left); Grouper at Garajau (above); Breakfast room at Sé Boutique Hotel (right)

As I backrolled off the boat, I noticed that the visibility was noticeably less than the day before, but that was fine. It gave the water a darker, mystical feeling, with rays of light penetrating from the surface. I could see rock formations that looked like stacked boulder-like structures.

Unfortunately, the groupers did not want to play. I saw one hiding under a rock, and it allowed me to take a few photos before it swam away. But there were other fish, including colorful parrotfish, many trumpetfish and, at the end of the dive, a school of small barracudas.

Returning to the surface, we were greeted by sunshine but more wind. Leaving Garajau for our next dive site, we rounded a corner of the island that had sheltered us, and the seas got quite bumpy. Conceding that conditions were not great for our next dive, we decided to call it a day and headed back to shore.

Scorpio Madeira also offers snorkeling trips, dive training and daily whale- and dolphin-watching tours. These tours often include incredible sightings of many different species, including pilot whales, spotted dolphins, and even the occasional monk seal.

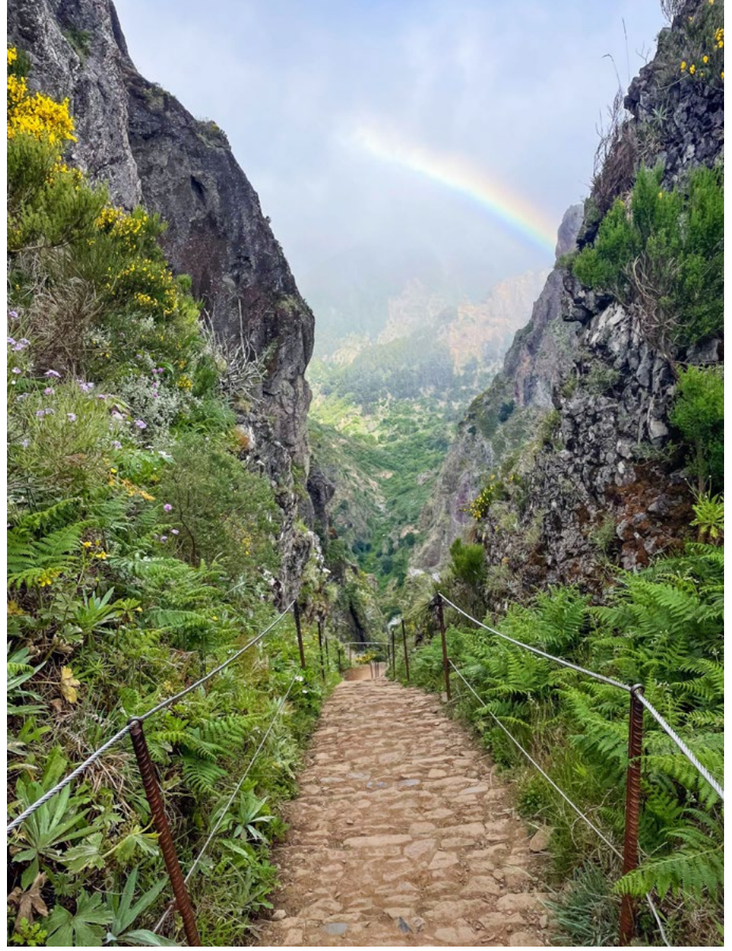
Fine art and good food

Back in Funchal, I spent some time wandering around the adorable Sé Boutique Hotel. With art everywhere, it was fantastic to walk around and look at all the photos and paintings. The rooftop bar was a nice place to chill and overlook the city. It was also decorated with flamingos, astroturf and signs saying things like, "The right place at the right time," which seemed to fit our monk seal experience perfectly.

We had dinner at the hotel's res-

Breakfast at Sé Boutique Hotel

Passion fruit pudding with almonds



View of Pico do Areeiro (far left and above); Rainbow at Pico do Areeiro (left)

taurant, and I swore to myself that I would only have a small meal because of all the amazing food I had been eating on this trip. But once again, I ended up with a three-course meal worth raving about. After a soup starter, I opted for a salad of baked goat cheese covered in honey and walnuts on a bed of fresh arugula and cherry tomatoes. And I could not say no to a lovely glass of Portuguese red wine or a dessert of passion fruit gelato.

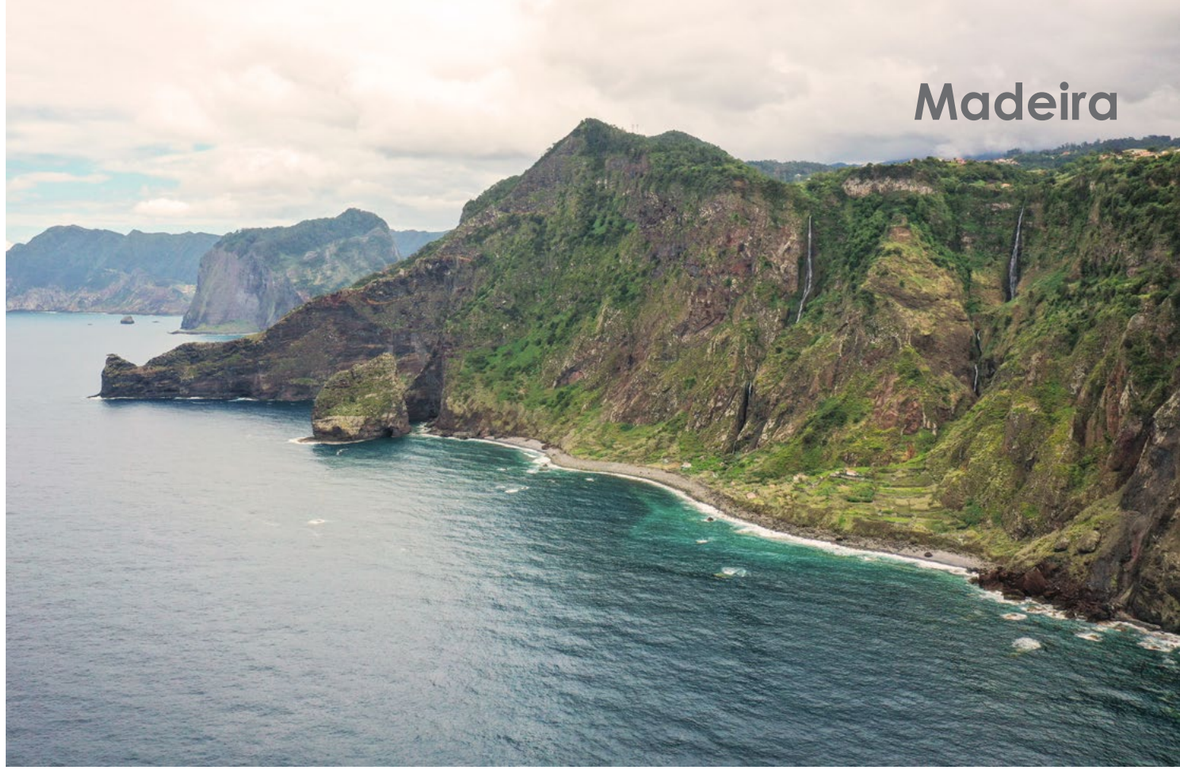
Hiking two peaks

In what seems to be typical fashion for me, I decided to change my flight and stay an extra day. After our first levada hike, I saw pictures of a stairway leading straight up a mountain peak. Digging further with an online search, I read that the trail was quite famous and connected two peaks, Pico do Areeiro and Pico Ruivo, the highest point on the island at 1,862m (6,109ft). It is probably one of the most popular hikes on the island, with many buses offering one-way drop-offs and pick-ups at the end of another trail, allowing for a 10km, four-hour hike that crosses the two peaks. As I was changing my flights, the weather forecast looked perfect, but as the days got closer, the weather forecast showed a higher and higher percentage of the chance of rain. But plans were already changed, and I was going.

Having bid goodbye to my travel friends the night before and possibly staying up a little too late, morning came too early. It was about an hour's drive from Funchal to the starting point, and when we arrived, there were a lot of people there. Some, like me, were setting off for the hike; some had come just to see Pico do Areeiro at the viewpoint, which was just a short walk from the car park; and others were already returning from a sunrise hike. I would start my hike by going to the top of Pico do Areeiro, continue to Pico Ruivo, and then go a bit further down to another car park and pick-up point.

I set out under partly cloudy conditions, but blue skies could be seen between wispy white clouds that felt close enough to touch. You could not wipe the smile off my face as I began the hike. It looked like I was walking into a dream floating in the clouds. A yellow brick road (maybe more white than yellow, and stone, not brick) led the way up the middle of a mountain. On either side were views of lush green foliage as far down as the eye could see.

Wildflowers of purple, white and yellow dotted the sides of the trail, and I was fully impressed with how well-maintained the trail was. There were handrails, ropes and wire lines to hold on to. The trail was well-marked with signs and distances. There were sturdy stairs and ladders in some places. And tunnels! I was so excited to walk through several tunnels and so glad that I had brought a real light and not just used the light on



Waterfalls (left) on the northern coast of Madeira (above); Diver at Badajeira dive site (right)

my smartphone like I saw so many others doing.

But the clouds continued to roll in and, for a while, created a rainbow in the valley. I made my way through a tunnel, and on the other side, the view had turned to a white fog. Nothing could be seen too far in front of me. Then the rain started. I had about 45 minutes of dry hiking, and the rest of the four-hour hike was in steady rainfall that got progressively heavier. I guess that is why it was so green and so many flowers grew here. I could not help but laugh, though. Even soaked all the way through, the hike was still beautiful.

In some areas, I was on the edge of a cliff. Due to the mist, I could not tell how far up the mountain I was. So, when I reached the highest point of Pico Ruivo (as confirmed by the sign), I would not have known it because I could not see anything. The photos I had seen on Instagram showed a 360-degree view of the island, and on some days, you could even see Porto Santo Island, 70km in the distance. But not on this day. I will just have to come back someday to see that view.

What I found most amazing was that there was no charge for this hike (or any hike on Madeira). There was no national park permit or entrance fee required, and it was such an incredibly well-maintained trail. I never felt unsafe, or that the trail was crumbling, or that I was in any danger, even though, for much of the hike, I was on the edge of a very steep precipice. I would love to return to Madeira to experience more of the many trails the island has to offer.

The next morning, as I headed to the airport from Funchal, the sun was just coming up and a deep red-orange glow was in the sky, reflected on the water. Dark clouds embodied the island, but beyond the land, looking to the sea, the sky was clear. Just before arriving, I spotted a rainbow in the morning light. I could not help but think what a lovely island Madeira is, from above and below, and I look forward to returning. ■

Special thanks go to Arlindo Serrão, Portugal Dive, Visit Madeira and Scorpio Madeira.

Brandi Mueller is an American photographer, writer, captain and scuba instructor who is based in Micronesia half the year and traveling the rest. She is the author of The Airplane Graveyard. *You can see more of her work at:* ***brandiunderwater.com***.

Madeira

Europe's Underrated Gem for Whale Watching

Sperm whale at the surface, off the coast of the Portuguese island of Madeira in the Atlantic Ocean

Text and photos by Daniel Brinckmann

In some developing countries, dolphin and whale watching is not very common. In Madeira, the authorities, biologists and whale-watching operators are working together to promote conservation and research. They aim to ensure that visitors can continue to enjoy amazing encounters with these animals in the future. Daniel Brinckmann has the story.

The sensation reverberated through our bones. Getting scanned by a sperm whale's bio-echo sounder from up close was just as memorable as the sheer volume at which the world's largest predators communicated.

So much for Cousteau's *Silent World*. Sperm whales can generate up to 230 decibels—as loud as a jet taking off—and the three whales in front of my camera clearly had a strong urge to communicate, presumably because the two females had a calf with them.

Mother sperm whale and calf dive after taking a breath at the surface (above). Paula Thake collected a few dark grey scraps of skin from a sperm whale for research (right). Pod of diving sperm whales (far right).

While the second massive whale positioned itself protectively in front of the young one, the first began its descent process as if in slow motion, followed by the other two after a brief pause.

Even before we reached the boat after our encounter with the whales in the water, skipper Daniel Jardim was already gesturing and shouting, "Two o'clock... swim, swim, swim." A little over a hundred metres farther out in open sea off Calheta, another whale with its offspring came into view.

Both dolphins swam towards us unfamiliar humans in the water without changing their course. Then, they calmly dove down five or seven metres while keeping a constant eye on us.

Before the dolphins departed, marine biologist Paula Thake had managed to collect a few dark grey scraps of skin, which looked like pieces of trash bags, and placed them in a prepared sample cup on board the boat. Thake, a German-speaking Maltese woman, and her partner Daniel work for the whale-watching operator Lobosonda, providing new data for research colleagues on the mainland.

Samples obtained

Biologists Luís Freitas, former

Pilot whales take a breath at the surface before diving to deeper depths where they hunt for squid in the open sea around Madeira (above and top right).

director of the Madeira Whale Museum and now head of the scientific department, and Filipe Alves from the MARE/ARDITI Centre for Marine and Environmental Sciences were pleased with the recent sighting data and the new samples obtained. These samples contained genetic material that could be used for future studies.

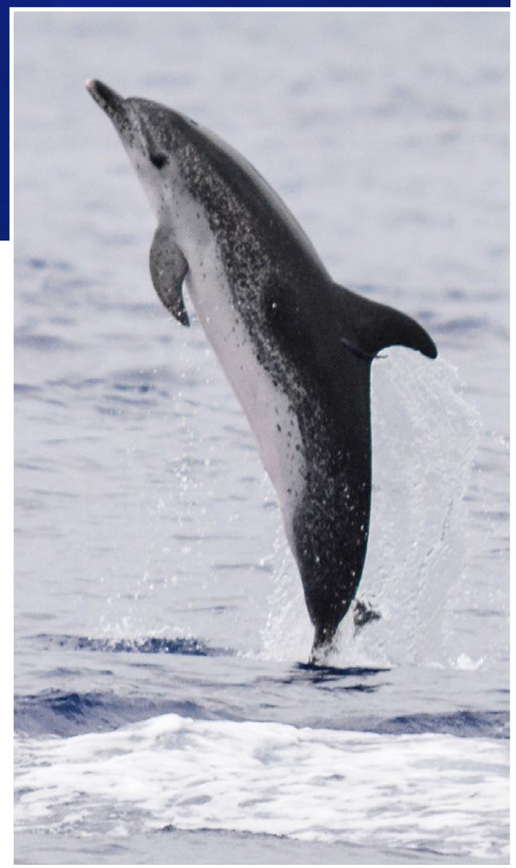
According to Freitas, these samples are being stored with information on their origins until enough DNA samples are collected to conduct ecotoxicological studies. These studies will help in drawing conclusions about relationships, population comparisons, and migratory movements of marine animals between Madeira, the Canary Islands and the Azores. The latter is also being investigated in cross-archipelago cooperation between scientific institutes and projects such as Mistic Seas Macaronesia, MARCET II and the Whale Tales Project. Specific animals are being identified using photo databases to which whale-watching crews and guests can contribute their images.

At the moment, scientists from both Portuguese archipelagos are collaborating to study the impact of human activities and the potential stress caused by whale watching as part of the META (Marine Mammal and Ecosystem: Anthropogenic Threat Assessment) project. The research focuses on frequently present local herds, with the goal of establishing protective measures for them in specific areas of high activity.

Rich feeding ground

For example, in the village of Calheta, a deep-sea canyon near the coast provides a rich feeding ground for various types of whales and dolphins. These include large baleen whales benefiting from rising plankton during their spring migrations into the North Sea, as well as permanent residents such as pilot, sperm and beaked whales hunting for squid at the bottom of the abyss, while bottlenose dolphins hunt for fish in the shallows.

In addition to the year-round



In winter and spring, pods of common dolphins can be seen in the waters around Madeira (above). In summer and autumn, Atlantic spotted dolphin can be spotted leaping out of the sea (right).

species, blue, fin, humpback and minke whales pass by the island in spring, and the latter two sometimes return in autumn. Due to its location off the African coast, warm-water lovers such as Bryde's whales are also regularly found off Madeira, especially in summer—and the trend is rising. Freitas confirmed that "the migratory animals first come to Madeira to feed. They also stay in our coastal waters to breed and rest, where the young are safe, but they can't do it without an energy supply, and the subtropical open Atlantic is low in nutrients."

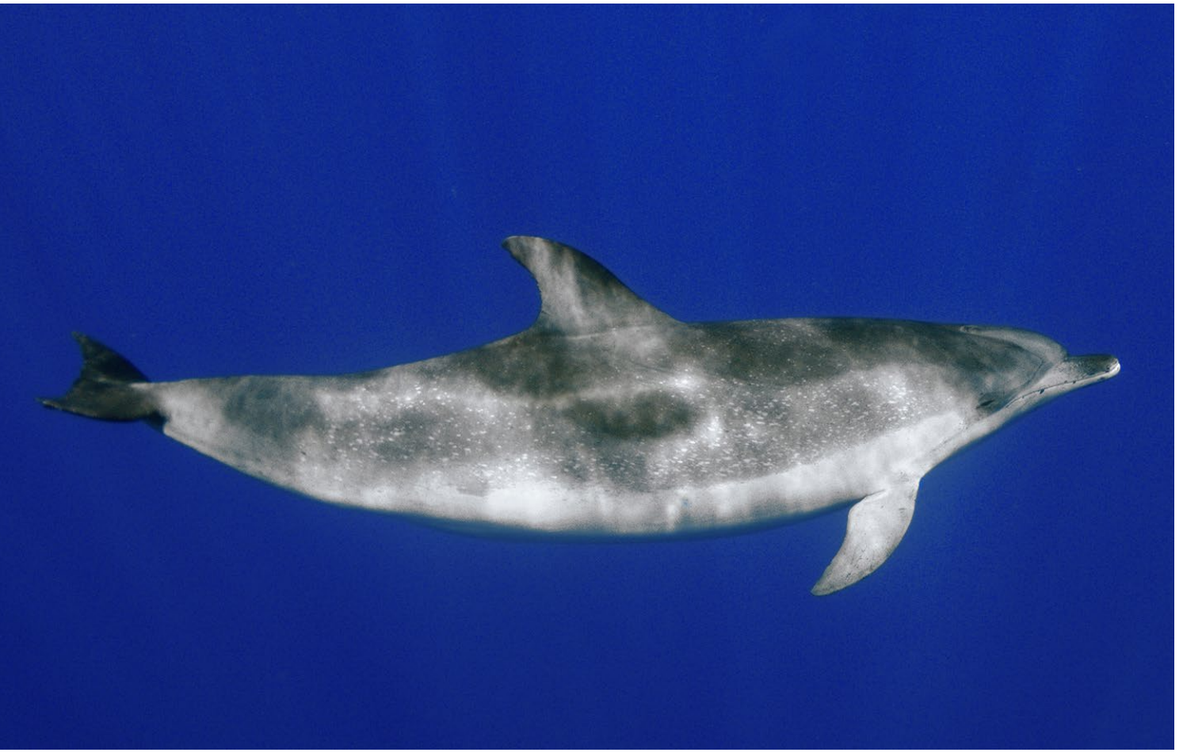
End of whaling

Between 26 and 29 species of marine mammals can be found off Madeira, also known as the Island of Eternal Spring, with dolphins being the most frequently observed from boats. Despite this, and several scenes shot here for the 1950s film classic *Moby Dick*, Madeira has not been very popular with dolphin lovers.

The region had a brief era of whaling, which ended in 1981, and it took more than 20 years before whale watching became a commercial activity. However, in 2013, stricter laws were put in place due to the flourishing whale-watching industry, regulating boat distance, manoeuvres and observation times.

Snorkelling with whales and dolphins had not been expressly prohibited before, but now encounters with Atlantic spotted dolphins (in summer and autumn) and common dolphins (in winter and spring) are only permitted off Madeira, with one hand of the snorkeller remaining on the boat or on a rope with buoys pulled behind the boat, as practised by Lobosonda. According to Thake, this open sea approach offers

Atlantic spotted dolphins are playful, and sometimes a cheeky individual will stalk snorkellers in their blind spot.



Atlantic spotted dolphins are often seen playing in the wake of boats and leaping out of the water. They also like to hassle other species of dolphins, sperm whales, and even sea turtles, turning them on their backs.

more safety and advantages in observation, as the animals feel more comfortable and have the chance to initiate encounters themselves rather than being approached or pursued by snorkellers.

Playful dolphins

The following day, we witnessed firsthand what the researchers had explained to us. Even before one of the three herds of spotted dolphins approached the whale-watching boat *Stenella*, seven snorkellers held onto the boat's rope and were pulled through the water. Shortly after, more than 20 Atlantic spotted dolphins swam and played between the bow wave and the last buoy, swimming under us in small groups and keeping their eyes fixed on the yellow rope.

The speed of the boat ensured that the animals did not lose interest quickly. Many snorkelers would be well advised to take the occasional look over their shoulder. Almost a dozen times, a cheeky spotted dolphin stalked us in our blind spot and came within two metres.

"That's typical of these animals," said Thake with a laugh after the 20-minute encounter. "For me, they are 'street-smart' and don't just mix with groups of other species. I've seen them annoying other dolphins or even sperm whales and turning turtles on their backs." In other words, they are ideal "snorkelling dolphins."

Snorkellers on a line dragged behind the dolphin-watching boat

Bottlenose dolphins playing in the wake of a boat (above) and porpoising out of the water (right). Dolphin-watching tour (bottom right).

Legal method

Whale watchers who want to take a photo for a whale poster to hang above their bed can use a two-metre-long pole with a thread for "action cams" to take close-up shots from dry land. Skipper Jardim confirmed that as long as your feet remain on board, there is nothing to stop you from using underwater camera housings.

"Sometimes young sperm whales swim curiously towards the boat and come closer than the 50-metre distance rule allows. In those cases, we turn off the engine," he said. He also emphasised the importance of adhering to a code of conduct: "Imagine someone suddenly starting the engine in the middle of a group of whales without a second thought."

The regulations protect us by providing precise instructions on how to behave. These rules of behaviour are issued by the Forestry and Nature Conservation Agency (IFCN) and are constantly revised by biologists to improve encounters between humans and animals. Additionally, biologists hold regular training courses for whale-watching crews to ensure proper adherence to these rules.

Successful model

The collaboration between scientists, ecotourism providers, and guests is a successful model, emphasised by Filipe Alves from MARE/ARDITI. He stated, "The incredible number of observations and data from whale watchers, who are out at sea practically every day, is of great value to our research group."

Additionally, Freitas highlighted the positive current results on the interaction between ecotourism and the welfare of the animals, stating, "Human activity around Madeira is at a level that does

Fluke of a Bryde's whale (above); Lobosonda whale-watching tour in a traditional fishing boat (right)

not keep whales and dolphins away from our coasts, and such a stable situation is a good sign."

Anyone coming to the archipelago to visit groupers and moray eels should consider spending a day or two whale watching and snorkelling with dolphins. On a good day, this decision can make the difference between a great diving holiday and a fantastic one.

Operator

The whale-watching operator Lobosonda in Calheta offers whale- and dolphin-watching expeditions using a modern speedboat that can accommodate up to 12 guests. They also use a traditional fishing boat, going out to sea two to four times a day (except on Sundays) for two to three hours during the winter season. Additionally, they offer dolphin snorkelling experiences. You can find more information on their website at **lobosonda.com**. Tip: Combine your dolphin snorkelling with diving at Manta Diving in Canico. See: **mantadiving.com**. ■

*Daniel Brinckmann is a German travel journalist, photographer, and tour leader based in Neuss, who has had several hundred travel reports published in Europe. Follow him on **Facebook** or **Instagram**.*

marine mammals

Edited by Peter Symes

The use of AI to decode sperm whale communication marks a significant step forward in our understanding of animal cognition and social structures.

KURT AMSLER

Decoding Sperm Whale Language

Groundbreaking research using AI technology offers a glimpse into the complex communication system of sperm whales.

Recent advancements in artificial intelligence have provided researchers with unprecedented insights into the communication patterns of sperm whales, suggesting a sophisticated language system among these majestic marine mammals.

A new study published in *Nature Communications* reveals that sperm whales may possess a highly structured form of communication and sheds light on the cognitive abilities of sperm whales, suggesting a level of social complexity previously attributed primarily to humans and some primates.

Codas are key

The primary focus of the research centres around "codas", distinct patterns of clicks that sperm whales use to communicate. These sounds, which vary in rhythm and pattern, are believed to convey detailed information and serve specific social functions within pods. By applying machine learning algorithms, scientists have begun to decode these patterns, identifying potential "phrases" and "sentences" that indicate complex, structured communication.

AI-Driven Analysis

Using sophisticated AI models, researchers analysed thousands of recorded codas collected over decades. The technology enabled them to distinguish between various click patterns and to start mapping out a possible "language" used by these whales. This approach is groundbreaking in that it allows for the analysis of large datasets of whale sounds with a precision and speed that manual methods cannot match.

Understanding how sperm whales communicate is crucial for scientific knowledge and conservation efforts. Recognising the complexity of whale communication can lead to better strategies for protecting these creatures, particularly in managing human activities that disrupt their communication, such as shipping and naval exercises.

Challenges

Despite these advancements, fully decoding sperm whale communication remains a significant challenge. The meanings of specific codas and how they are used in different social contexts are still largely unknown. Future research will need to continue refining AI models and involve more interdisciplinary approaches, combining marine biology, linguistics and artificial intelligence to further unravel the complexities of whale speech. ■

SOURCE: NATURE COMMUNICATIONS

GREGORY SMITH / FLICKR / CC BY-SA 2.0

Amazon River or pink river dolphin (*Inia geoffrensis*) is an endangered species. Nine countries have signed the Global Declaration for River Dolphins, a significant step towards global wildlife conservation.

Global Declaration for River Dolphins Signed

A landmark agreement signed by nine countries aims to safeguard the world's endangered river dolphin species.

Established in November, this initiative marks a concerted effort to protect some of the most vulnerable dolphin species inhabiting the world's rivers, many of which are on the brink of extinction.

The Global Declaration for River Dolphins was signed by nine countries, including Brazil, Colombia and India, all home to river systems where these endangered species are found. This agreement is pivotal as it represents the first international commitment explicitly focusing on the conservation of river dolphins, which face habitat degradation, pollution and fishing threats.

Multinational cooperation

The signatory countries have committed to reviewing their conservation efforts regularly and reporting on progress. This ongoing evaluation will ensure that the declaration's objectives are being met and will help adapt strategies as needed to respond to new challenges.

A crucial aspect of the declaration is its emphasis on international cooperation. The agreement encourages sharing scientific research, conservation strategies and policy frameworks between nations. This collaborative approach is essential for addressing the cross-border nature of environmental challenges affecting river ecosystems.

Conservation challenges

River dolphins are among the most endangered cetaceans in the world. The declaration outlines comprehensive measures to mitigate the critical threats to these species, including the Amazon River dolphin, the Ganges River dolphin and the Yangtze River dolphin. The primary focus is enhancing habitat protection, improving water quality and ensuring sustainable fishing practices.

The protection of river dolphins is vital for biodiversity and the health of river ecosystems, which millions of people rely on for food, water and transportation. Healthy dolphin populations are indicative of healthy rivers; thus, their conservation is directly linked to the well-being of local communities.

By addressing the specific needs of river dolphins and the broader environmental challenges of river ecosystems, the declaration aims to secure the future of these endangered species and promote the ecological health of some of the world's major river systems. ■ SOURCE: DECLARATION TEXT

Elephant Seals Nap During Deep Dives

Scientists uncover the unique sleep habits of elephant seals during their deep-sea dives.

Elephant seals were recently the focus of a groundbreaking study that explored their sleep patterns during dives. The research, partly funded by the US National Science Foundation, provides a unique insight into the world of these marine mammals.

During the breeding season, elephant seals sleep for up to 10 hours a day on land. However, when they go on their month-long foraging trips at sea, their sleep patterns change significantly. Research has shown that during these trips, the seals only sleep for about two hours a day, taking short 10-minute naps during their 30-minute deep dives. Interestingly, they often spiral downward in a sleep-induced drift and sometimes rest motionless on the seafloor.

Deep sleep stage

Dr Jessica Kendall-Bar, the lead author has developed an innovative system to record brain activity in wild seals during their typical diving behaviour. The team used a neoprene headcap to secure the EEG sensors and a data logger. They were then able to retrieve the data when the seals returned to the beach.

Sleep spiral

This system revealed that the seals enter a deep sleep stage known as slow-wave sleep while maintaining a controlled glide downward. They then transition into REM sleep, resulting in a "sleep spiral" due to sleep paralysis.

The study's findings suggest that the seals' unique sleep pattern might be an adaptive response to their environment. Being vulnerable to predators like sharks and killer whales when at the surface, the short surface intervals between dives minimise exposure to threats. Kendall-Bar said, "They're able to hold their breath for a long time, so they can go into a deep slumber on these dives deep below the surface where it's safe." ■ SOURCE: SCIENCE (JOURNAL)

BROCKEN INAGLORY / WIKIMEDIA / CC BY-SA 4.0

Northern elephant seal male, female and pup

LYLE KRANNICHFELD AND BRANDI ROMANO

Humpback whales spend their summer months feasting in polar waters, then migrate to tropical regions, where they birth and pursue behaviours related to reproduction.

Surprising Sexual Encounter Seen in Humpback Whales

Researchers in Hawaii have documented the first sighting of sex between humpback whales. Remarkably, it was an encounter between two males. Scientists have long puzzled over the mysteries of these majestic creatures, known for their intricate social structures. However, despite extensive research, reports of sexual encounters among humpback whales have remained elusive until now.

Lyle Krannichfeld and Brandi Romano observed two whales circling near their boat before joining in sexual activity about five metres below their vessel, off the Molokini crater near Maui. They were able to photograph them, providing an unprecedented glimpse into the intimate lives of these marine giants. Dr Stephanie H. Stack, marine mammal researcher in Hawaii, published the observations in a study.

During the encounter, an emaciated whale covered in whale lice was pursued by a healthier counterpart. Despite its weakened state, the injured whale exhibited a series of interactions with the second whale, including repeated penetrations with his extruded penis, which is visible in the photograph above.

Why same-sex interactions?

While the exact motives behind the encounter remain unclear, researchers speculate that it could be linked to a variety of factors, including mating rituals, social bonding or even dominance displays. The injured state of the first whale adds an additional layer of complexity to the observation, raising questions about the role of health and vulnerability in such interactions.

Same-gender affection and sex have been found throughout the animal kingdom, including in whales and dolphins. However, such observations were suppressed until recently because they contradict the doctrines of the major Western religions. Christianity, Judaism and Islam, as well as others, hold that sex is for reproduction only and that same-sex interaction is morally wrong.

Scientific studies seem to indicate that this behaviour is neither due to sexual frustration nor the lack of available mates of the opposite sex. It seems to be the choice of those concerned and, at times, seems motivated by the desire for comfort and pleasure.

Such behaviour presents in a variety of ways in different species among both males and females, and in some cases has been linked to improving the chances of successful reproduction. In geese, for example, families with two fathers are better able to defend the territory and the offspring from danger than those with one father. In ducks, same-sex behaviours appear to reinforce the bonds between the males in the flock, which is of vital importance in defending the hens and juveniles in this heavily predated species.

Given the prevalence of the territorial instinct across the animal kingdom, strengthening male bonding could help to explain how widespread same-gender sexual behaviour is. In some cases, it has become part of the established culture, meaning that it is learned by the offspring from the adults as they grow up. An example is the Japanese macaque society.

Community involvement

The observation of same-sex behaviour in humpback whales not only adds to our knowledge of humpback whale behaviour but also underscores the importance of community involvement in scientific research.

As marine enthusiasts and scientists alike come together to unravel the mysteries of the ocean, each new revelation brings us one step closer to understanding the captivating world beneath the waves. Stay tuned as researchers dive deeper into the secrets of humpback whale society, unlocking new revelations with every discovery. ■

SOURCE: MARINE MAMMAL SCIENCE

LYLE KRANNICHFELD AND BRANDI ROMANO

Male humpback whale encounter

Yap

Seven Perfect Days Diving with Mantas & More

Text and photos by David Fleetham

This tricolor parrotfish has secreted a mucus bubble to protect itself from predators at night (above). Blacktip and gray reef sharks cruise the surface, off the island of Yap (top right). Clark's anemonefish are excellent parents. This one tends to a newly laid batch of bright orange eggs next to the Mertens' carpet sea anemone it calls home (top left). Reef manta ray with Moorish idols, saddleback butterflyfish and six-banded angelfish (previous page).

In the western Pacific island group of Yap, divers can enjoy beautiful tropical reefs teeming with diverse marine life, including majestic manta rays, and experience the thrill of blackwater diving. Underwater photo pro David Fleetham tells us about his adventure there.

I have been to Yap many times. For more than a decade, I have been one of several professional photographers invited to MantaFest to share my camera experience with the full house of guests at Manta Ray Bay Resort. Each year, upon my departure, owner Bill Acker has invited me to come back any time to enjoy what Yap has to offer. I finally accepted and spent seven perfect days diving as a guest rather than a staff member. My girlfriend, Jennifer Ross, also joined me for the entire week.

The flight from Guam arrived at the ungodly hour of 1:10 a.m. Remarkably, the resort staff was wide awake and chipper at that hour, greeting us with a bottle of water and a chilled washcloth to wipe off the airline ambience. They handled all of our luggage and tagged it with our room number. During the 15-minute ride to the resort, we were informed of all the things that we needed to know about the resort's operations, the diving and the resort restaurant, The Mnuw. On our bus were a number of divers and a group of would-be ornithologists from the United Kingdom who were excited to view the four endemic species found on Yap—basically, the above-water version of divers looking for rare fish species.

Shortly thereafter, we made it to our room, and so did our bags—five 50-pound cases of cameras and dive gear, padded with our garments. We agreed to deal with the equipment in the morning—well, later that same morning—after getting some much-needed shut-eye. With the blackout curtains drawn, the hum of the air conditioner and no alarm

Day or big blue octopus (above). Spotted guard crab holding eggs in antler coral (top right). Leaf scorpionfish, about 4 inches long, has no venomous fin spines (right). Pajama cardinalfish photographed at night (left).

clock, morning soon turned to afternoon, and we leisurely assembled our cameras and carried our scuba equipment down to the dive shop.

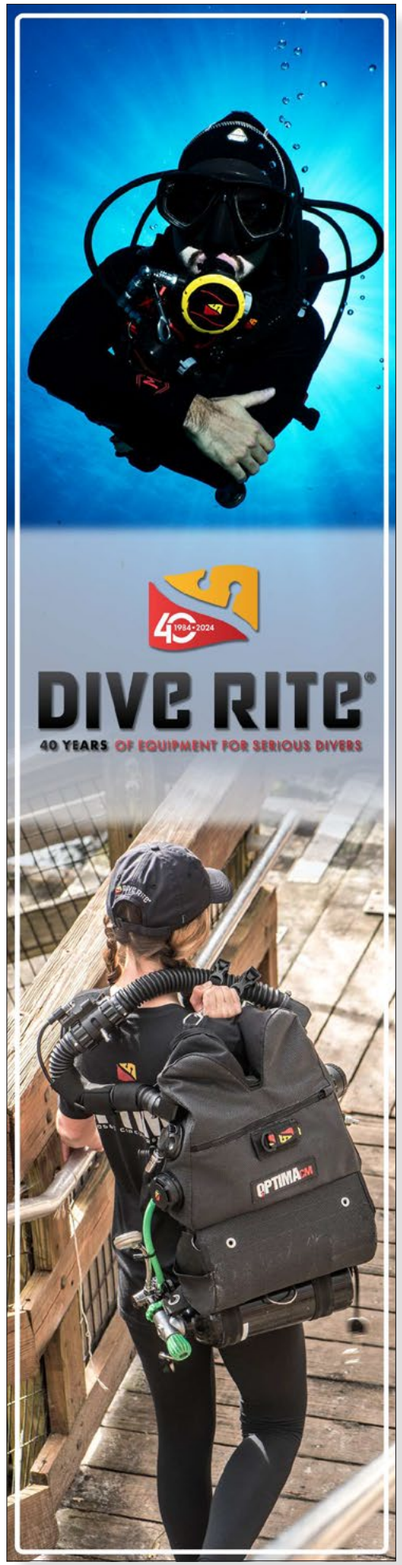
Diving

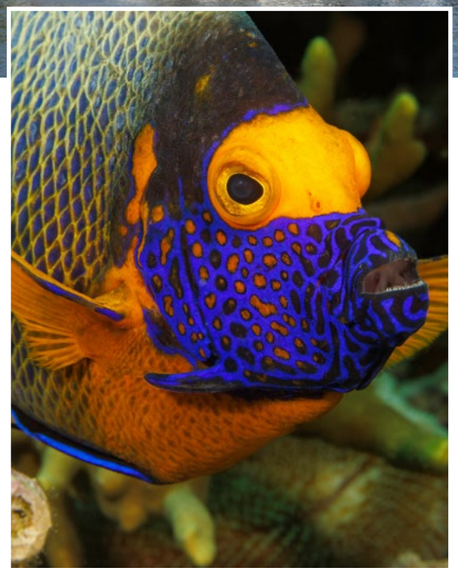
Slow and Easy. We were assigned dive cubicles number 56 and 57 and a bag with the same number. This was where our dive gear would be stored at the end of the day after being rinsed by the staff. The day was getting away from us, so we decided to do an afternoon dive at Slow and Easy, a site close to the resort that we had visited many times before. It did not boast the amazing visibility of the other sites, but it had a wealth of macro critters if you took the time to look, or if you were diving with one of the Yap dive guides who knew how to find even the tiniest of nudibranchs. We stayed fairly shallow and stretched our bottom time to 90 minutes. A good start to the week.

A 10-minute boat ride had us back at Yap Divers before we even got out of our wetsuits. We dunked our cameras into the two dedicated camera rinse tanks, making sure to push all the buttons to flush out the salt water. While we were doing this, the crew put our dive gear in the equipment rinse tanks and then hung it up to dry in the locker area. It was just a matter of peeling out of our neoprene under the outdoor showers, grabbing fresh towels, hanging up our wetsuits to dry, and we were ready to pull our memories captured in pixels out of our cameras and plug everything in to charge.

The pool was situated along the walk back to our accommodations and we were tempted to jump in for another rinse, but with pixel images in our minds, we made a dash for the room to download our cards onto our PowerMacs and plug in external drives to back everything up. As we shared what we had shot, we made a pact to return to Slow and Easy for a night dive.

That evening, we tore ourselves away from our screens and wandered down through the lobby, past the dive shop and up the short walkway leading to The Mnuw, a 170ft phinisi schooner originally from Indonesia, which was the resort's restaurant and bar. The dinner menu was written on a chalkboard and changed daily, along with the fresh fish caught that day. Jennifer





Manta Ray Bay Resort and its floating restaurant, The Mnuw, in Yap (above); Schooling bigeye jacks (right); Giant moray eel with banded coral shrimp inspecting its teeth for parasites (lower right); Yellowmask angelfish, also commonly referred to as a blue-face angelfish (left)

and I ordered the sushi platter, fish tacos and mugs of Hammerhead Amber Ale from the resort's own microbrewery, the Stone Money Brewing Company. Freddy, their Swiss brewmeister, produces two varieties in 600-liter batches just off the hotel lobby and has it down to a fine science. The kitchen was at the bottom of the ship, and a vintage-era dumbwaiter brought our dishes to us just as the colors of the sunset faded into the night sky.

After a quick glance at the whiteboard with the next day's dive schedule, we headed for our pillows. An 8:00 a.m. departure and a three-dive day was on the books.

The Mi'l Channel

Breakfast at The Mnuw started at 6:30 a.m., and we got in shortly after the doors opened. A spread of local fruit, bacon, rice, scrambled eggs, toast and other baked goods was laid out, and we ordered custom omelets from the chef in the corner. Coffee and tea greeted us as we sat down, and two plates were not far behind.

By 7:30, we were in the camera room, checking that all the batteries were charged and that the housings were well sealed. Our dive gear was already on the boat, and all we had to do was analyze our nitrox mixes and attach our regulators. Three other divers from California joined us, along with our captain and guide. Ten minutes after leaving the dock, we found ourselves zipping through a narrow channel in a mangrove forest on our way to the other side of the island and the Mi'l Channel.

We grabbed a mooring, and our guide, Bruce, explained that we had a flooding tide and would be riding the current into the channel to a ridge where a school of jacks liked to congregate. It was a drift dive, and the boat would pick us up wherever we ended the dive.

The incoming tide brought clear water, and we dropped

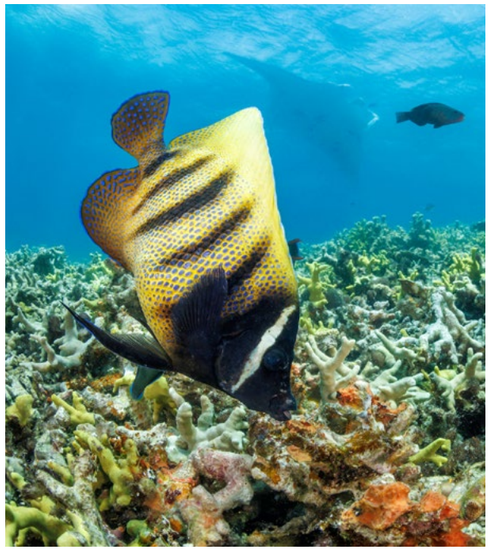
to the bottom of the passage at 55ft and crossed to the other side. A manta ray greeted us, gliding against the current with seemingly no effort. As we got to the ridge, a second manta ray passed overhead, or perhaps the same manta ray turned around. We did not get a firm ID on the first one.

Moorish idol and reef manta rays over hard coral (top left). A wrasse follows a reef manta ray, which was unidentified, so I was asked to pick a name for it (top right). Six-banded angelfish, parrotfish and reef manta ray over hard coral (right). A bluestreak cleaner wrasse carefully searches the mouth of a clown sweetlips for parasites (left).

In front of me, Jennifer pointed out a large Javanese moray eel swaying in the current, and I motioned for her to turn around as the school of jacks surrounded us. They were very used to seeing divers and exceedingly cooperative subjects. We spent the rest of the dive photographing the school as it circled, then turned and headed back toward the ridge. After three minutes at 15ft, we surfaced, and Captain Brian brought the boat to pick us up.

Stammtisch. The next dive was a bit further into the Mi'l Channel at a site known as Stammtisch. The manta rays we saw on our first dive were likely on their way to this reef, where they like to get cleaned. The mooring is 100 yards from the cleaning station, which is as shallow as 8ft deep on a low tide. The idea was to have as little impact on the cleaning area as possible, so we did not mind making the short swim over to the area that Bruce had indicated would be our best vantage point without disturbing the action.

Visibility was not as good as on the first dive, which is typical as you get closer to the mangrove forests that are so prominent around Yap. The coral was a bit worn down from years of divers taking advantage of the same places. Fish that had been difficult to approach on other reefs immediately began swimming up to us—angelfish, wrasse, butterflyfish and parrotfish. So, not only was this a good spot for manta rays, but it was also a unique area for getting fish shots of species that are difficult to get close to on regular dives. It was not quite like "shooting fish in an aquarium," but it was certainly close. Several of my manta ray shots were "photobombed" by these reef fish residents.



Within ten minutes, our first manta ray showed up, passing right over Jennifer's head to circle around the

A NEW MANTA

Each manta ray can be identified by a pattern of spots on its underside. These markings are as unique as a human fingerprint and are with them for life. Researchers use this identification to learn more about the species.

We photographed manta rays at several different dive sites, and when I searched for the names of some of them, I was unable to find one of the individuals. After confirming with the Manta Trust that I had a photo of a manta ray that had never been identified (above), I was asked to pick a name. The group of rays around Yap have been studied for many years, and it is rare to find a new one. It is a privilege to choose a name for it. "Kamahele", Jennifer's middle name, is a nod to our connections to the Aloha State and the new name for Yap's latest addition to its cartilaginous tribe. See: **mantatrust.org** ■

A cleaner shrimp carefully checks a coral grouper (above). A Clark's anemonefish tends to its egg mass, which is placed beside its host anemone for protection (right).

Silhouettes of blacktip reef sharks

cleaning station. Cleaner wrasse and other species of wrasse were joined by butterflyfish to inspect the manta rays for parasites, a spectacle of symbiotic dexterity. A few minutes later, a second manta came by, and the two danced a swirling marine waltz until one of them objected to an over-enthusiastic cleaner and darted vertically to touch the surface, only to roll completely over and return to the dance.

This went on for over an hour until Bruce signaled that he was guiding the rest of our group back to the boat. He indicated that we were fine where we were and that he would be back. The great thing about diving with Yap Divers is that they allow you to utilize your bottom time as you wish. There is rarely a time limit put on your dives, and when you are in just 15ft of water, that can be a long time. We made the most of it and returned to the boat around the two-hour mark. The prepared lunch had already been served to the others, and we joined them under the shade while Captain Brian switched our gear onto fresh tanks.

Sakura Terrace. We discussed our third dive and agreed that we would take advantage of the tide to make our way back through the mangrove channel to the resort side of the island for Sakura Terrace and better visibility, along with the chance of seeing a cuttlefish. From the mooring, we dropped to the reef at 30ft and then made our way down the coral slope. The visibility was the best of the day, which made the variety of hard coral formations all the more spectacular. A large carpet anemone covered a fresh patch of eggs laid by the two Clark's anemonefish, which took turns fussing over their future offspring. They flicked any sediment off the bright orange orbs with their pectoral fins and then blew water over them through their mouths.

It was a drift dive, and Bruce signaled that he was moving on in search of cuttlefish. We decided to linger a bit longer with the colorful anemonefish parents and caught up with the group half an hour later, but alas, the cuttlefish was not making itself available today. We did see two whitetip reef sharks napping under a ledge, and a large nurse shark made its way against the current below us in deeper water than we were prepared to experience on our third dive of the day. We all surfaced together. Brian plucked us out of the clear water, and 15 minutes later, we were back at the resort.

Spearing mantis shrimp

Boring giant clam with anthias sharing a moray eel's hole for protection (top left). Magnificent frigate birds over blacktip reef sharks (top right). Mating pair of mandarinfish (right). A robust ghost pipefish blends in perfectly with the seagrass bed (above). Bumphead parrotfish (left).

Yap Caverns

Our third day was a two-tank dive in the morning and then a night/dusk dive to photograph mandarinfish. We headed out of the channel in front of the town of Colonia and turned right towards Bill Acker's favorite dive site, Yap Caverns.

The surrounding reef extended out into open ocean from the southern end of the island to a point that dropped quickly into deep ocean. The vertical, current-swept wall began at 20ft, but at Yap Caverns, a section of the wall had long since collapsed, with huge sections tumbling down the slope. What remained was a series of canyons cut into the reef and several free-standing pinnacles on the outer edge.

Large schools of anthias hovered over the spires, feeding in the passing water. Hunted by jacks, they pulsed back into the reef and then cautiously took their chances back in the open ocean. Various species of anemones with anemonefish decorated this outer area, and gray reef sharks patrolled the blue. Below 100ft was a shark cleaning station, and the visibility was so good you could watch from above as they tried to hover and stay in place, opening their jaws while cleaner wrasse inspected between their teeth.

Bruce guided us back into the canyons, where a light was recommended. Eelgrass from beds close to the island blew out over the reef and accumulated in clumps on the sandy bottom. Our guide insisted there was something to see here, but it escaped me. Finally, a pipefish moved into a vertical position. It matched perfectly with the plant life it was using as camouflage. Nudibranchs, bright red soldierfish and eels occupied the corners back inside the canyon. As we emerged, a school of bumphead parrotfish was winding its way through the site. Too much for just one dive,

Blacktip and gray reef sharks circling a boat.

Mandarinfish (above); Mating pair of mandarinfish, their eggs and sperm just released (top center); Blacktip reef sharks (right and top right)

we unanimously agreed to stay at Yap Caverns for our second dive.

Rainbow Reef

It was well into the afternoon when we got back to the resort, so we plugged in our batteries to recharge for our dusk/night dive in search of mandarinfish. It was still light when we got to Rainbow Reef, and Captain Nico explained that this was not your typical night dive. The mandarinfish would emerge from the finger coral at this time, and mated pairs could regularly be seen dancing up into midwater to release eggs and sperm just as it got dark.

Almost directly below the mooring, I saw my first subject and then another, and eventually, five of them moving about the convoluted maze of polyps. After several false starts, I got two of them together, but the climax ended in a split second. I was better prepared for the next pair and kept shooting continuously, hoping to capture the release of the eggs. Jennifer, just 40ft away, had her own harem and got to see the same spectacle.

Vertigo. The next morning found us zipping again through the mangrove passage to the other side of the island, but this time we passed through the Mi'l Channel to the outside of the reef and a site called Vertigo. The Manta Ray Bay Resort has been feeding the sharks here for decades and has perfected the scenario for divers and photographers. Before we had even donned our gear, blacktip sharks were circling the boat.

We all descended to the bottom at 40ft, and a guide brought down a PVC pipe with bait and positioned it in the reef. It was explained that if you wanted to get close to the sharks, simply move closer to the container.

YAP INFORMATION

Yap is part of the Federated States of Micronesia, and the indigenous culture and traditions of the Yapese people are admirably resolute compared to other states in the FSM, which include Chuuk, Pohnpei and Kosrae. The main island of Yap is actually four islands, three of which are connected, and there are 14 outer islands (mostly atolls) scattered to the east and south of the main islands, some nearly 500 miles away. The entire state has come to be known as Yap in recent years. Colonia is the capital, and the surrounding land is mostly made up of rolling hills that lead down to mangrove forests along the coast, interspersed with narrow beaches.

Temperatures range from 23-30°C (75-86°F) throughout the year, with heavy rainfall possible at any time. The water temperature is a balmy 27-28°C (82-84°F), and a 3mm wetsuit is more than enough to be comfortable on some of the longer dives. There are a limited number of flights to Yap, so no matter where you are coming from, your best bet is to ask the resort for suggestions on possible routes, which they will even be happy to book for you. Most itineraries include a stopover in Guam, followed by a United Airlines flight to Yap. ■

Fire dartfish are common in the outer reef zone (top left). Sailfin tang and parrotfish (top right). Clark's anemonefish peeking out of a Mertens' carpet sea anemone (far right). Pair of variegated lizardfish (right). Yaeyama coralblenny (above).

If you wanted more of a distant perspective, just stay back. The sharks were well aware of their role and were well-behaved subjects. Once we were all back on board at the end of the dive, the bait was brought to the surface and tossed to a conglomeration of blacktip and gray reef sharks competing for their reward.

Back to Stammtisch. Our second dive was back at Stammtisch for another stint with the manta rays. This time, I decided to go with a macro lens, shoot the overly cooperative reef fish, and ignore the giant winged regulars. Jennifer's Olympus system allowed her to do both, and I was inwardly jealous. After two hours, the group had identified five different manta rays, with up to three at a time being serviced at the cleaning station. I had no complaints after capturing 30 different fish portraits that I would never have gotten on a single dive anywhere else.

Kayaking the mangroves

With just two dives left on our schedule, we headed back to The Mnuw for lunch and to prepare for our afternoon kayak tour through the mangrove forest. Our dive boat was filled with kayaks and paddles, and we departed the dock for a new adventure.

When we reached our destination, Bruce slipped the kayaks into the water, then we paddled under a local

MANTAFEST 2024

David Fleetham will be one of six photo pros participating in the 14th annual MantaFest photo festival from 24 August through 8 September. Manta Ray Bay Resort packages are available and range from 4 to 14 nights. With only 30 rooms available, this event is limited to just 60 divers. Besides seminars, workshops and evening media presentations, all participants will be eligible to enter a photo contest involving images shot during the festival. There will be separate categories for digital SLR, compact camera and video, giving both seasoned shooters and novice photographers the chance to win some impressive prizes from Ikelite, Mares, Light & Motion, Henderson wetsuits and several dive vacation packages, including a 10-day luxury liveaboard trip to Indonesia for the Best in Show category. The pros will be diving with the participants every day, offering tips above and below the surface to improve your photographic skills. For more information and to book a spot, check out **mantatrust.org**. ■

walkway and past a traditional men's house with stone money decorating the sides. There was not a whisper of wind, and the paddling was easy. Birds flew overhead and chirped to each other as we left the wide channel and headed down a narrow opening in the forest, where it was silent. Here, the trees formed a canopy overhead, with sunlight filtering through the thick layer of green.

It was just two feet to the bottom, and our guide pointed out a large anemone on the muddy sediment with no anemonefish. It was the only one he had seen deep in the forest, and it appeared to be thriving somehow in the murky water.

Mangroves are vital for an array of fish species. Here, archerfish spit jets of water from their mouths into the air to knock insects into the water. It is also where many juvenile fish begin their lives, including some species of sharks.

We emerged again into a wide channel and then took another turn into a narrow opening, not as wide as our paddles were long, and continued until we met up with our ride. We were surprised that the tour was over and even more amazed to learn that we had been paddling for over three hours.

Two kayakers paddling in a saltwater channel through a mangrove forest (top left and right). Banded archerfish, hiding in mangroves, feed mainly on terrestrial insects by spitting water at them, knocking them out of the air and into the water (above). Red-banded prawn-goby sharing a burrow with a yellow species of prawn (left). These pairs are often found in the coarse carbonate or volcanic sand of the outer lagoon and seaward reefs.

COAST GUARD RESCUE

Just before we arrived in Yap, Jennifer's son, Christopher Rodgers, who works on a US Coast Guard vessel out of Guam, the *Oliver Henry*, was in port for a couple of days. They were then called away to search for three fishermen from Chuuk who had been missing for over a week. The missing men, experienced sailors in their 40s, had set out from Polowat Atoll in their 20ft open skiff with a single outboard motor. On the beach of Pikelot Atoll, where they were stranded, the men used palm leaves to spell out the word HELP. The sign was spotted by a search plane, and the *Oliver Henry* was sent to rescue the men.

Supplies were dropped, and the men were rescued and returned to their families. The Coast Guard ship returned to Yap, where the crew was greeted as the heroes they were. National and international news agencies picked up the story. ■

Diver at stern (left) and at propeller (right) of the Circus Wreck. Steinitz' shrimpgoby and alpheid worker shrimp share a burrow, which is maintained by the blind shrimp while the goby watches for predators (above).

Crocodilefish

Crescent Reef

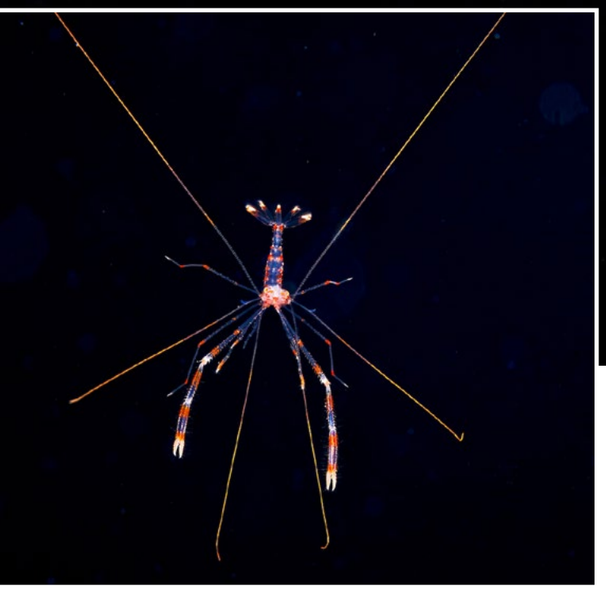
Our fifth day began with a good breeze, and it was suggested that we stick a bit closer to the resort. Crescent Reef is just outside the entrance to the channel, and the wind had made little impact on the visibility. The mooring was anchored at 30ft at the edge of the reef, which dropped down to 60ft where it became a flat bottom that extended out to another drop-off. A school of barracuda patrolled over the sand, and large snappers hung motionless in the blue. Goby and shrimp shared a hole in the sand rubble areas, with the pair darting into their den as I approached. These pairs seemed to be everywhere. I slowed down and took my time to approach for a photo.

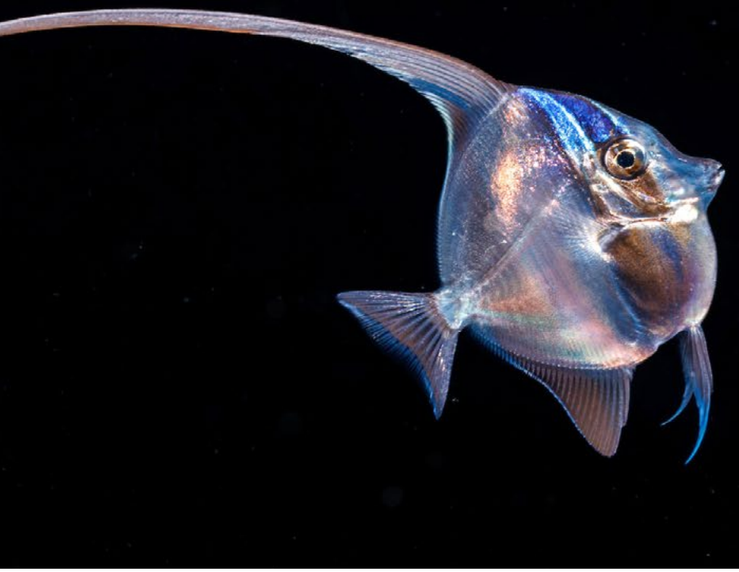
Circus Wreck. The wind had died down a bit, but we still preferred flat water and decided to dive the Circus Wreck inside the channel. Visibility here was not as good as on the outside of the channel, but the wreck made a dramatic backdrop to the reef beside it. The vessel came to Yap with a circus of animals, clowns and acrobats that had been traveling around Micronesia when it broke down and was abandoned. The circus company left the island on a barge, and the ship was sunk as a dive site. It was 75ft long and lay on its side in 70ft of water.

After making our way down the deck of the ship, we paused at the stern for a shot of the propeller, then worked our way up to a shallower depth and continued on down the reef. Several species of nudibranchs shared the corals with reef fish, including a very cooperative crocodilefish. It was a five-minute boat ride back to the resort, where we had lunch and rested for our blackwater night dive.

Blackwater diving

Blackwater diving can reveal creatures you will never see anywhere else. Yap is located on the rim of the Marianas Trench and just 100 miles from the Challenger Deep site, the deepest point on our planet. About a mile or so out in open ocean, a buoy is set with a light at the surface and several more lights at intervals down to 60ft to attract larval creatures that make a migration to the surface each





CLOCKWISE FROM ABOVE: Larval banded coral shrimp, larval Moorish idol, larval shrimp riding luminescent jellyfish, hydromedusa, sea angel, and pelagic tunicate, or salp, shot on a blackwater dive one mile into open ocean at night with the bottom 2000+ feet (~610m) below.

night. A dive guide keeps the buoy and group together while spotting subjects. This is not a dive for novices, and it does take a few minutes to orient oneself to the whole situation.

Immediately upon descending, I came across a shrimp riding a jellyfish. The shrimp was propelling the jellyfish in a dizzying circle, and I took 30 shots, hoping one would catch the pair at the right angle. Hundreds of squid, from six inches to two feet long, darted past us in waves. Occasionally, one would pause momentarily to be photographed and then bolt back to the mob. I saw various larval fish, more jellyfish, including a box jellyfish, more shrimp and other crustaceans. It can be a sensory overload, and time goes by quickly. It was after 10 p.m. by the time we got back.

Return to Yap Caverns

Day 6 was our last day of diving, and we decided to go back to Yap Caverns. The current was running a bit stronger, so the gray reef sharks were a bit more plentiful, and everything that fed in the passing water was hard at work to get what they could. A huge school of rainbow runners passed through, and we heard dolphin squeaks, which were later confirmed when we surfaced.

Lionfish Wall. The wall was so alive that we decided to start a drift dive from where we were and travel down to the next site called Lionfish Wall. It was a challenge to stop for photos, but the sheer volume of marine life made up for shooting on the fly. Multiple colors of feather stars decorated the walls, along with wire coral, alcyonarian coral and fans deeper down. Even the safety stop at 15ft was filled with school after school of snapper, bream and surgeonfish.

Night dive

We had made a pact on the first day and kept it for our last dive. We ended up back at Slow and Easy for a wonderful night dive that started with a huge mantis shrimp whose hole was big enough to put your hand in. A hawksbill sea

Lionfish and gray reef sharks (top left). Common or pink anemonefish are often found in magnificent sea anemone (above). Juvenile starry dragonet (right). Hawksbill sea turtle (center). Trumpetfish, a reef predator, swims behind a yellow boxfish, using it as a blind to ambush prey (far left). Stonefish are capable of inflicting a painful, heart-stopping wound with its venomous dorsal spines (bottom left).

turtle, sleeping rabbitfish and parrotfish, lionfish, lobster, cowries, an upside-down jellyfish and a giant moray getting its dental work examined topped off our critter list for the last bubbles of this trip.

Topside attractions

Day 7 was for drying out our gear, packing and getting ready for our 2:35 a.m. departure the next morning. The hotel staff caught wind of a rehearsal for an upcoming cultural event and managed to get us on the guest list. This was to take place in the late afternoon, so we decided to join Derek, one of the staff, for a morning hike on the Tamilyog Trail, up a hillside to an ocean overlook and back down through the village where he lives.

It was a mild uphill climb on a well-tended path paved with stones that had been placed together like a jigsaw puzzle. The heat of the morning sun and the humidity added to the workout, but we were easily distracted by the jungle and grasslands around us. At the summit, we relaxed under a shaded rest hut, which had an ocean view of the reef surrounding the island. On the way down, we passed through Derek's village, where he plucked starfruit and oranges from his trees to share.

The street in front of the village of Rumuu was bustling with traffic when we arrived in the early afternoon. Locals with food and drink were on the path and along the walkway over a stream leading to the dance area in the middle of the jungle. Fifty women in traditional dress were seated in a row along a stone path, and others were making last-minute adjustments to their dresses and makeup. It was an impressive and moving sight. The dancers

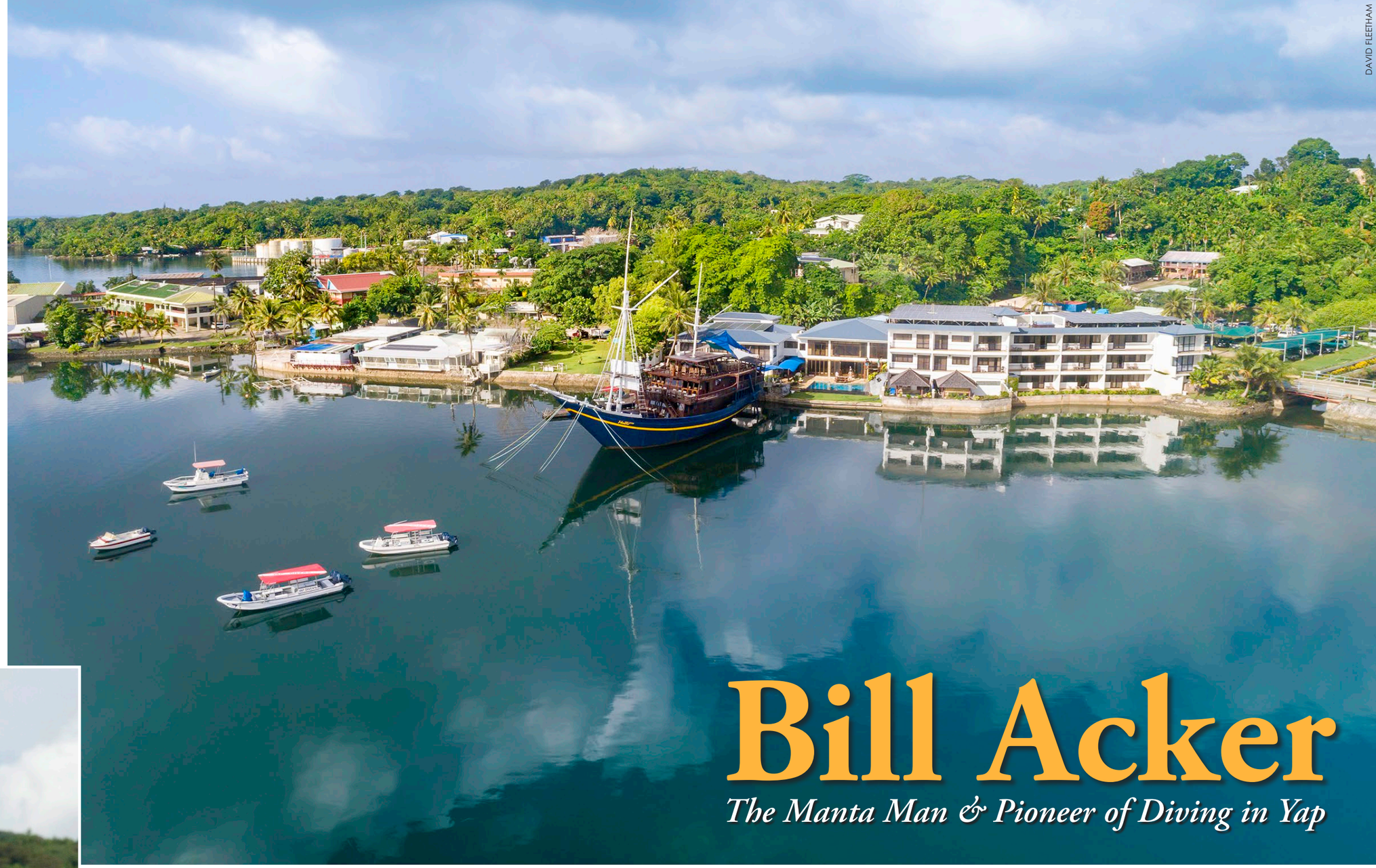
Colourful sunrise over Yap (above). Dancers in traditional dress rehearse for an upcoming cultural event (top right). Pod of spinner dolphin (far right). Stone money covered in moss at the village of Rumuu (right). This ancient currency, which is still in use today, involves carved round stones known as "Rai", which can be up to four meters in diameter. A man in traditional dress climbs a tree with stone money at the base (left).

spanned several generations, from toddlers to the elderly. As the only non-natives, we felt extremely privileged to be invited to the rehearsal, which went on for well over an hour and included seven or eight dances and chants.

The same cheerful staff who greeted us on our first night were at our door shortly after midnight to handle our bags and boxes for the drive to the airport. Our hugs and goodbyes were short and sweet as we reminded each other that we would be back in a few months for MantaFest 2024. ■

David Fleetham is one of the world's most widely published underwater photographers. He began diving and underwater photography in Canada in 1976 and has been in Hawaii since 1986. In 1991, his photograph of a sandbar shark appeared on the cover of Life *magazine. It is the only underwater image ever to appear on the cover of the magazine. His award-winning work has been published by many, including* National Geographic, *for which he has done several assignments. His photographs have been reproduced around the globe, with over 200 magazine covers to date. Galleries and agents in over 50 countries sell his images thousands and thousands of times each year. His career has now taken him to most of our planet's oceans. For more information, visit:* ***davidfleetham.com****.*

Bill Acker (below) and the Manta Ray Bay Resort with its floating restaurant, "The Mnuw," on the island of Yap (right)



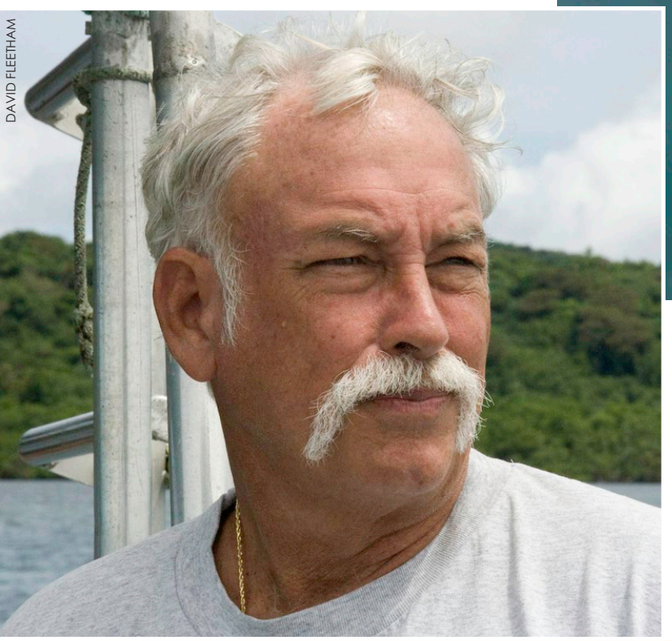
DAVID FLEETHAM

Bill Acker

The Manta Man & Pioneer of Diving in Yap

Text by Svetlana Murashkina
Photos courtesy of Bill Acker and David Fleetham

The island of Yap, a tiny dot in the vast Pacific Ocean, is home to a world-renowned dive resort, embedded in the authentic culture and traditions of the Yapese people. It all happened because of one person whose charisma, enthusiasm and desire to share the thrill of diving became the driving force behind the development of diving in Yap. That person is Bill Acker, founder and owner of Manta Ray Bay Resort & Yap Divers. Svetlana Murashkina tells his story.



DAVID FLEETHAM

Bill Acker is a member of the original class of SSI Platinum Pro Divers. As a PADI and SSI Instructor, he remains active in exploring new dive sites and teaching the sport to those interested in sharing his love of the marine environment. His accomplishments are recognized by the worldwide diving community. In 2014, Acker was inducted into the Scuba Diving Hall of Fame for pioneering diving in Yap. He celebrated 30 years in business that same year. In addition, his dive resort was recently recognized in 2024 as the best dive resort in the Pacific and Indian Ocean.

Manta Ray Bay Resort & Yap Divers are known for having many repeat guests, myself included. Not only is it a great place with awesome diving and professional staff, but the friendly atmosphere created by Acker and his whole family at the resort instills a real family feel.

Childhood dream comes true

Acker has dreamed of faraway tropical islands ever since his childhood. Growing up in Garland, Texas, USA, he read and watched everything he could find about Southeast Asia, including books by Rudyard Kipling and Joseph Conrad. He was drawn to mysterious lands overseas without knowing why. Of his dream destination and place to live, he said: "If coconut trees do not grow here, I cannot live either. I need warmth.

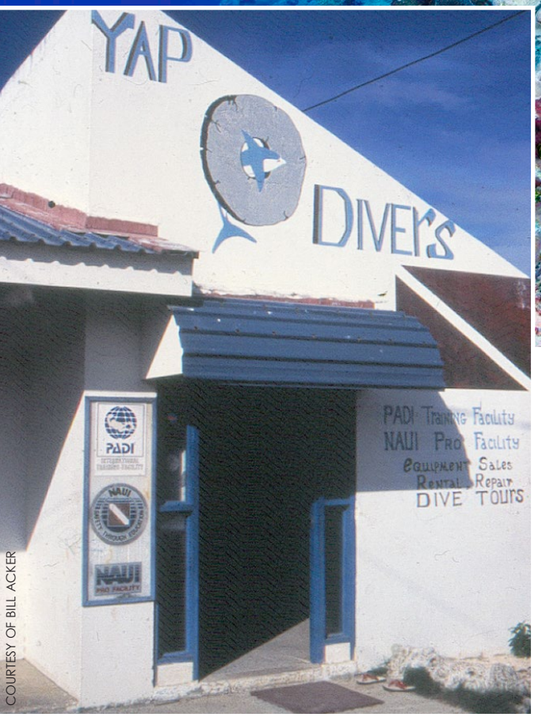
Bill Acker

Diver with Clark's anemonefish in anemone on reef in Yap (left); Bill Acker and Peace Corp volunteer group in Yap (below); Bill Acker with his co-workers from WAAB Transportation Co (bottom right); Acker's old dive shop in Yap (bottom left)

DAVID FLEETHAM

COURTESY OF BILL ACKER

COURTESY OF BILL ACKER



COURTESY OF BILL ACKER

And palm trees live only in an eight-degree strip along the equator, inhabiting the most wonderful places on earth!"

First time in Yap

Bill first visited the island of Yap in 1976 as a Peace Corps volunteer. At that time, he had graduated from high school in Garland and attended the University of Texas, where he earned a degree in marketing. He then worked in the city center of Dallas in the men's clothing industry (not the most exciting job in the world, he said with a grin).

One day, he read in a newspaper that the US government was sending volunteers to work in various "undeveloped" countries. Two positions were open: Yap and Tonga. In Tonga, the work involved setting up a cooperative fishing enterprise, and in Yap, it involved drawing up a five-year economic development plan. As a young man, he thought that it would be better for his future career to work in Yap, so he agreed to a two-year contract.

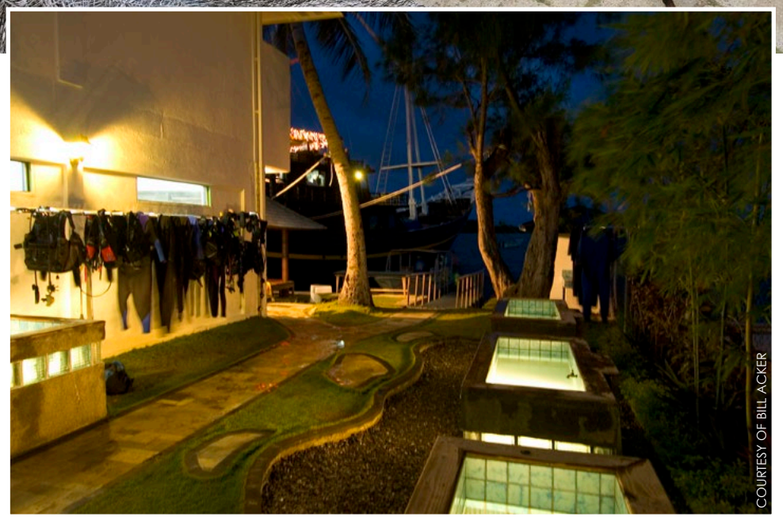
Island life

He really loved the island, the climate, and the people. The only thing that bothered him was that it was so far away from everything, isolated from the rest of the world...

After two years in the Peace Corps, Acker attended the University of Hawaii's Graduate School of Business and planned to settle there. But an invitation from friends in Yap changed his plans and his whole life. He left Honolulu and became the manager of the WAAB Transportation Company, where he worked for the next 13 years.


COURTESY OF BILL ACKER


COURTESY OF BILL ACKER


COURTESY OF BILL ACKER

COURTESY OF BILL ACKER

COURTESY OF BILL ACKER

One of the activities of the company was the production of oxygen. Some people who were going to fly to Palau to dive asked if they could fill their tanks there. This sparked his interest in scuba diving. At that time, there was no diving on Yap—no dive centers, no decent hotels.

WAAB Transportation then invited a dive instructor to visit, and together, all 45 of their employees started learning how to dive. The idea was simple and appealing: everyone could go spearfishing, catch fish, barbecue them up and party all together! And this is how the dive industry in Yap started. In 1985, the idea of opening a dive center was born, and the search for new dive sites began. So, Acker started a dive business—almost by accident. A happy accident indeed for divers all over the world.

Yap Divers

By the summer of 1986, the dive center was ready to open. It was affiliated with both NAUI and PADI. However, during its construction, there was no specific knowledge of how to build a dive center. The idea of how it would work came from the notion that guests would come with equipment, so the center would have to store it somewhere, somehow. Acker's personal requirements for the accommodations were basic: It has to be clean, with a good shower, a soft towel and a comfortable bed. That would do. Acker was responsible for the construction of the buildings. He also came up with the idea of giving each room a different name. As for the design, a good friend from Palau offered a lot of advice.

The expectations and goals of the creators of Yap Divers were no less than to create the best dedicated dive resort in the world. Of course, there were unique obstacles. Everything about living on a very remote, isolated tropical island added to the difficulties. Supplies take months to get, if you can even get them at all, and the cost of visiting Yap in terms of the airline fares has made sustaining the business a

Divers at Acker's old dive shop, Yap Divers (top left). Construction in process of Acker's new dive shop in Yap (top center and top right). Yap Divers' dive boat moored at the new dive shop of Manta Ray Bay Resort with its floating restaurant, "The Mnuw" (above). The new dive shop has convenient camera tables for guests to prepare and store their underwater camera gear (center). Wetsuits and BCDs hang to dry by the rinse tanks of the resort's new dive shop (far left).

DAVID FLEETHAM

Reef manta ray, *Mobula alfredi* (previously known as *Manta alfredi*), in Yap

challenge. But the result has been magnificent, and Acker is proud of what they have created and continue to do today.

Manta rays

Another happy accident occurred with the manta rays. The locals told stories about manta rays and their frequent haunts in the channels. Acker's house was situated very close to the channels. So, Acker started diving with these beautiful creatures. With no diving experience outside of Yap, and only reading about the rest of the world's oceans in dive magazines, he was sure that manta rays were everywhere, so he thought that no one would be interested in coming to Yap to see manta rays.

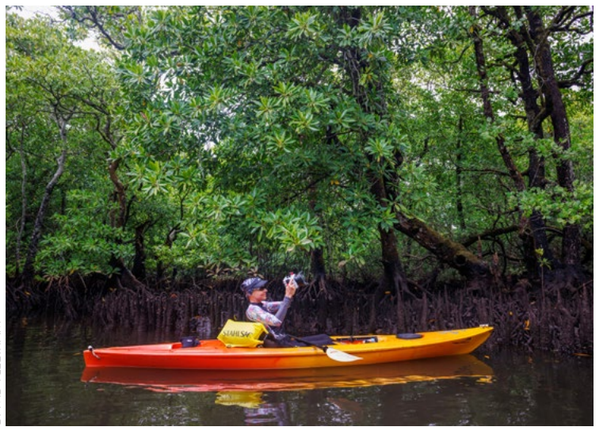
At that time, 35 years ago, images of mantas could be seen everywhere—in advertisements, in dive center logos, and in photos (but people were afraid of sharks. Their attitude towards sharks was very different back then). Manta rays became the most popular creature, so Bill had the impression that manta rays were very common. An ordinary phenomenon. So, when he took people on dives, manta rays were the last thing he wanted to show them, let alone dive with.

Enter Paul Tzimoulis, editor-in-chief of *Skin Diver* magazine, the leading dive magazine in the United States at the time. Yap Divers hosted him in their first attempt at advertising. Paul and his wife, Geri, spent a few days on Yap, staying at Acker's house, but there was a heavy storm, and they did not dive. On the last evening

DAVID FLEETHAM

Pair of mating reef manta rays (left). A kayaker, paddling through a saltwater channel in a mangrove forest in Yap, pauses to take a photo (bottom right). Early photo of Acker family when the kids were youths (bottom left).

COURTESY OF BILL ACKER



DAVID FLEETHAM

before leaving the island, the editor's wife had managed to break her collarbone, and the fracture was serious. A cast could not be put on the fracture, and it was recommended that they not fly for seven days. So, they had to stay put for a whole week.

The next day, everything was terrible. Geri felt bad. Everyone's spirits were down. And the only Yap Divers boat was moored in the channel right in front of the house. So, Acker suggested a dive with the manta rays. The answer was immediate: "That's impossible." But Acker decided that it was "impossible" to leave Geri on shore in that miserable situation. He continued to try to persuade the couple to go, saying: "It's very close. Let's look at the mantas and come back. It will only take us an hour." Paul asked again: "So, are you saying that we can go diving and we will definitely see mantas?"

Indeed, they went to the nearest dive site. From Acker's point of view, if there had been anything else more interesting to show them, he would never, ever have mentioned the manta rays. But they dived, and they saw what every diver who visits Yap today sees: manta rays, lots of them, coming to be cleaned and basking in the divers' bubbles.

After the dive, Paul said: "No one anywhere in the world can say for sure that during a dive, we will see mantas!" Thus, Yap, with its magnificent manta rays, was featured on the covers of dive magazine issues under the guidance of the late Paul Tzimoulis, Hall of Fame dive pioneer and publisher. Yap Divers enjoyed the glory of being the only place in the world to experience this unique manta dive!

Manta ray awareness

In 2003, Yap Divers introduced the PADI Manta Ray Awareness specialty course. It includes a one-hour lecture and two dives with manta rays. It covers how to tell females from males, how they behave, and when and why they come to the channels. Acker shared his extensive knowledge of Yap's manta rays. He has made over 18,400 dives, mostly in Yap, and most of them with manta rays. Probably, no one else in the world has made as many manta ray dives as he has.

Acker is still active in teaching

COURTESY OF BILL ACKER

COURTESY OF BILL ACKER

DAVID FLEETHAM

DAVID FLEETHAM

Bill Acker and his wife, Patricia, pose with their big family clan (above). Bill Acker with his wife, Patricia (top right). Moss covered stone money in the village of Rumuu on the island of Yap (right). An ancient currency still in use today, these carved stones known as "Rai" are up to 4m in diameter with a hole in the center. Yapese dancers in traditional dress in the village of Rumuu (far right).

the Manta Ray Awareness specialty course, and the center is training Acker's son-in-law, Francis, to be a dive instructor so he, too, can teach the course. The guides at Yap Divers are also very knowledgeable about Yap's manta rays, and they are a wealth of information for the resort's guests.

A big family and family business

While in Yap, Acker met and married a local woman, Patricia Mangthin. According to Yapese tradition, he had to give shell money as a dowry for his wife. Of course, as an American, he could not have shell money! But it was given to him by the family he was living with at the time.

Bill and Patricia live together with great respect and devotion for one another. They have four children (Numie, Nathan, Valerie, and Opie) and six grandchildren.

All members of the family are active in the sport of diving and share Acker's commitment to the safety and preservation of Yap's natural resources. Patricia and all four of the children have been active in the construction and operation of Manta Ray Bay Resort.

Patricia started the Taro Leaf Spa, and her treatments are based in part on traditional knowledge passed down from her grandfather. She also spent three months training in spa treatments in Cebu, Philippines. She also started the Planet Blue Kayak Tour division. She still occasionally kayaks with guests.

Bill and Patricia's eldest daughter, Jessica "Numie" Acker, has worked at the hotel since she was 12 years old and is now the general manager.

Yapese culture and tourism

Yap is known for its unique stone money. But before Acker's ventures, there was no tourism on Yap. When divers began to visit the island, it was Acker's team that started to hike to the Yapese villages hidden in the depths of the island. They brought guests with them, and the locals spoke to them, showing them their crafts and dancing, and treating them to local fruits. They even let visitors chew betel nut right off the tree. Most of the proceeds from the village cultural tours that Manta Ray Bay Resort offers its guests go back to the community.

"Retirement"

From Acker's point of view, the word "retirement," as it is traditionally used, does not have the same meaning

Bill Acker

DAVID FLEETHAM

COURTESY OF BILL ACKER

Patricia and Bill Acker enjoy drinks by the resort's floating restaurant, "The Mnuw" (above). Manta Ray Bay Resort in the town of Colonia on the island of Yap, Micronesia (top). Bill Acker with his wife, Patricia, at the awards ceremony in 2014 where he was inducted into the Scuba Diving Hall of Fame (far right). Bill Acker gives a presentation at the Boot Show in Dusseldorf, Germany (bottom right).

for him. Manta Ray Bay Resort & Yap Divers was conceived, built, developed and run by him, and he has been very fortunate to have a strong, supportive family working with him, as well as a great staff. He still loves everything about the business that got him into it in the first place—namely, meeting people, trying to fulfill their dreams, and, of course, the diving.

Acker doubts that he will ever fully "retire," but he, along with his wife, are officially retired, splitting their time between Yap and the Philippines and spending less and less time in Yap these days. The goal is to spend half the year in Yap and half the year traveling. They both still dive, Acker much more often than Patricia, but she still dives as well. They dive in Yap, and he dives almost every day when he is home because he wants to be with the guests as much as possible.

They also dive in the Philippines when they are there. Now that Numie Acker is the general manager, father and daughter talk together daily, of course, about the business, and Bill helps as much as he can. He is particularly active in the dive shop, marketing and recruiting prospective new employees.

When asked if he had to do it all over again, where would he choose to live and what would he do, Bill is unequivocal: "Yap Island, the municipality of Ma'ap, and the village of Digin. In other words, I wouldn't change a thing. The Yapese people are the most humble and friendliest people I have ever met. The Yapese are smart, industrious and proud of their island and culture. I have a beautiful wife. I live in a good place where the diving is great. They say if you do a job you love, you will never really work a day in your life. I am living the dream and very grateful for it."

Making a comeback

Like many dive centers and resorts, Manta Ray Bay Resort & Yap Divers endured the difficult times of lockdown during the Covid-19 pandemic. They struggled mightily but are still here. Getting their customers back has been a slow process, and many of their co-workers were forced to leave the island during Covid and have not returned. Staffing is a challenge, but the reefs are healthy, the marine life is as prolific as it was before Covid, and the climate provides a perfect tropical paradise. ■

For more information, please visit: ***mantaray.com***

COURTESY OF BILL ACKER

COURTESY OF BILL ACKER

Cuba

Escapade in the Caribbean

Text and photos by
Pierre Constant

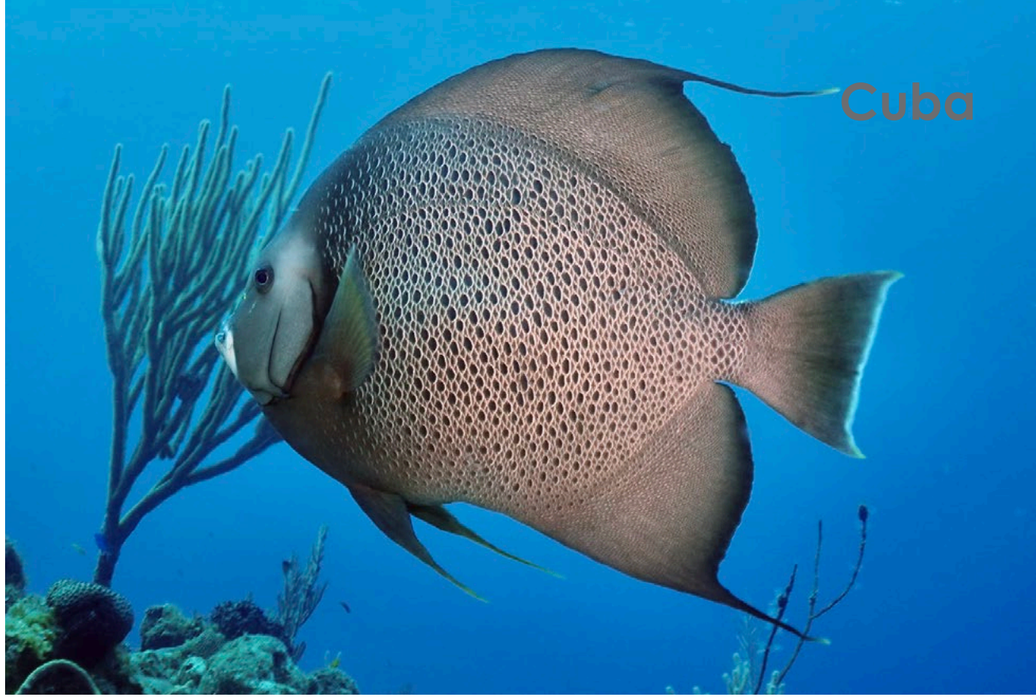
The picturesque beach at Maria La Gorda (above); Endemic Cuban tody in forest at Playa Giron (right); Yellow tube sponge and sea fan at Acuario (previous page)

There are wonders to discover and explore in Cuba's natural world, both above and below the surface of the sea, from endemic species of marine life to exotic birds and animals in the national parks. Pierre Constant shares his journey there.

At the confluence of the Gulf of Mexico and the Atlantic Ocean, Cuba is an archipelago of 4,195 islands in the northern Caribbean Sea. It is located south of the Tropic of Cancer, between latitudes 19°N and 24°N and longitudes 74°W and 85°W. Key West lies 150km across the Strait of Florida to the northwest, the Bahamas 22km to the north, Haiti 77km to the east, and Jamaica 140km to the south. Mexico is 210km to the west across the Yucatán Channel.

The largest island in the Caribbean, with a land surface of 109,884 km sq, Cuba is 1,250km long. It is mainly flat with some rolling plains and its highest point is Pico Turquino (1974mi) in the Sierra Maestra mountain range in the southeast. Cuba's second largest island is Isla de la Juventud (2,204 km sq) in the Canarreos Archipelago, off Cuba's southwestern coast. The population of 11.3 million people (2022) is composed of several ethnic groups, including White (64%), Mulatto (26.6%) and Black (9.3%). The main languages are Spanish, Haitian Creole and English.

The Caribbean Current brings warm water from the equator. Cuba has a tropical climate, with the northeast trade winds blowing most of the year. The dry season extends from November to April, and the rainy



Rope sponge at Cabezo de Ludo (above); Grey angelfish at Patio de Vanessa (top right)

Panoramic view of the "mogotes" from Balcon del Valle (above); Caverna de Santo Tomas in Vinales (right)

season extends from May to October. Average temperatures are 21°C in January and 27°C in July.

Geological features

Geologically speaking, Cuba records three important episodes: the Jurassic breakup of North and South America (Pangea) 135 million years ago; the sedimentary-magmatic and metamorphic evolution of an intra-oceanic Cretaceous-Paleogene ophiolite arc-complex; and the Paleogene "soft collision" of the NW Caribbean Plate (45 million years ago) with the North American Plate (NOAM).

A Greater Antilles subduction zone of the NOAM under the NW Caribbean Plate (in a southwest direction) occurred from 120 million years ago to late Cretaceous (65 million years ago). Western and central Cuba is an orogenic belt (i.e., a mountain range by uplift) created by the collision during the Cretaceous of an island arc with the Florida-Bahamas Platform. Jurassic and Cretaceous limestone appear conspicuously in the western part of Cuba, in the Pinar del Rio region of Vinales, as massive ranges and outcrops locally known as "mogotes". Rocks scraped off the Caribbean Plate have accumulated on the North American Plate.

Cuba is, therefore, affected by active fault systems, which are responsible for several

Sculpture on the waterfront, La Havana

Gran Teatro de La Habana, Centro Havana

Classic American cars used as taxis for tourists, Centro Havana (above); El Capitolio, La Havana (top left); Beach view of Hotel Maria La Gorda, located on the Guanahacabibes Peninsula in Pinar del Río (below)

earthquakes each year. Over the past centuries, major quakes with a magnitude of 7.0 or above have been highly destructive. The last one was in January 2020.

Getting there

After arriving at the airport, I took the Viazul Yutong bus, which made a beeline from La Havana to Pinar del Rio, in three hours. From there, it was a 45-minute ride on a winding road up into the hills to Vinales. Nestled in a very lush and green countryside with mountainous scenery, the little town was a highlight on any tourist map. There, I had hired a car for the continuation of my journey to the far west of Cuba, a place known as Maria La Gorda. In the afternoon, I showed up at the car hire agency to confirm that everything was set for me to pick up the vehicle first thing in the morning the next day.

"We cannot make the contract on the computer now because we have no electricity. It is on for three hours and off for nine hours. Come back before 6 p.m.," said a none-too-friendly man with a rough, low-pitched voice. "Bienvenidos a Cuba. Viva la Revolucion!" I thought. When the electricity was back, it took over an hour to make the contract with the gruff man behind the counter. I came out in a high state of agitation. The Hyundai Grand i10 car, for which I had paid a high price, was dented and scratched on all sides. Not an auspicious sign.

In the early morning, I was off to my final destination. After three and a half hours on a potholed road in terrible condition, I reached Maria La Gorda, which was an exclusive, government-owned hotel in a so-called paradise setting on the Bay of Corrientes. It faced the Strait of Yucatán to the west, with the Caribbean Sea to the south. A white

Lounge chairs on a scenic beach (above) and royal terns (left) at Maria La Gorda; Shell ginger flowers at Sierra de Guaniguanico (top left)

sandy beach under a line of coconut trees fringed turquoise blue waters. The sun was high. Virtually, not a soul around.

Upstairs from an old cement building painted yellow, the room was alright. I made myself at home after paying a visit to the laid-back dive centre next to the beach bar and restaurant. After noisy and hectic La Habana, this felt like relaxation at last.

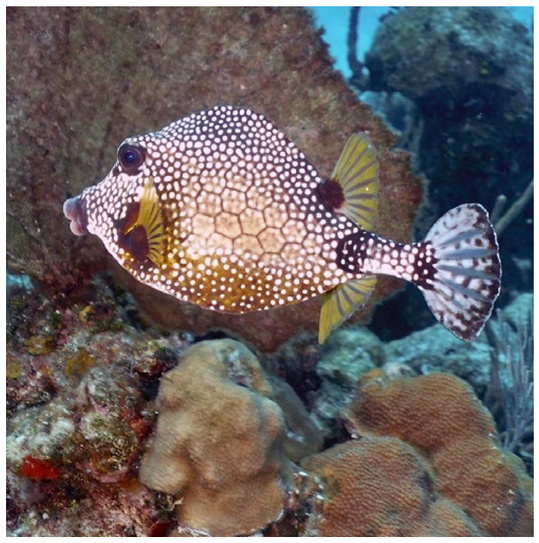
Two big steel-hulled dive boats were moored at the jetty. The dive operation looked well-seasoned, with brand-new aluminium tanks. Cuban cigar in hand, Rafael, the dive manager, had the cool face of a Richard Gere.

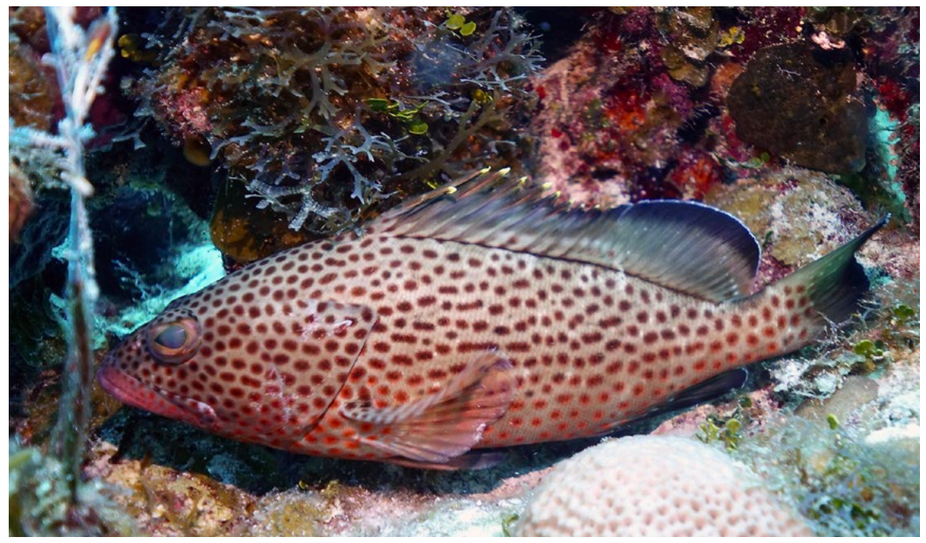
Prehistory to present day

As history would have it, humans from northeastern South America are thought to have settled in Cuba 6,000 years ago. They caused the extinction of the native fauna, such as the endemic sloth. Around 1,700 years ago, the Arawakan-speaking ancestors of the Taino came to the island. The Taino produced pottery and practised agriculture. Pushed westward by the Arawak, descendants of the first settlers roamed around the western part of Cuba. Recorded as the Guanahatabey people, these were hunter-gatherers. The Taino cultivated yuca (also known as cassava), cotton and tobacco.

In his search for a route to India, Christopher Columbus explored Cuba's northeastern coast in 1492 and passed along the southern coast on his second voyage in 1494. Cuba was fully mapped by Sebastián de Ocampo in 1508. After they defeated the fierce Taino guerilla warriors, the island fell to the Spanish in 1514, and a settlement on the southern coast was founded. Priest Bartolomé de las Casas observed various massacres of local populations, which were butchered by the invaders despite a friendly approach by the Indigenous people.

Conquistadors sought slaves from surrounding islands and the continental mainland. In 1519, Hernan Cortès launched his Spanish conquest of the Aztec Empire from Santiago de Cuba via Yucatán. After 1550, the natives were largely decimated by diseases such as measles and smallpox. Invaders were taught how to raise tobacco and consume it as cigars. Soon, Spanish colonists mixed with the indigenous pop-





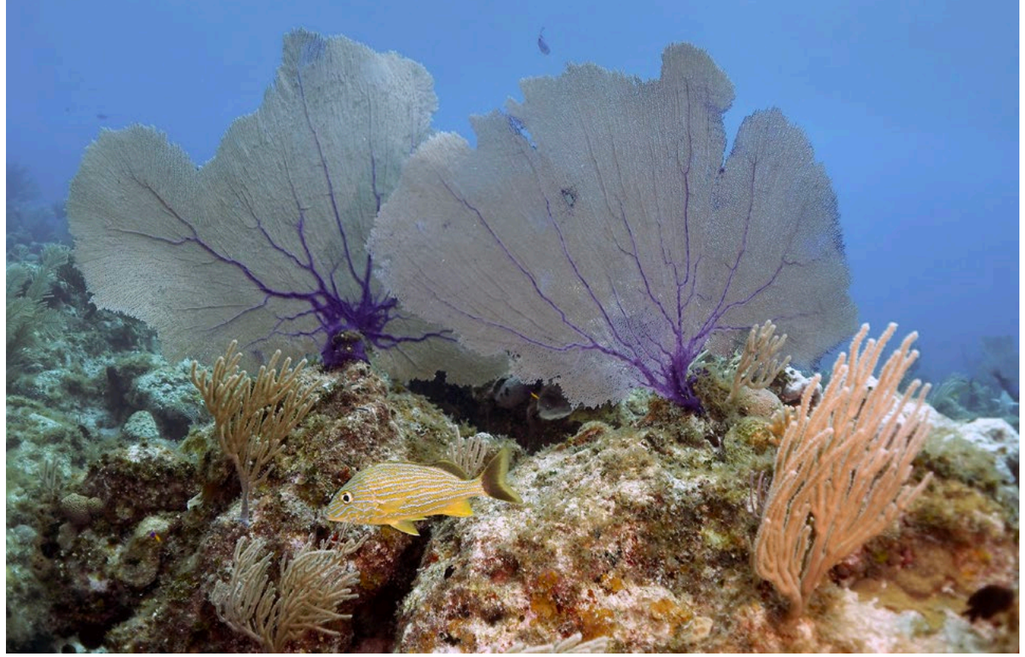
Creole wrasse (top left), vase sponge and bluehead wrasse (top centre), stoplight parrotfish with white and bluestriped grunts (top right), and black triggerfish (right) at Paraíso Perdido; Red hind at Moby Dick (above right); Smooth trunkfish at Acuario (above left); Trumpetfish (left) at Paraíso Perdido

ulation, sharing DNA. The Spaniards established sugar and tobacco plantations and imported black slaves from Africa to work on them. Colonial Cuba was a frequent target of buccaneers, pirates and French corsairs.

In 1741, the British launched an invasion to capture Guantanamo Bay. Later, they had La Habana under siege in 1762, captured the town, and took control of the western part of Cuba, opening trade with North American and Caribbean colonies. The Seven Years' War with Spain ended up with a treaty, the "Peace of Paris", which gave Florida to the British in exchange for Cuba. The Spanish governor of Louisiana reconquered Florida in 1781. The Slave Trade Act of 1807 abolished the slave trade in the British Empire. Spain followed suit in 1820, but Cuba continued with slavery throughout the 19th century. The late 19th-century boom in Cuba's sugar industry improved the transportation infrastructure, with new roads and railways being built. In 1860, the United States imported 82 percent of the sugar produced in Cuba.

Cuba's early liberation movement occurred after the success of the French Revolution and the revolt of the black slaves in Haiti in 1791. Following its Declaration of Independence in October 1868, the War of Independence in February 1895, a handing over to the United States in December 1898, and a final independence from the United States in 1902, the Republic of Cuba was born.

The Cuban Revolution took place between 1953 and 1959, 170 years after the French Revolution. Socialist



Rope sponge on edge of drop off (above) and porkfish (right) at Almirante; Bluestriped grunt with gorgonians (top right), white grunt (far right) and smooth trunkfish (left) at Acuario

Marxist Fidel Castro, with Che Guevara, opened a new chapter in Cuba's history, declaring in April 1959: "Patria o Muerte, venceremos" and Che Guevara, upon his departure for Bolivia, concluded: "Hasta la victoria siempre. Viva la Revolucion!"

Diving

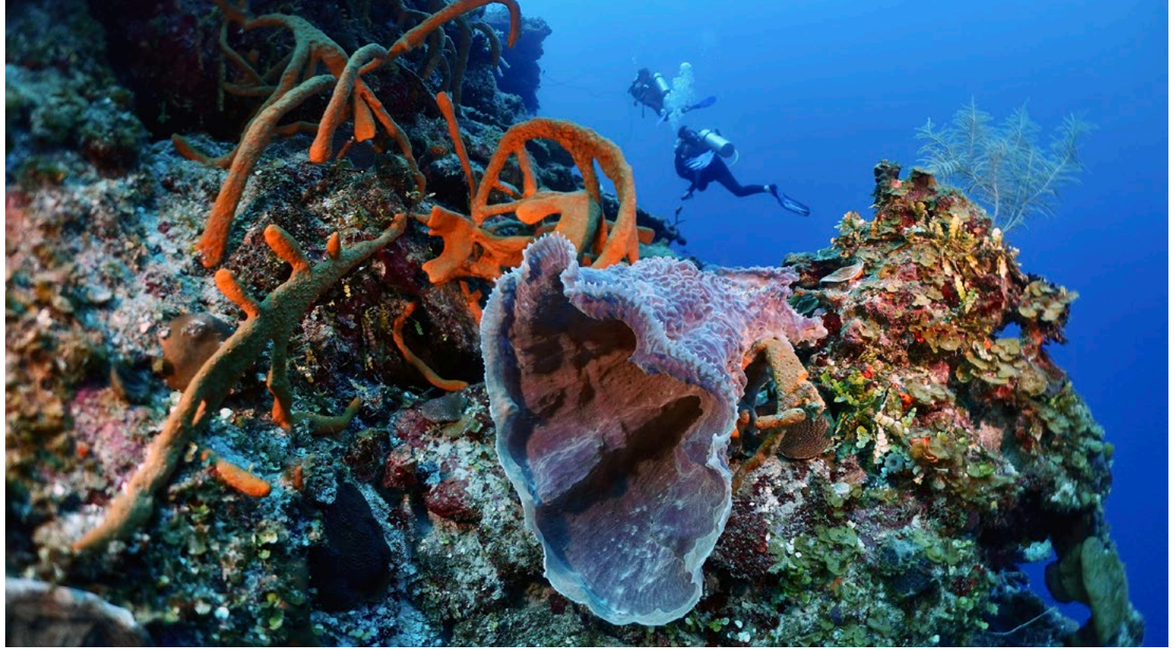
On my first day of diving, the sun was out, the sky was blue, and the bay was like a calm lake with hardly any breeze. A group of 12 American students working in conservation and their university professor joined me on the boat. Without much diving experience, it took them a long time to get ready and get through a "refresher" briefing.

Paraíso Perdido. This dive site was a 25-minute boat ride towards Cabo (Cape) Corrientes, following the coastline of uplifted coral limestone. The water was rather warm at 27°C, so I did not need a shorty.

Visibility underwater was excellent. The offshore reef was surrounded by white sand. The bottom was full of gorgonians (rather brownish in colour) interspersed with pink vase sponges, golden yellow tube sponges, and a few barrel sponges.

Marine life was vibrant. Schools of fish included bluestriped grunt (*Haemulon sciurus*) and French grunt (*Haemulon flavolineatum*) with yellow diagonal stripes. There were Creole wrasse (*Clepticus parrae*), a typical Caribbean species sporting a mix of blue, black, purple, yellow and white. The small but attractive bluehead wrasse (*Thalassoma bifasciatum*) was very active. Marvels included the Spanish hogfish (*Bodianus rufus*), with a purplish-pink top half and a yellow belly. Dorsally black with white diamond shapes and a flashy red belly, the female stoplight parrotfish (*Sparisoma viride*) was a stunner. Purple common sea fans (*Gorgonia ventalina*) abounded. A little school of silvery bar jacks (*Caranx ruber*) with a black stripe on the rear and another one on the lower caudal fin flashed by me.

Acuario. This dive site was a real aquarium, full of life, with a depth of 8m. The smooth trunkfish here (*Lactophrys triqueter*) was exquisite, and so was the elusive French angelfish (*Pomacanthus paru*). There was also the charming four-



Flamingo tongue snails at Patio de Vanessa (top left); Rope and vase sponges at Cabezo de Ludo (top centre); Rock beauty angelfish at Cabezo de Ludo (above); Grey angelfish at Ancla de François (left)

Four-eyed butterflyfish at Patio de Vanessa (above); Tube sponge at Moby Dick (top right); Spotted spiny lobster at Cabezo de Ludo (left)

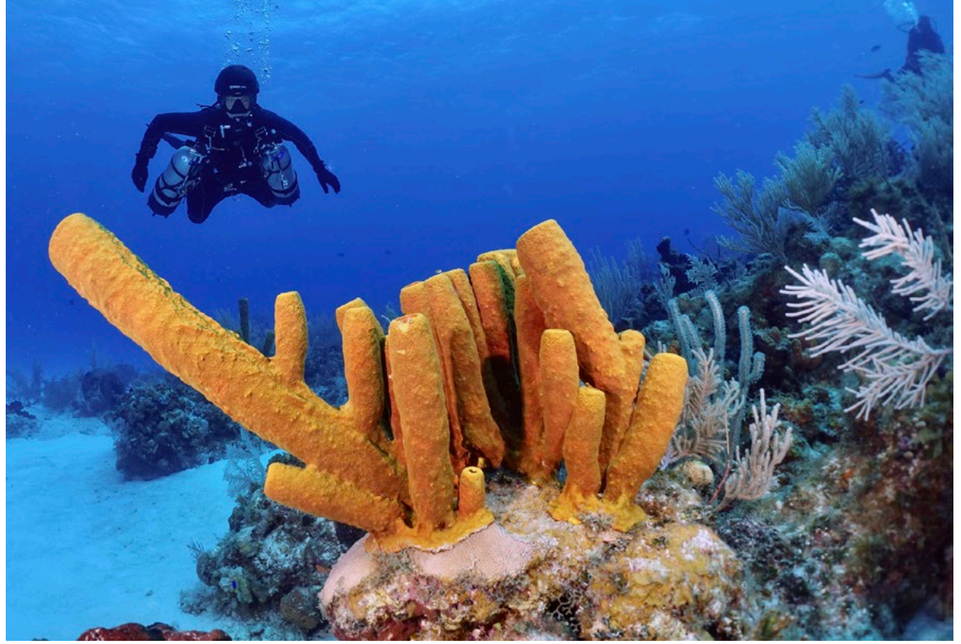
eyed butterflyfish (*Chaetodon capistratus*) with a black spot on the rear end, and the blue tang (*Acanthurus coeruleus*) was rather common.

Almirante. Here, the offshore fringing reef was preceded by a white sandy bottom. I glided over a prairie of garden eels before reaching the drop-off, plummeting into the deep. Orange, purplish-red, or brown filamentous sponges were numerous. Bushes of copper brown to black coral were of good size. A lone great barracuda and a crevalle jack (*Caranx hippos*) cruised by into the blue. At 34m, an attractive porkfish (*Anisotremus virginicus*) with yellow horizontal stripes and double black stripes on a bluish-white face left me breathless. I marvelled at a queen angelfish (*Holacanthus ciliaris*) with its blue and yellow face and waves of yellow-edged scales on its sides. Creole wrasse swimming in formation, streamed by. They were dark blue in the body and black at the head. Bermuda chubs (*Kyphosus sectatrix*) and white grunts (*Haemulon plumieri*) observed us divers with curiosity.

Patio de Vanessa was a shallow dive. I landed on a sea fan that hosted two lovely flamingo tongue snails (*Cyphoma gibbosum*), which were yellowish-orange with angular shapes along the dorsal ridge. The banded butterflyfish (*Chaetodon striatus*) here reminded me of one I saw in the Galapagos. The grey angelfish (*Pomacanthus arcuatus*) looked like a prince.

A short distance from Maria La Gorda, an old cement pier hosted a collection of royal terns (*Thalasseus maxima*) basking in the sun. The beach extended south towards Cabo Corrientes, ending on coral rubble. I entered a forest of Florida thatch palms (*Thrinax radiata*), locally known as *guano de costa*. Turkey vultures (*Cathartes aura*), which were black with a red head, flew back and forth above the coastline. A trail into the palm forest followed the edge of a saltwater lagoon inhabited by caimans. "They are not aggressive!" I was told.

Cabezo de Ludo. Close to Cabo Corrientes, this wall dive was where I encountered a spotted spiny lobster of significant size and a large tiger grouper (*Mycteroperca tigris*).



Nassau grouper (above) and banded butterflyfish (centre) at Ancla de François; Smooth flower coral (left) and lettuce sea slug (bottom left) at Cabezo de Ludo

There was also a rock beauty angelfish (*Holacanthus tricolor*) with a golden yellow head and black body. An eagle ray flew by, and I was pleasantly surprised by a lettuce sea slug (*Elysia crispata*), which was cream-white in colour.

Back on land and rather bored with the food at Maria La Gorda, which had a poor selection, hardly any vegetables and frozen fish for days, I felt the need to drive to a nearby village. The only hiccup was that the car would not start. A passing mechanic found out that the gasoline pump was not working and the battery was flat. I had to call the car rental company in Pinar del Rio for replacement parts, and the assistance truck did not show up until well after dark. But more diving was ahead…

Cadena Misteriosa was another wall dive bordering an inner lagoon. I saw a diamond stingray take off from the sand with a fish on top of it. The yellow-headed wrasse (*Halichoeres garnoti)* caught my attention, and so did the redband parrotfish (*Scarisoma aurofrenatum*).

Upon returning over the top of the reef, we faced a strong current from the south. It was tough going and got us pumping air wildly!

Ancla de François was a shallow and quiet dive site. Rafael, the dive leader, drew attention to a tame juvenile lionfish, then pointed out an awesome juvenile spotted drum (*Equetus punctatus*),

Diamond stingray (above) and yellowfin snapper (top left) at Cadena Misteriosa; Diver with yellow tube sponge (top right) and queen angelfish (left) at Ancla de François

Juvenile lionfish (left), queen angelfish (top left), and longspine squirrelfish on coral bommie (top centre) at Ancla de François; Freshwater sinkhole near the seashore at La Bajada (top right); Endemic Cuban pewee (far right), striated heron (right), and juvenile red crab (above) at Guanahacabibes National Park

which was black and white with an exquisite crescent shape.

Topside foray

As my vehicle was alive again, I finally made it to the village of La Bajada for lunch. Maité's "casa particular" (a private homestay similar to a bed and breakfast – ed.) agreed to prepare a fish dish for me. "You have to wait one hour and 30 minutes," they warned and suggested a dip while I waited. "Follow the track along the seashore to 'Poza de Agua Dulce'." It was a freshwater sinkhole, located on the seashore in Guanahacabibes National Park—a perfect place for a swim. Back at Maité's place, a royal meal awaited: snapper with rice, black beans, vegetables and papaya for dessert!

Cabo San Antonio

Done with my diving at Maria la Gorda, I chose to head to Cabo San Antonio the next day. The western point of Cuba was a 75km drive into the wilderness of Guanahacabibes National Park. Near the visitor's centre at La Bajada, I suddenly came across a migration of red crabs on the road.

"Do you have a spare tyre?" inquired the guide.

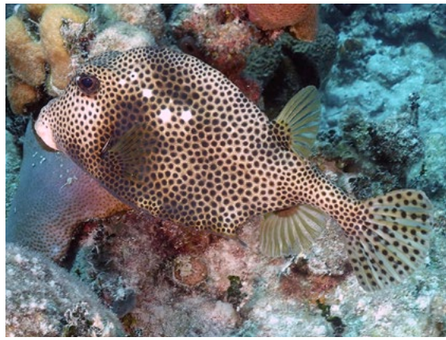
"Well, yes… why do you ask?" I replied.

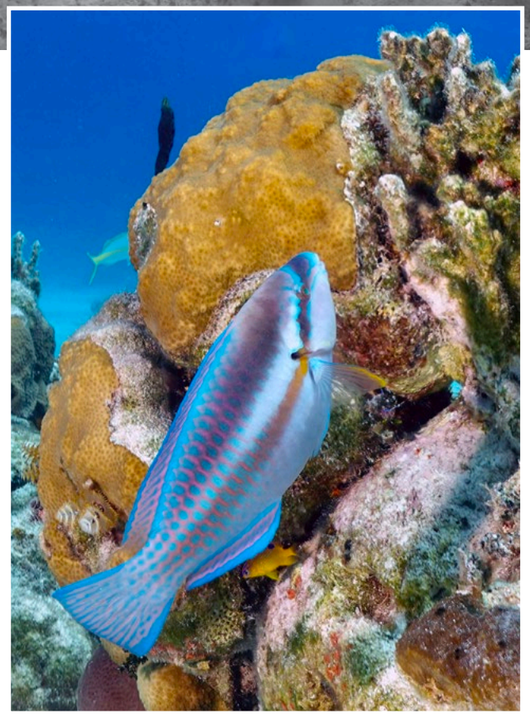
"There is a 50 percent chance that you will have a punctured tyre from one of the crab's claws," said the guide.

It was raining, and so I did not like the idea of getting into trouble. I postponed the trip and instead had a walk in the forest with a local ranger. The endemic birds here were fascinating, including the bee hummingbird (*Mellisuga helenae*), also known as *zunzuncito*; the Cuban emerald (*Riccordia ricordii*), a hummingbird with dark green plumage; the loggerhead kingbird (*Tyrannus caudifasciatus*); and the Cuban pewee (*Contopus caribaeus*). In a shallow cave underground, a Cuban boa (*Epicrates angulifer*), known locally as "Majá de Santa Maria", was on the hunt for bats.

I went back to Guanahacabibes National Park the next day. Wild pigs roamed along

TOP LEFT TO RIGHT: Wreck of a fishing boat at Los Tunneles; Blue-striped grunts and French grunts at Alejo de Moro; Ocean surgeonfish at Cueva de los peces; Spotted trunkfish at Alejo de Moro (below)





Yellowhead wrasse at Los Tunneles (left); Juvenile spotted drum (right), grey angelfish (below), diver with sunken fishing boat (centre) and princess parrotfish (far left) at Alejo de Moro

the roadside, but there were also Desmarest's hutia (*Capromys pilorides*), a fat brown rodent with a face resembling that of a capibara, and white-tailed deer (*Odocoileus virginianus*). I spotted an endemic Cuban iguana (*Cyclura nubila nubile*) basking in the sun on a branch. Caimans floated lazily like wooden logs on the surface of the lagoon.

Cabo Corrientes and Cabo San Antonio were once refuges for British, Dutch and French pirates in the 16th and 17th centuries, including famous British privateers and commanders such as William Dampier, Francis Drake, Henry Morgan, Thomas Baskerville and Thomas Maynard; Dutch privateers Roc el Brasiliano, Alex Oliver Esquemeling, Vaude Vin, Piet Pieterszoon and Lorenzo de Graaf; and French privateers Francis el Olonès, François Leclerc, Roberto Baal and Jacques de Sores. Opposing the rule of Spain and the commercial monopoly of the port of Sevilla, piracy and contraband from corsairs and pirates were the norm back in the day. Several shipwrecks have been found in the area.

On to Vinales and Playa Giron

I returned the car, fearing I would run out of fuel before Pinar del Rio. A few days in Vinales proved great for walks in nature, visiting a tobacco plantation, and tasting a unique rum made of tiny guayaba fruits. Limestone caves included the thrilling Cueva de Palmarito, which was an underground river and lake.

Playa Giron, located on the southern coast, was part two of my trip. A couple of Viazul bus trips via La Habana were needed to get to the destination. Here, a private "casa particular" ran a dive centre from home. Julio, the owner and a bona fide diver, had a long-standing reputation. Personal service at this point in the trip would be more appropriate than a commercial operation. The 67-year-old Juan Carlos, Julio's assistant, showed up in his vintage matte silver car, pulling a homemade trailer.

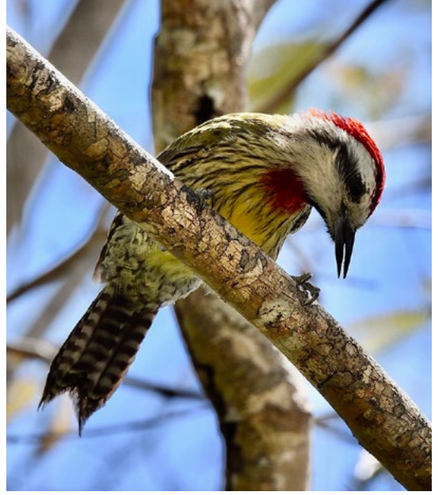
Diver passing between the cave's straight walls at Cueva de los Peces (top left); Azure vase sponge at Los Tunneles (top centre); School of blue tang at Cueva de los Peces (top right); Upside-down jellyfish (above right) and great star coral on reef (centre) at Los Tunneles; Underground river during the dry season in Cueva del Palmarito (left)

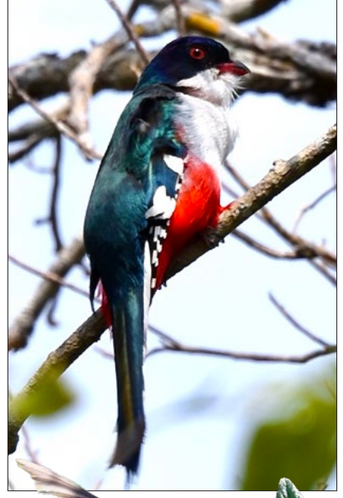
"A Russian Volga, model 1989, the best car in the world!" he boasted. The 35-year-old car had done its time, but Juan was proud of it. "It runs great with a new Hyundai engine!"

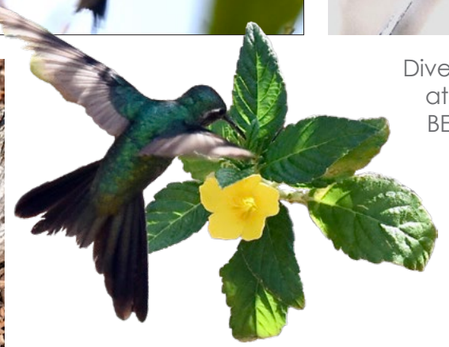
Punta Perdiz. We reached Punta Perdiz some kilometres away, zigzagging between swarms of red land crabs (*Gecarcinus ruricola*). Also known as zombie crabs, four colour morphs distinguish the species: black, red, yellow and green. The crabs head out towards the sea to spawn. Sadly, many are crushed, ending up as a free meal for the turkey vultures. The eggs of zombie crabs hatch in the sea, where the larvae live as plankton and return to land as megalopa (post-larvae).

Playa Giron. In Playa Giron, diving is shore-based. Divers get ready on the uplifted limestone shelf, jump into the sea, and swim 100m to 150m out over the sandy shallows. Sea surface conditions are usually perfect, but it can be rough if the wind blows.

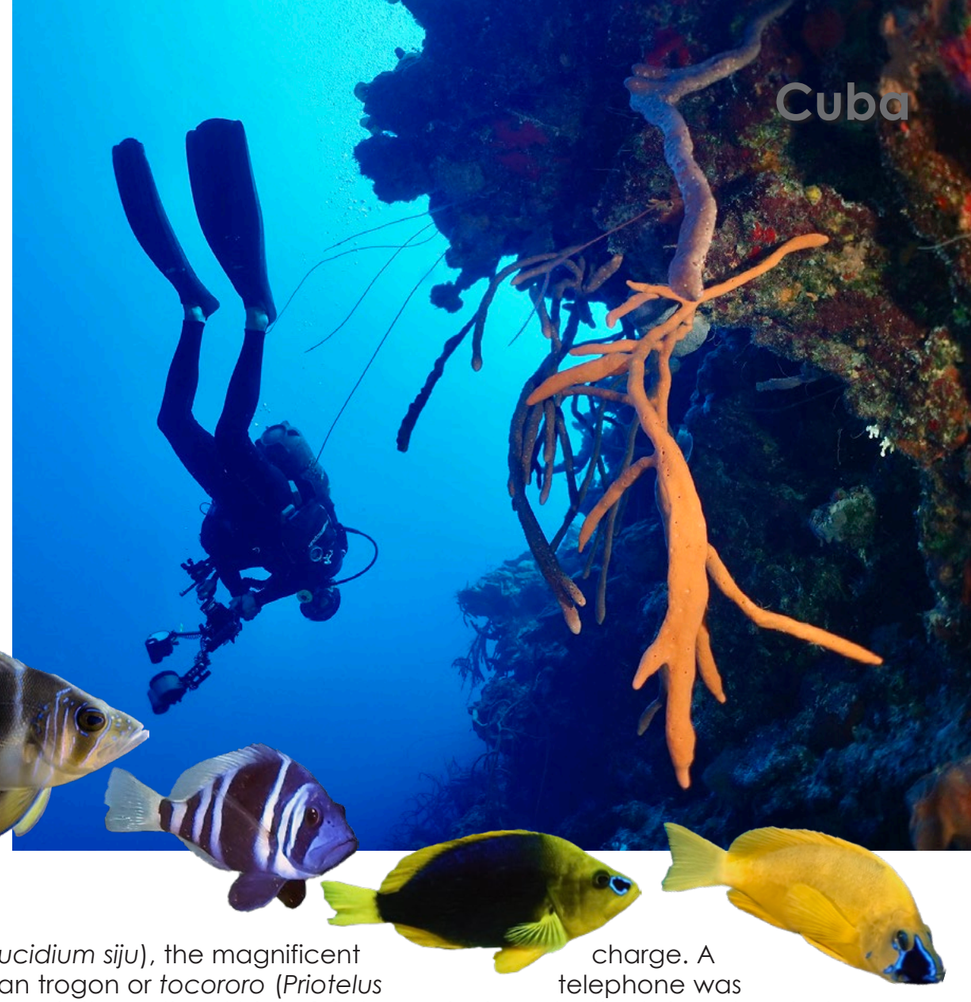
Dressed in his 7mm wetsuit, Julio took me straight to the drop-off. I wore only a pair of shorts because the temperature was a balmy 27° to 28°C. The visibility was good, and the slope was full of purple, blue and red filamentous sponges, orange sponges, vase sponges, and the classic yellow tube sponges. There was little fish life, however. "People have to live, you see," I was told. We passed by a sunken fishing boat, upturned, where







Diver with rope sponges at Los Tunneles (right). BELOW LEFT TO RIGHT: Barred hamlet at Cueva de los Peces; Indigo hamlet, shy hamlet and golden hamlet at Los Tunneles



Endemic birds (top left to right) Cuban pygmy owl, Cuban green woodpecker, Cuban trogon and Cuban tody in forest near Playa Giron; Demarest's hutia (above) and Cuban emerald hummingbird (centre) at Playa Giron

two big Santoyo crabs (*Mithrax spinosissimus*) with impressive claws hid.

A grey angelfish cruised by as I sank to a depth of 27m, and a large cubera snapper

Male stoplight parrotfish at Alejo de Moro and female stoplight parrotfish at Cueva de los Peces

(*Lutjanus cyanopterus*) was inquisitive. A spiny lobster was on the lookout at the entrance of a hole. A blue and white spotted cleaner shrimp with long claws (*Periclimenes yucatanicus*) danced in its anemone.

Depending on the weather, Julio took me to dive sites with canyons and swim-throughs at depth. It was an opportunity to explore a family of fishes that was new to me. The *Hypoplectrus* genus has no less than 18 species. Related to groupers (Serranidae), these "hamlets" are small in size and have a distribution from the Bahamas to Yucatán. I got shots of the indigo hamlet (*Hypoplectrus indigo*); the shy hamlet (*Hypoplectrus guttavarius*), which was yellow-headed with a brownish-black body; the golden hamlet (*Hypoplectrus gummigutta*), which was all yellow with a blueish-black mask; and the barred hamlet (*Hypoplectrus puella*), which had greyish-brown stripes. The butter hamlet (*Hypoplectrus unicolor*) was cream-white in colour.

Cueva de los Peces is a so-called cave dive. Hardly 100m from the seashore, this waterhole has freshwater above and saltwater below. A tectonic fault running along the coast connects different cenotes. Plummeting to a depth of 70m, this dark abyss between straight walls had no appeal for me as someone who has enjoyed the magnificent cave diving in Yucatán.

More rewarding was a stroll in the forest with experienced birdwatcher Leoncio. It allowed one to see the endemic Cuban pygmy owl (*Glaucidium siju*), the magnificent Cuban trogon or *tocororo* (*Priotelus temnurus*), the national bird of Cuba, and the ravishing Cuban tody or *cartacuba* (*Todus multicolor*), which was apple green, white and red. In a cave full of Jamaican fruit bats (*Artibeus jamaicensis*), a Cuban boa was stalking in the darkness.

Cuba's natural world is full of unexpected wonders, one just needs a little bit of time and dedication to discover them.

Towards the end of my trip, I was at the Cienfuegos bus station, waiting for the Viazul bus to Trinidad. The hall was crowded with noisy people talking loudly on their cell phones. Some people were even shouting in the background. A local bus had been cancelled, so passengers were gathering angrily around a man in charge. A telephone was ringing relentlessly in a deserted office. It all sounded like a madhouse. A compassionate Cuban suddenly leaned towards me and whispered, "Sorry, Señor. This is Cuba… it's complicated." ■

With a background in biology and geology, French author, cave diver, naturalist guide and tour operator Pierre Constant is a widely published photojournalist and underwater photographer. Visit: ***calaolifestyle.com****.*

SOURCES:
ITURRALDE-VINENT MA, GARCÍA-CASCO A, ROJAS-AGRAMONTE Y, PROENZA JA, MURPHY JB, STERN RJ. 2016. THE GEOLOGY OF CUBA: A BRIEF OVERVIEW AND SYNTHESIS. GSA TODAY. 26(10).
WIKIPEDIA.ORG

POINT & CLICK ON BOLD LINKS

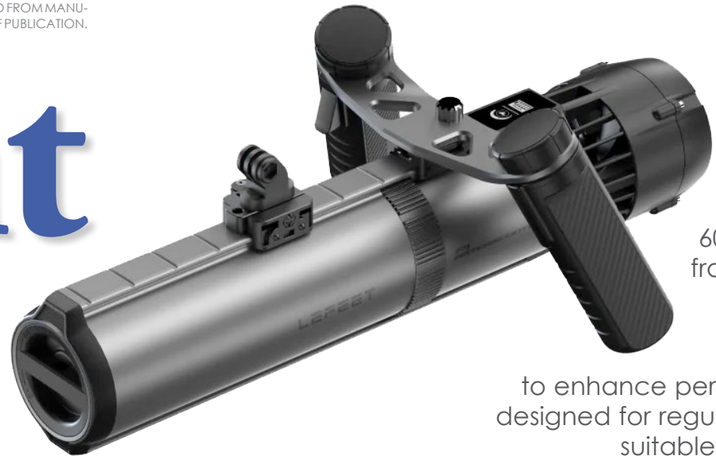
Equipment

Edited by
Mats Gunnarsson
and Peter Symes

PHOTOS COURTESY OF THE MANUFACTURERS

Cressi Digi 2

The Digi 2 is a compact digital pressure gauge and bottom timer with additional features. It is equipped with a user-changeable battery that can last for 700 dives over a year. The device features a luminescent display that shows the current tank pressure, temperature, dive time, current depth, and maximum depth. It also alerts the diver about the remaining time they can spend at the current depth before the pressure in the cylinder drops to 50 bar. Its depth range is 0-120m. **cressi.com**



Lefeet P1 Scooter

The P1 model is larger but about 10 percent lighter than the S1 model, weighing 2.3 kg. The significant difference lies in the performance. The maximum depth has increased from 40 to 60m, and the running time has increased from 35 to 60 minutes for the base model, while the top speed has increased from 1.8 to 2.0 m/s. Similar to the previous model, two scooters can be linked to enhance performance on the surface. The scooter is designed for regular sport divers and freedivers and is not suitable for towing technical divers. **lefeet.com**

Suunto Ocean

Diving and sports converge effortlessly with the Suunto Ocean, featuring contemporary Finnish design and premium features tailored for diving, sports and all adventures in between. Dive modes range from simple single gas for recreational diving with nitrox support to multiple gas support for technical diving. Additionally, it offers over 95 standardised sports modes, GPS, barometer, offline maps, advanced sports training features, wrist heart rate monitoring, and activity tracking for daily use. To enhance safety during dives, Suunto Ocean offers a comprehensive selection of customisable sound and vibration alarms. **suunto.com**

Dynamic Nord Camo

The new SFS-3 and SFS-5 apnea suits have been specially designed for freediving but can also be used for scuba diving. They come in 3mm and 5mm neoprene thicknesses and are made with high-quality Yamamoto #39/45 limestone neoprene. This material is known for being lightweight and flexible. These suits provide exceptional comfort, flexibility, and maximum thermal insulation. They fit snugly like a second skin due to their open-cell design. **dynamicnord.com**

Ratio iX3M 2 GPS Tech+

This dive computer has integrated GPS navigation. Just set a position, and the iX3M 2 will guide you there. The state-of-the-art Global Navigation Satellite Systems (GNSS) can use all types of satellite systems, including GPS, GLONASS, BeiDou, and Galileo. Mark a point by pressing a single button on the iX3M2's main screen and save it to memory. The iX3M 2 can take you to that point via the new navigation screen. It shows you not only the direction but also the distance from the point. The new interface provides a very good user experience. The iX3M 2 has a clear interface and a huge display—the largest in its category. You do not need your reading glasses to read this one under the surface. **ratio-computers.com**

Atomic Aquatics B2x

According to the manufacturer, the B2x achieves a remarkable balance by merging Atomic Aquatics' distinctive second-stage design in titanium with a first stage featuring a sleek, black diamond-like carbon (DLC) over chrome plating. By utilising the DLC process, B2x achieves very good friction properties not found in a standard brass regulator. This provides good durability and corrosion resistance without compromising the function of the first stage. DLC coating provides 16 times more protection than raw metal alone. The B2x is equipped with a stainless-steel comfort swivel with black coating, allowing 30 degrees of rotational movement without bending or kinking the hose. **atomicaquatics.com**

books &media

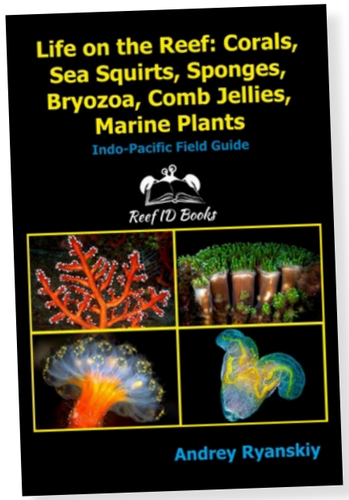
Edited by
Peter Symes

Cenotes

Light in the Underworld: Diving the Mexican Cenotes, by Martin Broen

This book by Martin Broen, with a foreword by Alex Mustard and introduction by Paul Nicklen, takes readers into the captivating underwater caves and cenotes of Mexico's Yucatán Peninsula. Broen's stunning photographs and engaging text reveal over 250 cenotes, showcasing their dramatic and beautiful features. The book highlights the unique aspects of these ancient time capsules and their critical environmental role today. Contributions from Mustard and Nicklen add depth to this extraordinary journey, making it a must-read for divers, cavers and explorers.

Publisher: Rizzoli New York
Date: 17 September 2024
Hardcover: 160 pages
ISBN: 978-0-8478-3090-9

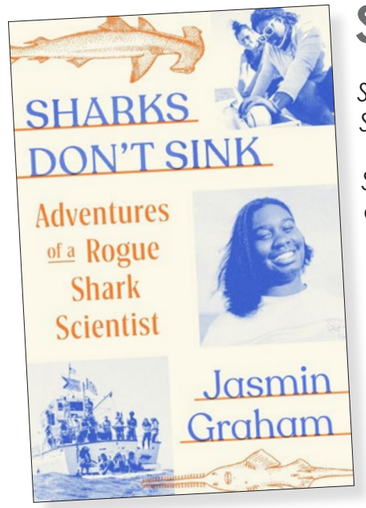


Reef Life

Life on the Reef: Corals, Sea Squirts, Sponges, Bryozoa, Comb Jellies, Marine Plants Indo-Pacific Field Guide, by Andrey Ryanskiy

This book covers the critical features of corals, sponges, bryozoans and sea squirts, emphasising their importance in the underwater environment. It explores habitats of nudibranchs, shrimps and fish, and is essential for experts. Ideal for scientists and reef conservationists, the book provides an in-depth examination of the benthic community, incorporating the latest scientific findings and taxonomic classifications. With a strong focus on corals and anemones, it fills a significant gap left by the lack of updated guides over the past two decades. Part of the Reef ID Books series, this publication is an invaluable resource for understanding and conserving reef ecosystems.

Publisher: Andrey Ryanskiy
Date: 14 May 2024
Hardcover: 226 pages
ISBN-13: 979-8986828732

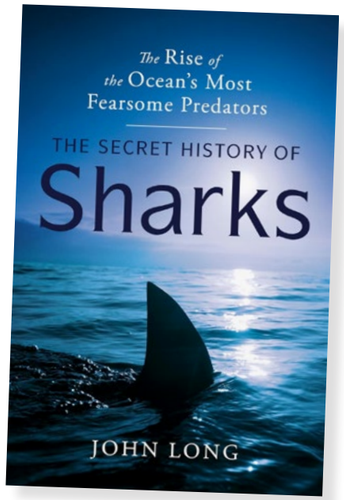


Sharks

Sharks Don't Sink: Adventures of a Rogue Shark Scientist, by Jasmin Graham

Sharks Don't Sink by Jasmin Graham chronicles her journey as a young Black scientist challenging traditional academia to pursue her passion for sharks. Drawing lessons from these ancient creatures, Graham founded Minorities in Shark Sciences (MISS) to support women of colour in marine sciences. Her memoir highlights sharks' resilience and parallels it with the struggles faced by marginalised communities. It is a story of science, social justice and the transformative power of empathy and determination.

Publisher: Pantheon
Date: 16 July 2024
Hardcover: 224 pages
ISBN: 9780593685259

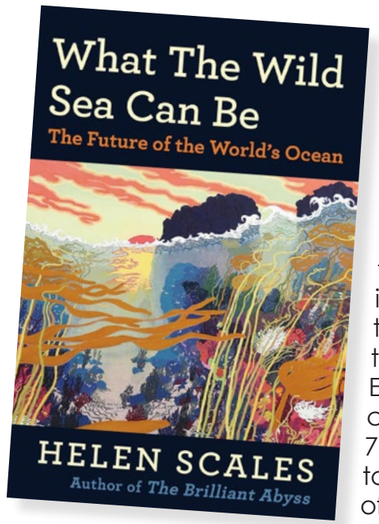


Shark Evolution

The Secret History of Sharks: The Rise of the Ocean's Most Fearsome Predators, by John Long

This book by John Long traces the 500-million-year journey of sharks, showcasing their survival through mass extinctions and modern threats. This thrilling narrative reveals the ancient and enigmatic evolution of sharks, highlighting their unique adaptations. From 30ft giants with saw-like jaws to the fearsome megalodon, Long's discoveries span all continents and offer new insights into these fascinating creatures. The book also addresses contemporary issues, including threats to sharks and their role in medical science. With vivid storytelling and scientific depth, Long redefines our understanding of sharks as nature's ultimate survivors.

Publisher: Ballantine Books
Date: 2 July 2024
Hardcover: 480 pages
ISBN: 9780593598078



Oceans

What The Wild Sea Can Be: The Future of the World's Ocean, by Helen Scales

Helen Scales, marine biologist and author of *The Brilliant Abyss*, delves into the ocean's existential threats and offers cautious optimism for its future. She connects the ocean's deep history to today's ecological patterns, highlighting the struggles of marine life amid warming seas. Emperor penguins and sharks face significant challenges, with shark populations decreasing by 71 percent since the 1970s. Orcas also suffer from toxic pollution. Yet, Scales points to the recovery of seagrass meadows and kelp forests as positive signs. She stresses the need for sustainable fisheries and warns against deep-sea mining, urging us to protect and preserve our oceans.

Publisher: Grove House
Date: 17 July 2024
Hardcover: 227 pages
ISBN-10: 366268375X
ISBN-13: 978-0-8021-6299-1

MAL B / FLICKR / CC BY-ND 2.0

Dive Culture Confusion

How Passive Group Response Can Suppress Individual Action

Text by Simon Pridmore

What happens when confusion hits a group of divers during a dive trip? Simon Pridmore takes a closer look and offers insights and advice to keep you diving safely.

A friend recently sent me a detailed account of the Red Sea dive trip he joined in 2022. Lots of people send in "it happened to me" stories. They have read my books and know I like tales like this. I dissect them, feast on them, and then regurgitate them as magazine articles or newsletter anecdotes with the idea that divers might learn something from them.

Some reports tell the story of a problem-free fortnight in paradise, extolling the virtues of a destination or dive operator. Others talk about a dive that went wrong or a dive centre that did not live up to expectations.

And then, there are the stories that seem relatively unexciting at first but open an entire Pandora's box of issues when you delve deeper. These are the stories I enjoy the most, and this one is an excellent example.

The first trip in a long time

In 2022, the Covid-19 pandemic was starting to fade, and the scuba diving industry was emerging from two years of inactivity. Twenty friends from the United States and Canada, who travelled regularly as a group and had logged many dives together over the years, met up in Egypt for a liveaboard trip. Most had not been diving for over two years.

They were an experienced bunch. Seventeen of them had over a thousand dives, five were rescue divers, four were also divemasters, and one was also an active instructor. They considered themselves well-trained and self-sufficient. They normally dived with liveaboard operators who maintained high standards of service and were used to catering to customers from North America.

As soon as the divers arrived, they quickly discovered that the particular


LARS PLOUGMANN / FLICKR / CC BY-SA 2.0

Red Sea liveaboard they had chosen was not accustomed to working with North American divers, as the boat cylinders provided for them were mostly 15-litre cylinders fitted with DIN-style valves. This caused some consternation as the group was used to diving with 12-litre cylinders, and all but a few of them had regulators with yoke-style first stages.

The boat crew responded well and managed to source enough smaller cylinders and screw-in DIN to yoke valve adapters to equip the entire group. Nevertheless, this took a while. Night had fallen by the time everything had been sorted out, all the divers had set up and dry-tested their gear, and the boat could finally depart. During the process, one diver needed a cylinder O-ring to be replaced, but apart from that, there were no other significant issues, and they went to bed happy that the problem had been overcome.

Dive day 1

The following day, on the first dive, one of the divers entered the water and began his descent. Almost immediately, he heard the sound of rushing bubbles behind his head and resurfaced in a whirlpool of foam. He signalled to the crew and reboarded the dive boat while his buddy waited patiently at the surface.

The crew tried reseating the regulator first stage on the cylinder valve, assuming the diver had not attached it properly, but that did not help. The valve still leaked. They then removed the DIN to yoke valve insert, replaced it with another one and fitted the regulator again. The subsequent hissing sound told them that this had not solved the problem either, so they took the valve insert out again and replaced the diver's regulator with one of the liveaboard's regulators, which had a DIN first stage. This worked perfectly; the diver rejoined his patient buddy, and they had a great, though somewhat shorter, dive.

Dive day 2

On dive day 2, four more incidents occurred where cylinder O-rings blew while the divers were underwater. Each time, air would start pouring out of the cylinder valve, and when the divers glanced at their pressure gauges, they could see their remaining air pressure dropping quickly.

One incident took place at a depth of around 22m and, with air running out fast, the diver went to share air with the divemaster. However, during their air-sharing swim back to the boat, the mouthpiece came off the second stage of the divemaster's octopus, and they had to buddy-breathe, taking turns on the divemaster's primary second stage all the way to the surface. Fortunately, the diver, in this case, was experienced enough to stay calm and had no problem performing this impromptu test of a rarely practised skill.

In addition to the interrupted and aborted dives, there were also numerous instances where diving was delayed by O-ring failures on the dive deck while divers were gearing up or waiting at the surface for their team members to join them.

The group was rattled by this succession of problems. What could be behind this rash of incidents? Was it a single problem, or was it a coincidence of multiple issues, such as human error, faulty valve inserts, poor quality O-rings, or damaged regulator fittings?

Small groups formed during surface intervals to share opinions and experiences, and a couple of the divers brought the issue up with the liveaboard divemasters, asking them what they thought the problem was and how it could be solved.

Still, the diving continued. At some point, there was a shift in mindset. Instead of being completely surprised by the fact that their O-rings kept failing, the divers began to expect that it would happen. They started staying much closer to each other during the dive, always bearing in mind that at any moment, they might have to abort the dive when (not if) their cylinder O-ring blew. Even those who would normally swim away from the group on their own resisted the urge and hung around the group instead. Everyone was also more rigorous about keeping an eye on buddies and other teams for issues.


MOHAMED EL-GAYAR / FLICKR / CC BY-NC-ND 2.0

Dive day 3

The next day, there were two further cases of a valve O-ring failing, leading the diver to abort the dive immediately. At the end of that day, with plenty more diving to come and some deeper dives, the group came up with a plan. They searched through all the personal save-a-dive kits they had brought with them on the trip, assembled all the cylinder O-rings they could find and asked the crew to replace the boat's valve face O-rings with these.

That did the trick. The issue was immediately resolved. There were no further O-ring failures either on deck or underwater for the remainder of the voyage.

More than just a story

Those eventful three days at the start of the trip produced plenty of drama, but fortunately, no one was hurt. However, I think the story is more than just an entertaining anecdote. It also raises some noteworthy points and questions.

As I write this with the benefit of hindsight (and as you read this from your armchair, desk, train seat or bathtub), it is easy to see immediately what the problem was and wonder why this group of divers acted the way they did and why it took them so long to fix it.

Looking back, the people involved have been asking themselves the same questions. These were experienced divers. However, if we had been in their position, in that combination of unusual circumstances, who is to say that we would not have done exactly the same as they did?

The key issues

It is useful to summarise and expand on a few points. There seems little doubt that a major factor at play


DEREK KEATS / FLICKR / CC BY 2.0

here was the long Covid-19 hiatus, which had made everyone rusty, both the dive crew and the divers.

Poor advance communication between the operator and the customer's agent meant that the liveaboard cylinders were incompatible with the divers' equipment. The liveaboard was not prepared for a group with yoke-fitted regulators, and the divers were not prepared for DIN valves.

A dive operation that uses DIN valves and usually caters to divers with DIN-fitted first-stage regulators will certainly have a good supply of the fat O-rings (112s) that fit onto a DIN first stage and the inner end of DIN-yoke converter valve inserts. But they will rarely use the thinner O-rings (014) that fit on the face of the yoke valves and the outer (regulator-facing) end of the valve inserts, so they may well have very few of these to hand.

All O-rings can deteriorate, split, and blow at any time, but usually, valve face O-rings will leak for a long time before they split, and dive operators usually replace leaky O-rings before they fail. This is why it is rare that divers ever experience an

PBSOUTHWOOD / WIKIMEDIA / CC BY-SA 4.0

Dual DIN connection cylinder valve.

underwater O-ring failure. It is so vanishingly rare (it has only happened to me twice in many thousands of dives) that, as seems to have been the case here, divers come to expect that it will never happen, are shocked when it does, and stunned when it happens time and time again.

Wherever the liveaboard rustled up the O-rings from at short notice, the two-year Covid-19 hiatus may have had an impact on their condition. O-rings do not get rusty (unlike divers), but they will dry out and become stiff and brittle if they remain unused for too long.

When a valve face O-ring blows, the air pours out fast, as these divers discovered. A full cylinder will empty in less than two minutes, irrespective of how deep you are.

After the first incident, it should have been clear what the problem was, but the response to every incident for the first three days was just to replace the broken O-ring and move on. Everyone concerned, both divers and crew, was reacting to what was happening rather than thinking about what was causing it and how to prevent it.

During this time, although it was recognised that the problem was systemic, nobody involved treated it as such. Each emergency was handled in isolation. An incident that both the divers and the liveaboard staff would have rightly considered before the trip to be extraordinary quickly became normal.

Neither did anyone act to source a new batch of O-rings from elsewhere, perhaps even from another liveaboard, when the opportunity arose. Rather than figure out a solution, the group members collectively changed their diving behaviour, anticipating that they might at any moment need assistance from their buddy or the divemaster and have to get to the surface quickly.

None of the group members refused to continue to dive once it was obvious that the O-ring failures were taking place at an extraordinary rate, despite the greater-than-usual risk that on every dive, they might have to perform an emergency abort.

It was only after three days that the dive group finally decided to act and try using the stock of spare O-rings that they had brought with them on the trip. The fact that many of the divers had brought their own supply of spare cylinder O-rings suggests that, on some level, they were expecting to have to use them in an emergency, but somehow, despite

LARS PLOUGMANN / FLICKR / CC BY-SA 2.0

encountering exactly the sort of emergency they had prepared for, it took three days before they deployed them.

Some of the why's

I have come up with a few possible reasons why the group floundered and failed to respond and resolve the problem more quickly. An expert in human behaviour would no doubt have more informed thoughts, but this is my take.

The divers were used to a high level of customer service on the liveaboards they chartered. They expected that the boat crew would solve—even over-deliver on—the problem. However, the crew seemed content just to continue to deal with each emergency as it arose.

The cylinder and valve mix-up at the beginning of the trip and the difference in dive cultures led to confusion on both sides and a lack of trust.

A group dynamic seemed to override individual action. It is unlikely that each buddy team acting alone would have delayed so long in taking the right course of action, particularly as they were armed with their own O-rings.

The group response was initially passive, whether because the divers were rusty, distracted by the chaos on day one, jet-lagged or for some other reason. At least one person pointed out that they did not want to miss a dive after such a long period off.

This passive group response was so powerful that it suppressed individual action and normalised a situation where the divers were at greater risk.

A few recommendations

- To avoid last-minute surprises like this, maintain good communication with the dive operator or make sure that your tour leader does.
- Do not be overly dependent on any one operator, and never back down on safety issues.
- Travel with a save-a-dive-kit that includes cylinder O-rings.
- Deploy your save-a-dive kit when necessary.
- Seek advice, but think for yourself.
- Know that the group is not always right. Lead by example.
- If something is going wrong with the diving, take a break. Dive another day. ■

TRIDENT / AMAZON

Trident Save-A-Dive O-ring kit

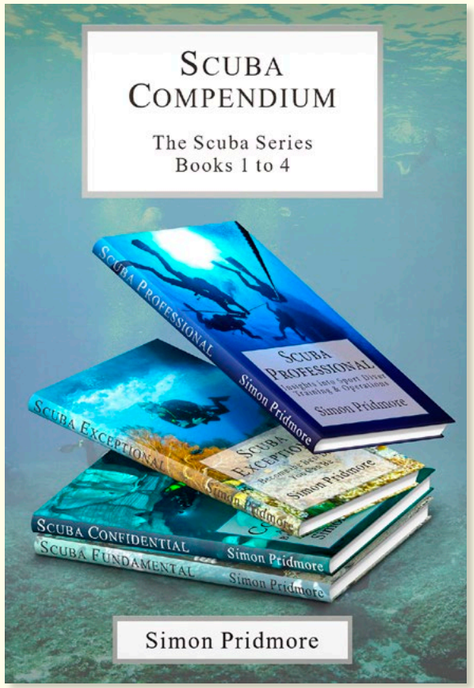
NEW 4 in 1!

Simon Pridmore has released a new single-volume e-book, bringing together four books in his bestselling *Scuba* series:

- ***Scuba Fundamental – Start Diving the Right Way***
- ***Scuba Confidential – An Insider's Guide to Becoming a Better Diver***
- ***Scuba Exceptional – Become the Best Diver You Can Be, and***
- ***Scuba Professional – Insights into Sport Diver Training & Operations***

As Simon puts it, this is "a remastering and repackaging of the original albums rather than a greatest hits." Nothing is missing. *Scuba Compendium* gives e-book readers the advantage of being able to access all the knowledge contained in the four books in one place, making this a unique and easily searchable work of reference for divers at every level.

Simon has always promoted the idea of safer diving through the acquisition of knowledge, which is why he has chosen to release this highly accessible version. If you have read his work before, you will know that he provides divers with extremely useful advice and information, much of it unavailable elsewhere; his points often illustrated by real life experiences and cautionary tales. He examines familiar issues from new angles, looks at the wider picture and borrows techniques and procedures from other areas of human activity.



E-book File Size: 5298 KB
Published by Sandsmedia
Sold by: **Amazon**, **Kobo**, Tolino & others
ASIN: B09DBGHJSC

simonpridmore.com

Simon Pridmore is the author of the international bestsellers Scuba Fundamental: Start Diving the Right Way, Scuba Confidential: An Insider's Guide to Becoming a Better Diver, Scuba Exceptional: Become the Best Diver You Can Be, *and* Scuba Professional: Insights into Sport Diver Training & Operations, *which are now available in a compendium. He is also the co-author of the* Diving & Snorkeling Guide to Bali and the Diving & Snorkeling Guide to Raja Ampat & Northeast Indonesia. *His recent published books include* The Diver Who Fell From The Sky, Dive into Taiwan, Scuba Physiological: Think You Know All About Scuba Medicine? Think Again! *and the* Dining with *Divers series of cookbooks. For more information, please visit his website at:* ***SimonPridmore.com.***

Epaulette Sharks

Walking Sharks of Papua New Guinea

Papuan epaulette shark, Loloata Island, Papua New Guinea. Found in shallow coastal reefs in the Coral Triangle, epaulette sharks are small, nocturnal predators.

Text and photos by Andy Murch

Having photographed most of the sharks and rays that can be seen on scuba around the world, Andy Murch is doggedly pursuing the remaining few. Recently, his elasmobranch obsession took him to Papua New Guinea, where he hoped to find three endemic species of epaulette sharks.

Sometimes referred to as "walking sharks" because of the way they use their pectoral fins to clamber over the substrate, epaulette sharks are small, nocturnal predators that inhabit shallow inshore reefs within the Coral Triangle of Indonesia, northern Australia, and Papua New Guinea (PNG). Not far from world-renowned Raja Ampat, PNG is blessed with its fair share of coral-encrusted reefs, crowded with tropical fishes and exotic invertebrate life. The country's best diving is concentrated around its offshore coral bommies, but PNG's shallow inshore reefs are also worth exploring, especially if you are looking for epaulette sharks.

Sadly, rising sea temperatures have led to coral bleaching in some inshore areas. Combined with highly destructive dynamite fishing and toxic run-off from strip mining that poisons and clogs the reef, PNG's coastal habitats have seen better days. Unsurprisingly, all three of the country's endemic epaulette shark species are listed as "vulnerable" by the IUCN, so I was particularly keen to give them some time in the spotlight.

On to Tufi

After a gruelling 62-hour journey from Vancouver Island in British Columbia, Canada, to Tufi Resort on the remote eastern tip of PNG, I dropped my bags, threw my camera together, and stumbled down to the dive shop to enquire about a night dive.

Walking Sharks

Leopard epaulette shark (*Hemiscyllium michaeli*). Tufi, Papua New Guinea. This species is confined to a short stretch along the coast at this end of the country. Epaulette sharks are sometimes referred to as "walking sharks" for the way they use their pectoral fins to scrabble over the reef or sea bottom.

With dusk fast approaching, the dive shop manager immediately began rallying spotters to help me look for a leopard epaulette shark (*Hemiscyllium michaeli*), a species that is confined to a short stretch of coastline at this end of the country.

Diving

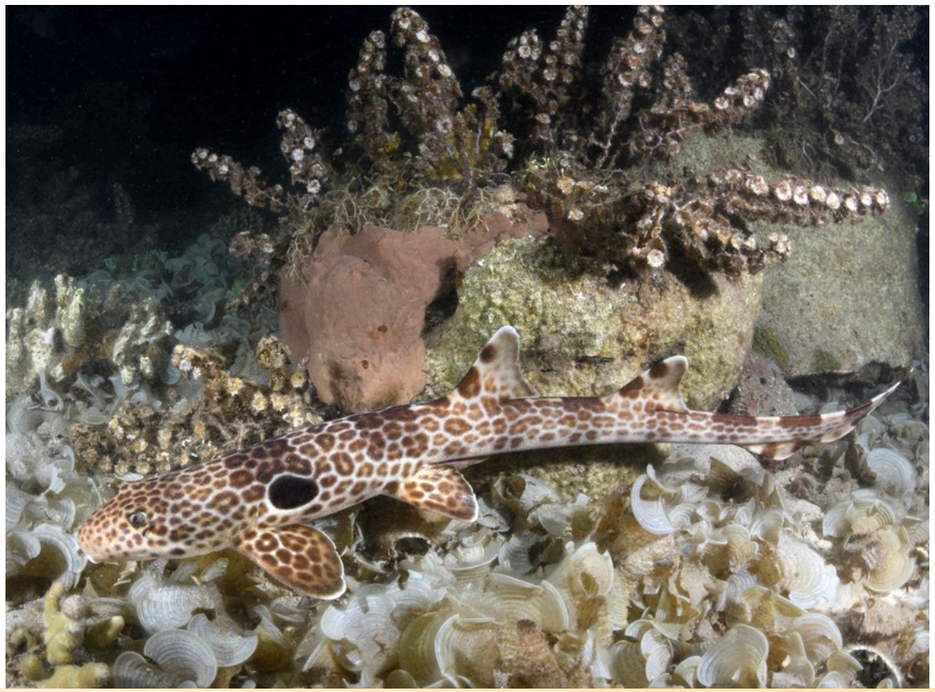
Slipping off the dock just after sunset, we levelled out at 6m and started scanning. Like most house reefs, Tufi's check-out site was a bit scruffy, but the further we kicked from the dock, the healthier the corals appeared.

Under the cover of darkness, the night shift had already clocked in. Painted spiny lobsters waved their antennae wildly as if conducting invisible orchestras, and a variety of nocturnal crab species scurried about, nipping at anything potentially edible in their path.

The pre-show was fun to watch, but 45 minutes in, we still had not seen any walking sharks. During the kick back to the dock, I finally glimpsed the sinuous outline of a tiny shark, visible for a tantalisingly brief moment as it wriggled between two plate corals and disappeared into the inner sanctum of the reef. There was no way I could get a shot, but it was reassuring to see one firsthand.

The following night, we took a small skiff to the far side of the bay, where mangrove roots reach down to the shallowest corals, creating a shady haven for walking sharks and other light-averse creatures of the night. Sure enough, this turned out to be a far more productive spot. Within minutes of descending, one of the spotters frantically signalled me with his light, then pointed to an eel-like shape slowly making its way across a patch of hard corals. Carefully sinking down beside it, I was able to compose a short series of shots before it found a hole in the coral canopy and disappeared. Success!

The next one I stumbled upon took off like a mako, but the third was more relaxed, giving me time to enjoy its beautiful leopard-like markings. One species down, two to go.

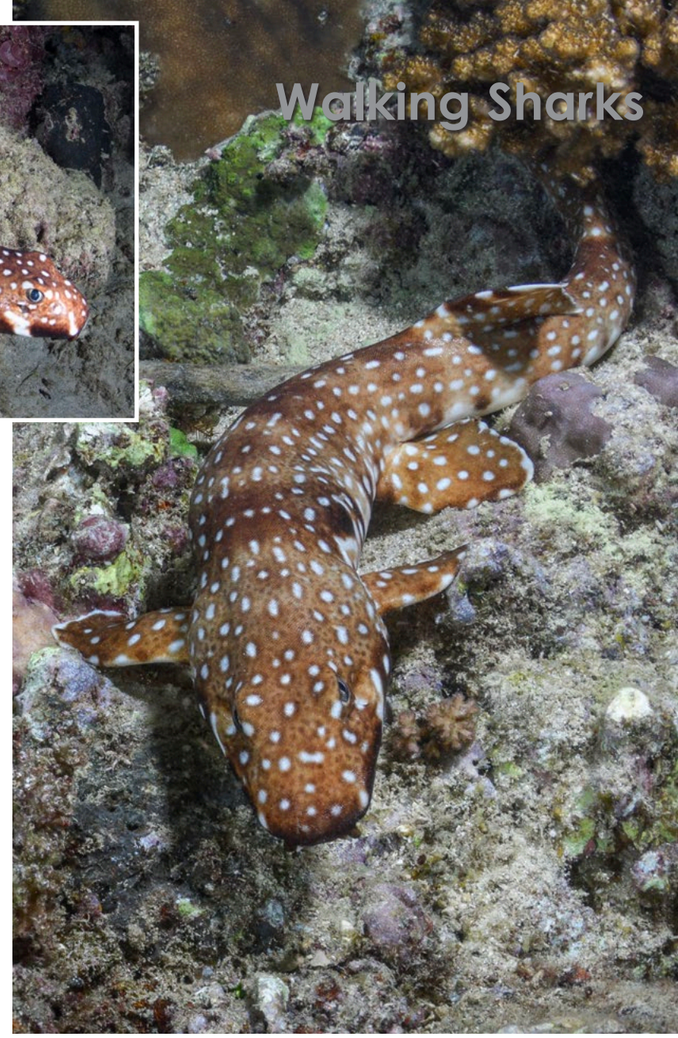


On to Madang

With no time to linger, the next morning, I hopped on a flight back to the capital and caught another to Madang on the north coast of PNG. A decade ago, Madang was a highly regarded destination among adventurous, in-the-know divers. Sadly, the region has since developed a reputation for tribal unrest and violent crime. Numerous people on the flight cautioned me to be extra careful. One local even went so far as to tell me that I should be fine as long as I did not leave the airport compound!

A shrewder diver might have steered clear, but Madang is the only place where it is possible to see the hooded epaulette shark (*Hemiscyllium strahani*), so I was determined to give it a try. To make

Hooded epaulette shark (*Hemiscyllium strahani*), Madang, Papua New Guinea. A larger species of walking shark, it has a reddish-brown torso dotted with bright white spots and blends into its rocky environment.



matters worse, the only dive shop in Madang had been closed since the pandemic. However, when I contacted the owners before I left for the trip, they were kind enough to arrange for a small cargo boat to take me to the outer reef and supply me with a couple of tanks.

At sunset, I carried my gear out of the hotel compound, trying to look as confident, inconspicuous and un-muggable as possible—not easy to do while wearing a neoprene suit and carrying a large underwater camera. Thankfully, it was only a short walk to the boat dock, where I was met by three local boatmen who directed me to their tiny banana boat.

On the way out to sea, we stopped at a small island to pick up a fourth crew member, which seemed like overkill, but they explained to me that they needed at least four guys sitting in the boat while I was underwater to avoid being attacked by machete-wielding pirates. As I absorbed this information, my eyes wandered to the now menacing-looking campfires I could see on the shoreline of the otherwise deserted islands we were passing.

Diving

After another 30 minutes, we arrived at a spot that the dive shop owners had said was a good place to look for walking sharks. Gearing up, I fell in and swam down alone to explore the terrain. Compared to Tufi, there were far fewer hard corals here, but the rocky substrate had an attractive purple hue and there was no shortage of fish life. It took less than a minute to spot my first hooded epaulette shark, a larger species with a reddish-brown torso peppered with bright white spots. Just as the paler leopard epaulettes from Tufi blend into their coral home, it made complete sense that this species would be darker and more plain in keeping with its rockier environment.

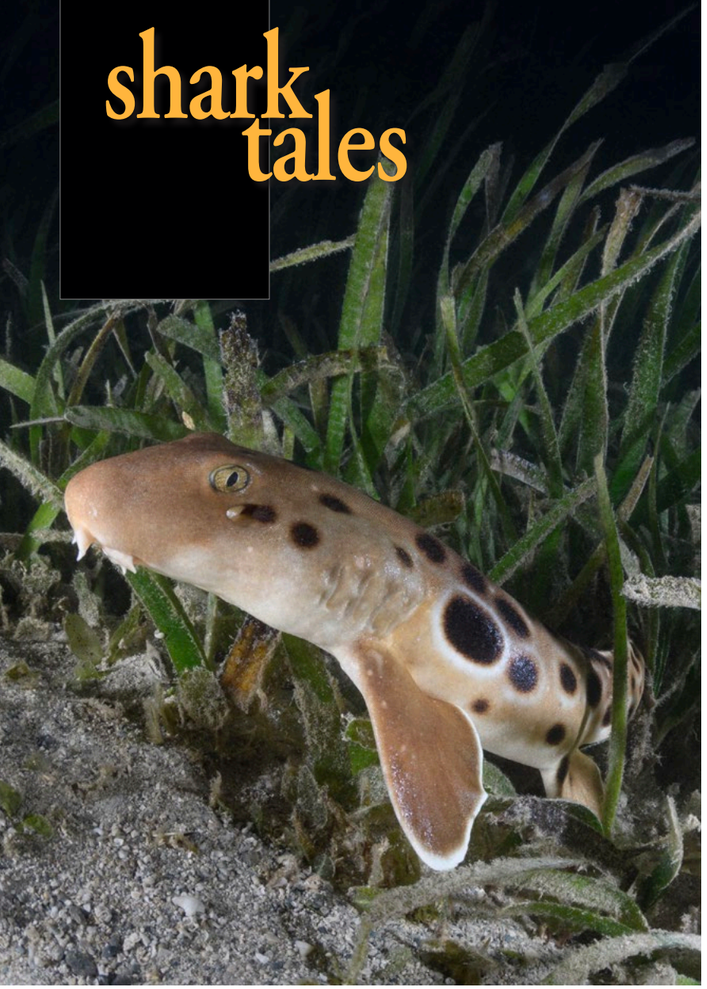
Fortunately, the hooded epaulette turned out to be far bolder than its eastern cousin, allowing me to compose some nice portraits before it nonchalantly wandered off. Before long, I ran into a second shark and then another and another. By the end of the dive, I had seen eight different hooded epaulettes, which was extremely encouraging considering their vulnerable status.

Surfacing after 60 minutes, I expected to find the boat hovering nearby, but there was total darkness and no sign of it anywhere. The current was pulling me steadily away from the island, so I threw on all my lights and started flashing in every direction to attract the crew's attention if they were still in the area. At the same time, I was painfully aware that it might not be my boat that I was attracting, and other boats might not be so friendly, but a night adrift in the Bismarck Sea was equally unappealing.

Thankfully, after a few minutes, my boat emerged from the darkness, and I clumsily pulled myself aboard. I am still not sure whether they had no lights on the boat or whether they had turned them off to avoid attracting too much attention. Either way, reunited, we returned to shore unscathed, with a good story and a great selection of hooded epaulette shark images.

On to Loloata Island

Two days later, I was back in Port Moresby, riding in a private limousine to a luxury island resort south of the city. Located in the middle of Bootless Bay, Loloata Island Resort is the weekend playground of well-to-do expats residing in the capital. It is also a good spot to hunt for PNG's other endemic walking shark species, the Papuan epaulette shark (*Hemiscyllium hallstromi*).



Papuan epaulette shark (*Hemiscyllium hallstromi*), Loloata Island, Papua New Guinea. Found in a shallow area of seagrass, it was very different from either of its cousins, with its beautiful orange/tan torso and bold black polka dots.

Diving

While the locals sat around the pool drinking cocktails, I set up a night dive at the resort's small dive shop and got ready for the hunt. At dusk, a boatman dropped my dive guide and me off at the edge of the seagrass that surrounded the island retreat. The visibility was disappointingly poor—not surprising, considering we were diving in a shallow bay fed by numerous muddy rivers.

We spent a while exploring the fringing reef, which was struggling under a thick layer of silt. Although the river has been depositing sediment into the bay for centuries, farming and mining have increased the sediment load significantly, resulting in inevitable reef degradation.

We moved up into the shallow seagrass and continued the search. Apart from a few crabs, there was not much to focus on until a flash of orange darted out of the lush foliage. This epaulette shark was completely different from either of its cousins, sporting a lovely orange/tan torso with bold black polka dots. This gorgeous little shark was the friendliest yet, nonchalantly continuing its foraging through its miniature forest realm while I snapped away whenever I had a clear shot. I watched it hunt for a good 15 minutes before my dive guide dragged me away.

Tragedy

The next night would be my last chance to see epaulette sharks before flying out. Excited, I headed down to the dive shop at dusk, but when I arrived, the dive shop manager told me with tears in her eyes that the boat driver and skiff were missing—almost certainly taken by pirates. Apparently, the boat had disappeared while doing a routine run to the mainland earlier in the day. The resort had sent out a search party, but all they found was a drifting life jacket. When I asked what would have become of him, she said they would have either killed him immediately or simply thrown him into the water far from shore, which amounted to the same fate. She asked me if I would like to dive from shore, but photographing sharks felt too petty.

Shocked and horrified, I returned to my room and contemplated this tragedy that had utterly eclipsed the success of my trip. As I write this account, I still feel awkward about sharing this aspect of the story, but perhaps it illustrates why the fate of tiny sharks is not a high priority in a country where life itself hangs in the balance. ■

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***.

By Ila France Porcher

DR DWAYNE MEADOWS, NOAA, NMFS, OPR / WIKIMEDIA / PUBLIC DOMAIN

Whitetip sharks (*Triaenodon obesus*) in the Northwestern Hawaiian Islands

Proven: Marine Protected Areas Boost Shark Populations

In a groundbreaking study published in *Nature Ecology & Evolution*, over 100 marine scientists uncover compelling evidence of the profound benefits of fully protected marine areas in nurturing shark populations and preserving marine ecosystems.

The **study**, spanning 66 marine reserves across 37 countries worldwide, sheds light on the stark contrast in shark abundance between fully protected zones and areas open to industrial fishing. Reef-dwelling species such as Caribbean reef, grey reef, whitetip reef and nurse sharks exhibited nearly double the population density within fully protected marine reserves compared to fishing-permitted zones.

Importance of sharks

Lead author Enric Sala, renowned marine biologist and founder of Pristine Seas, underscores the critical role of sharks in maintaining ocean health. "More sharks signal a healthier ocean," Sala emphasised. "They are the bedrock of ecosystems, under threat from the climate crisis, overfishing, and more."

Problem of damaging fishing gear

The research highlights not only the efficacy of marine protected areas (MPAs) but also the synergistic benefits when combined with strategic fisheries management measures. Areas bordering fishing zones with regulations on catch limits and damaging gear restrictions, such as trawlers, gill nets and longlines, exhibited higher shark populations, further emphasising the importance of integrated conservation efforts.

Reefs can recover

Sala advocated for comprehensive ocean protection strategies, stating, "When we fully protect coral reefs, they bounce back and eventually become more resilient to the impacts of global warming." He urged countries to consider these findings when formulating conservation policies, emphasising the need for balanced management both within and outside of protected areas to ensure the thriving of shark populations and broader marine biodiversity.

As the world grapples with mounting environmental challenges, this study offers a beacon of hope, illustrating the tangible benefits of proactive conservation measures in safeguarding our oceans' most iconic inhabitants and preserving the intricate balance of marine ecosystems. ■

SOURCES: PRISTINE SEAS, NATURE ECOLOGY & EVOLUTION

turtle news

Edited by Catherine GS Lim & Peter Symes

Diagnosing the "Bends" in Turtles Caught in Fishing Nets

KATHERINE ELTZ / NEWS RELEASE

Turtle receiving an ultrascan examination

Ultrasound technology is being used to determine whether turtles which have been caught in the fishing nets and brought to the surface have the "bends".

When sea turtles get trapped in fishing nets and are brought to the surface, they can suffer from gas emboli because their normal diving processes are disrupted. This can cause abnormal gas build-up in their organs.

To address this, marine veterinarians worldwide are developing methods to understand the possible consequences of this and to determine the most ideal treatment for them.

Ultrasound technology

Katherine Eltz, a doctoral student at the University of North Carolina at Chapel Hill, has made significant strides in distinguishing gas levels over time in sea turtles. Collaborating with veterinarians, she has utilised real-time ultrasound technology to measure gas emboli in turtles as soon as they are brought to the surface-aboard the fishing vessels.

"The benefit of ultrasound is that we can see bubbles flowing through vessels or stationary in tissues. The portability of ultrasound means that it can be brought onto fishing boats, which we took advantage of to collect half of the data used in this project," she explained.

It was Eltz's collaborators from the Oceanogràfic Foundation who first reported the occurrence of decompression sickness in turtles.

After examining all the ultrasound data collected—obtained from two experimental groups—she concluded that the brightness of the ultrasound could be used as a quantitative metric to determine whether the turtle needed any hyperbaric oxygen treatment, or whether it could be released.

"The largest task still at hand is to work towards standardising the acquisition of the ultrasound data collected for this project," she said. "Now, I can work with veterinarians to help adjust their methods, including improved image processing to standardise the data in post-processing." ■ SOURCE: ACOUSTICAL SOCIETY OF AMERICA (ASA)

STOCKVAULT / PIXABAY / CC0

After hatching, baby sea turtles hit the water, swimming out to sea to live on their own for several years until they return to nearshore foraging grounds.

Best Practices During Sea Turtle Nesting Season

Sea turtle nesting season is a crucial time for the activities of vulnerable and endangered species worldwide. Researchers at Florida Atlantic University have provided guidelines to protect nesting sites.

Various regions are home to species such as the green, leatherback and loggerhead turtles. Due to their endangered or threatened statuses, these species are protected by law in most countries, which requires specific conservation actions and monitoring. Sea turtles face numerous threats, including habitat loss, human interference and climate change, endangering their survival and reproductive success.

Sea turtles typically lay multiple clutches each season, with each clutch containing up to 140 eggs, depending on the species. The incubation period can vary significantly with temperature, affecting hatching success and the sex ratio of hatchlings.

To safeguard the nesting sites and ensure the survival of sea turtle hatchlings, researchers have developed "best practices". These guidelines are crucial for maintaining the delicate balance of marine ecosystems and offer insights into the most effective conservation measures.

Best practices

1. Keep your distance: Observers who encounter a nesting turtle or a nest should keep their distance, remain quiet and avoid using lights to prevent disturbing the turtle. It is crucial not to touch the turtles or the eggs. Report any sightings or injuries to local wildlife authorities immediately.

2. Avoid artificial lighting: Artificial lighting can disorient nesting females and emerging hatchlings, leading them away from the sea. To support turtle conservation, beachfront lighting should be minimized during the nesting season to avoid misguiding the turtles.

3. Dietary considerations: Sea turtles' diets vary significantly across different species and life stages. While some are predominantly carnivorous, others, like the green turtle, are more herbivorous, focusing on seagrass and algae. Understanding these dietary habits is crucial for addressing risks related to bait and debris ingestion. ■ SOURCE: FLORIDA ATLANTIC UNIVERSITY

Close-up view of a mirrorless camera sensor

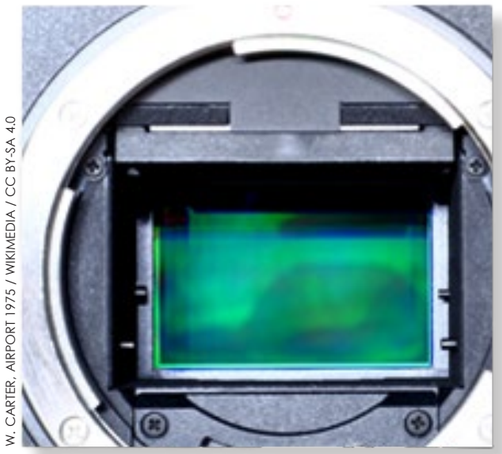
NULCHECK / WIKIMEDIA / CC BY-SA 4.0

Camera Sensors

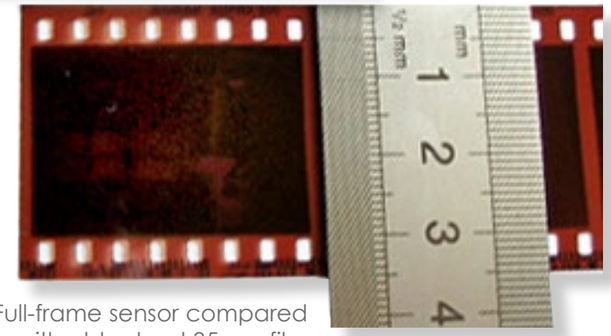
Size & Image Quality

Text by John A. Ares

How does sensor size impact image quality? Underwater photographer John Ares offers insights into the realm of camera sensors.



W. CARTER, AIRPORT 1975 / WIKIMEDIA / CC BY-SA 4.0



Full-frame sensor compared with old-school 35mm film

Since the development of the digital photography revolution in the early 2000s, there have been many attempts to describe or define image quality in simple terms, including factors such as megapixels, resolution, sensor size and photosite size. These factors are related but not interchangeable.

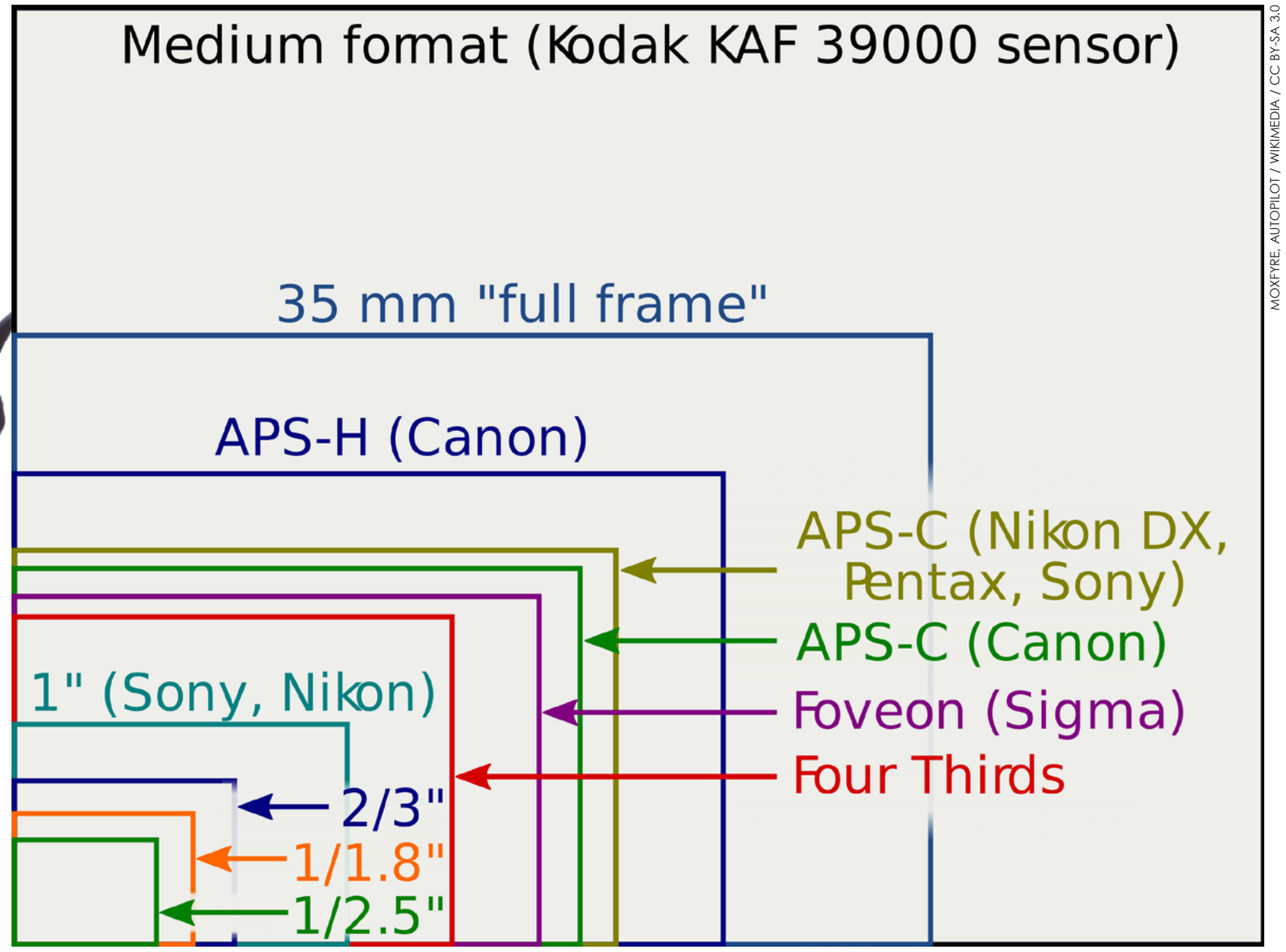
Megapixels were an early attempt to describe quality by multiplying the pixel dimensions of a photo. For example, 2,000 pixels wide multiplied by 1,500 pixels high equals 3,000,000 pixels, or three megapixels (3MP). One megapixel equals one million pixels.

Resolution is related to pixels, and for most discussions, the two are the same. In order to keep the original resolution (quality), it is best to shoot in RAW format rather than JPG or another format.

Sensor size is perhaps the most important factor in producing a quality image. Quality for viewing an image on a monitor or screen, as opposed to making an enlargement, is a critical difference. If you are making 3 x 4ft enlargements, then a large sensor is important. For years, I have used a 6MP APS-C-sized sensor camera for presentations on a screen and have never had a sharpness complaint.

Sensor sizes include small cell phone sensors, 4/3 sensors, APS-C sensors and full-frame sensors. Canon had an intermediate-size sensor called APS-H for a short time. In general, larger sensors are more expensive to manu-

This photo shows the slim body size of a mirrorless camera (on the left) in contrast to that of a DSLR camera (on the right).



This chart (right) shows the relative sizes and dimensions of various types of camera sensors.

facture and fit into the larger camera bodies required. Most cell phone sensors are about one centimeter wide, which does not allow for big enlargements such as 20 x 30 inches.

In the early 2000s, Olympus, Kodak and Panasonic developed the 4/3 sensor. Four-thirds refers to both the size (4/3 inch) and the aspect ratio (4:3) of the sensor. The aspect ratio of an image is the ratio of its width to its height. It is expressed as two numbers separated by a colon, width:height. For example, 3:2 in still photography.

The 4/3 sensor is roughly half the size of a full-frame sensor, allowing for greater apparent magnification of telephoto lenses, but cropped (or less wide) wide-angles. In 2008, the 4/3 format was replaced by the Micro 4/3 format. Micro 4/3 was designed for mirrorless cameras and allows the back of the lens to be closer to the sensor.

APS-C

APS-C sensors are a very popular format in D-SLRs and mirrorless SLRs because they offer a good compromise between cost, dimensions and camera size. The APS-C sensor's physical dimensions are 25.1 x 16.7mm, with an aspect ratio of 3:2. Canon, Nikon, Pentax and Sony have versions of APS-C that may vary slightly in the dimensions. Like the 4/3 sensor, the APS-C sensor has a crop factor as well. It is smaller than a full-frame sensor, allowing for greater "apparent" magnification of telephoto lenses, but cropped wide angles.

Full-frame sensors

Full-frame sensors are the same size as a standard 35mm film negative or slide (36mm x 24mm). Many lenses from the film era, and those made for full-frame sensors, retain their original angle of view and do not suffer from the "crop factor" of APS-C and 4/3 sensors. The primary advantage is the tremendous resolution, in addition to the ability to severely crop an image due to the large size of the file produced.

What else do you shoot?

I shoot birds and wildlife as well as fish. You can never get close enough to birds. A full-frame sensor allows you to crop in order to get a closer image—perhaps effectively using a 1,800mm lens crop from a frame shot with a 600mm lens. A disadvantage of the large sensor is that the files produced are larger and take up more space on a card and on your hard drive.

The Micro 4/3 sensor was designed for the mirrorless camera, which allows the back of the lens to be closer to the sensor.

Relative size of a photosite compared to a pixel (below). The photosite is the smallest component editable in software.

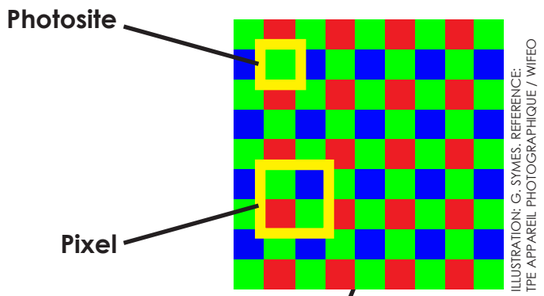
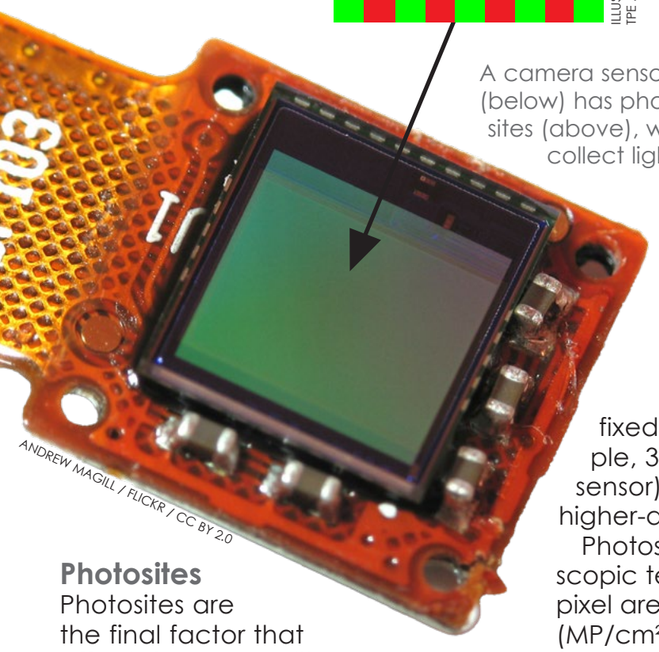


ILLUSTRATION: G. SYMES. REFERENCE: TPE APPAREIL PHOTOGRAPHIQUE / WIFEO



ANDREW MAGILL / FLICKR / CC BY 2.0

A camera sensor (below) has photosites (above), which collect light.

JOHN A. ARES

The Nikonos 15mm f/2.8 lens is a fantastic, sharp lens with manual diaphragm and manual focus.

MORIO / WIKIMEDIA / CC BY-SA 4.0

Nikonos V underwater film camera at the Nikon Museum in Tokyo, Japan

Photosites

Photosites are the final factor that affects image quality. This subject has the potential to really get into the weeds, technically speaking. Photosites on a sensor (hardware) are essentially small lenses that gather light. They are roughly equivalent to pixels, which refer to the smallest component editable in software. The larger the photosite, the more light it gathers. It is almost paradoxical to realize that within a fixed set of dimensions (for example, 36mm x 24mm for a full-frame sensor), larger photosites result in higher-quality images.

Photosites are described in microscopic terms of pixel pitch (microns), pixel area (microns) and pixel density (MP/cm²). Pixel pitch is the distance from the center of one photosite to the center of the next. Pixel area is described in terms of squared microns. In general, the larger (and newer) the sensor, pixel pitch and pixel area, and the lower the pixel density, the better the camera. Look up photosites for any given camera to see the dimensions, which are usually expressed in microns.

Contest

The dedicated underwater film cameras made by Nikon years ago were called Nikonos. Of course, they went the way of the dodo when the world went digital in the early 2000s. However, there were some fantastic, sharp lenses that were made for the camera back then, notably a 20mm f/2.8 and a 15mm f/2.8. There are still many Nikonos lenses out there, which are available on eBay and other sources at a fraction of their original cost. The lenses have manual diaphragms and manual focus.

Consider this a challenge posed to the manufacturer: Develop a full-frame sensor camera (with at least an 8MB sensor) that can accept Nikonos lenses for their original wide-angle coverage. In essence, build a digital Nikonos. The camera should display an image regardless of the aperture setting. A fiber-optic strobe connection should be offered. Provision for a conventional strobe is optional. Video is another option, but not necessary. ■

A former senior management consultant for Fortune 100 companies, studio commercial photographer and trained biologist and marine food toxicologist, John A. Ares is an assignment and stock photographer and image consultant based on Staten Island in New York City, specializing in portraits, nature, travel, underwater, food/restaurant and fine art photography. An avid diver, he has been a PADI instructor and instructor trainer, teaching underwater photography courses and traveling to many exotic dive destinations around the world. A member of the New York Underwater Photographic Society (NYUPS) and American Society of Media Photographers (ASMP), he has served as an associate editor and photographer for Seafood America *magazine and his work has won competitions of* American Photographer *magazine. He also conducts training seminars and has been a presenter at Beneath the Sea and NYUPS. For more information, visit:* **JohnAres.com**

photo news

Edited by
Peter Symes

PHOTOS COURTESY OF
THE MANUFACTURERS

SeaLife SportDiver Ultra

The SeaLife SportDiver Ultra is a compact underwater housing for smartphones. It allows for dives up to 40m (130 ft) deep. It is compatible with most Android models and iPhones from iPhone 8 to iPhone 15 Pro Max. The housing pairs with the free SportDiver App, available on the App Store and Google Play. Built from polycarbonate, stainless steel, aluminum and optical-grade glass, the SportDiver Ultra balances durability with portability and offers near-neutral buoyancy. Its ergonomic design includes a large shutter lever and rear control buttons for easy operation with dive gloves. The housing comes with a detachable colour-correction filter for accurate underwater colours and seven 1/4-20 tripod mounts for accessories such as SeaLife's Sea Dragon lights. For clear visibility, the SportDiver Ultra includes an anti-fogging agent and a TPE O-ring-sealed door with a secure cam-lock latch. **sealife-cameras.com**

Hardcase Carry-On

The new Manfrotto Pro Light Reloader Tough H-55 case was designed in Italy for professional photographers and videographers. It meets military standards and features the original Manfrotto style, prioritising safety and portability. The case fits international carry-on sizes and includes a 2-stage retractable trolley system. It features a removable camera organisation unit with adjustable dividers and accommodates a pro DSLR with a 400/f2.8 lens attached, a second camera body, and three to four lenses. It has been IP67 tested for dust and temporary water immersion (30 minutes). Additional features include cabin luggage compatibility, the Camera Protection System, external tripod connections, flexi dividers and interchangeable dividers. **manfrotto.com**

Weefine RingLight

The Weefine RingLight V2 is not a real flash but an 1800-lumen LED light with a boost function. It offers five lighting modes: White, Blue, Red, Auto Multicolour Changing (over 900 colours), and patented LED strobe. The Auto Multicolour Changing mode is perfect for macro and close-up photography. Note the light is not suitable for wide-angle photography. It features M67 thread mounting, optional adapters, and up to 3000 Lumens in Strobe mode, ensuring versatile lighting solutions. With a frosted glass design, adjustable power levels and a smart battery indicator, it provides 360-degree even lighting and efficient use. The rechargeable battery and durable build make it suitable for both underwater and above-water photography. **weefine.com**

Pentax WG-1000

The WG-1000 is designed for casual underwater photography up to 15m (49.2ft) deep or up to one hour of continuous operation. It is robust yet lightweight, making it ideal for both underwater and land activities. It is dust and stain resistant, and shockproof for drops up to 2m (6.5 ft). It features a 4x optical zoom (4.9mm to 19.6mm) and digital zoom extending up to 24x, ensuring detailed shots. The 16.35-megapixel back-illuminated CMOS sensor delivers sharp images. Choose from seven capture modes and various colour options, including Black and White, Sepia, and creative styles such as Japan Style (which enhances bluish hues), Italian Style (which enhances greenish hues), and French Style (which enhances reddish hues). **ricoh-imaging.com**

AOL Flip Adapter

This convenient flip adapter, capable of accommodating two M67 lenses, transforms any 67mm-threaded port into a versatile diopter holder, providing easy access to two macro lenses. Crafted from robust, hard-anodised aluminium, this adapter ensures secure attachment to ports with 67mm threads. Its clip-lock mechanism guarantees that lenses remain securely in place during intense shooting sessions. **aol-uw.com**

Signature Traits

Contributors' Picks

Text and photos by John A. Ares, Sheryl Checkman, Larry Cohen, Lureen Ferretti, Anita George-Ares, Gary Rose, Michael Rothschild and Olga Torrey

We asked our contributors to share their favorite underwater images that showcase the distinctive features of various underwater creatures, and they returned with a broad selection of macro and wide-angle shots featuring a variety of marine life, from majestic sharks and sea turtles to tiny nudibranchs and crustaceans. Here, *X-Ray Mag* contributors share their selected images from the tropical waters of the Philippines, Indonesia, Malaysia, the Cayman Islands, Saba, the Bahamas, Isla Mujeres in Mexico, and Cocos Island in Costa Rica, to the subtropical and temperate waters of the US East Coast.

GARY ROSE

Tiger shark (above), Jupiter, Florida. The very prominent bars and bands identify this individual as a young adolescent. Gear: Nikon D500 camera, Tokina 10-17mm lens at 10mm, Nauticam housing, Inon Z-330 strobes. Exposure: ISO 100, f/8, 1/100s.

Great hammerhead shark (previous page), Bimini, Bahama Islands. The shape of the cephalofoil (head) and the huge dorsal fin are quick identifiers. Gear: Nikon D500 camera, Tokina 10-17mm lens at 17mm, Nauticam housing, Inon Z-330 strobes. Exposure: ISO 400, f/11, 1/125s.

Instant Recognition

Text and photos by
Gary Rose, MD

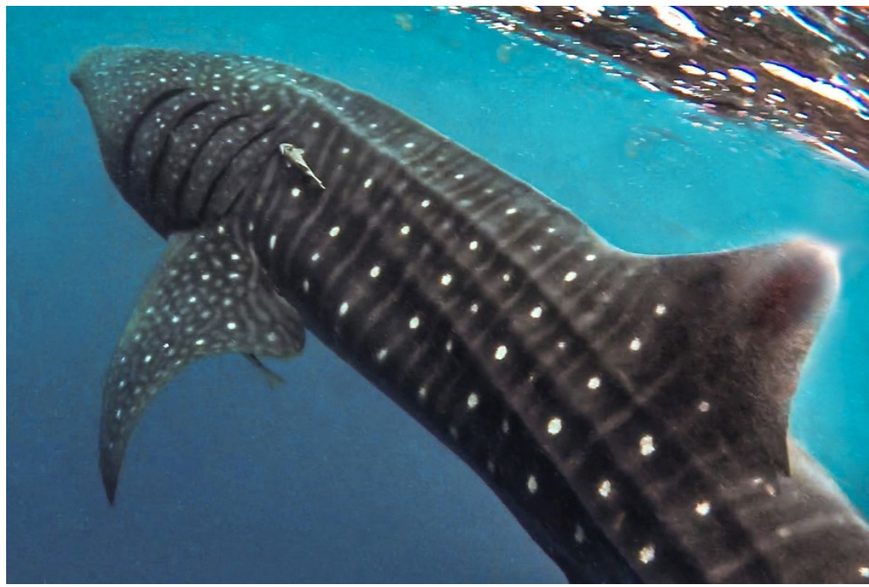
There are thousands of different species of fish that inhabit our oceans. Recognizing the different species and understanding the behavior of each is always a challenge. As divers navigate their way around shallow reefs in coastal waters or in the deeper blue water column, identification and understanding the behavior of different fish species will result in a safer and more rewarding experience. Conveniently, within the elasmobranchs (sharks), there are a few species that are instantly recognizable.

When I dive with new divers, I always enjoy the excitement they display when they instantly identify a nurse shark (Photo 1). The barbels (the two appendages that hang from the very front of the snout) are an instant giveaway. In addition, they have two equal-sized dorsal fins that are located far back on their bodies. Interestingly, over millions of years of evolution, the bottom portion of their tails has become absent as they spend most of their time lying on the sand and under coral outcrops.

I always love diving with tiger sharks. In the shallows of Tiger Beach, Grand Bahama Island, I have dived with 18 of them at one time. One only has to see a tiger shark to instantly identify it by its beautiful bars, bands and stripes. When they are young, the bars and bands are very dark and clearly delineated (Photo 2). With age, they fade but are still very visible. A word of caution: When diving with tiger sharks, you must always keep your head on a swivel and *never, never* lose eye contact.

Of all the sharks, my favorite is the great hammerhead. Fortunately, I get to see them from January to May on my weekly dives in Jupiter, Florida. I also love diving with them in the shallow, crystal-clear waters of Bimini, Bahamas. The huge dorsal fin, which is always taller than the thickness of their bodies, is a great identifier. But, the major instant identifier is their majestic cephalofoil, "the hammer"(Photo 3), which they gracefully swing from side to side to pick up minute electrical signals from their favorite food, the stingrays hiding buried in the sand.

Whale sharks are huge and can grow up to 33ft long (Photo 4). It is the unusual and beautiful surface markings of spots and bands that instantly identify these gorgeous sharks. Despite their enormity, they are filter feeders and eat only plankton, the smallest, almost microscopic creatures in our oceans. Isla Mujeres, Mexico, is a wonderful place to snorkel with whale sharks.



Nurse shark (top right), with two very posterior, equal-sized dorsal fins and barbels suspended on the edge of the snout, Bimini, Bahama Islands. Gear: Nikon D500 camera, Tokina 10-17mm lens at 17mm, Nauticam housing, Inon Z-330 strobes. Exposure: ISO 200, f/11, 1/125s. Whale shark (above), Isla Mujeres, Mexico. The spots and bands are always a giveaway, as is the enormous size. Gear: GoPro Hero4 Black camera.

One of my favorite courses I teach is "Shark Behavior and Identification." These four examples (Photos 1-4) are easily and instantly identifiable. There are many more species of sharks, and it can be very challenging to distinguish them from each other. As divers become more skilled with identification, they also gain knowledge of behavior, which results in greater enjoyment and safety. Visit: **garyrosephotos.com**

Photo 1. (top left) Octopus, Tulamben, Bali, Indonesia. Gear: Canon EOS Rebel SL1 camera, Canon EF-S 60mm Macro USM lens, Weefine ring light. Exposure: ISO 1600, f/10, 1/160s.

Photo 2. (above) Broadclub cuttlefish, Dumaguete, Philippines. Gear: Canon EOS Rebel T1i camera, Canon EF 100mm f/2.8 macro lens, twin Ikelite DS161 strobes. Exposure: ISO 400, f/16, 1/160s.

Photo 3. (bottom left) Flamboyant cuttlefish, Dumaguete, Philippines. Gear: Canon EOS Rebel T1i camera, Canon EF 100mm f/2.8 macro lens, twin Ikelite DS161 strobes. Exposure: ISO 400, f/16, 1/200s.

The Eyes of Cephalopods

Text and photos by John A. Ares

Cephalopods are some of the most fun creatures to dive with. Diving with squid, octopus and cuttlefish is always a treat. Since they are intelligent, they are naturally curious about us, and this frequently leads to some very interesting encounters instead of the usual flight reaction of most fish.

Their eyes are sophisticated and have a superficial resemblance to ours. However, their retinas do not have rods and cones. Instead, they have microvilli that are oriented in different positions, which enables polarized light sensitivity. (Hanlon & Messenger, 1996, p.17)

As shown here, their pupils have variable shapes. The octopus in Photo 1 was constantly observing our group of three divers near the wreck of the USS *Liberty* in Bali.

In Photo 2, the broadclub cuttlefish allowed a close approach to get a good close-up of its U-shaped pupil.

The flamboyant cuttlefish in Photo 3 is much smaller than the broadclub cuttlefish and is poisonous if eaten, hence the outrageous skin coloring. Unlike its cousin, the blue-ringed octopus, it does not inject venom. Visit: **JohnAres.com**

SOURCE: HANLON RT, MESSENGER JB. 1996. *CEPHALOD BEHAVIOUR*. CAMBRIDGE UNIVERSITY PRESS. P.17.

Overlapping scutes of hawksbill turtle (left), Donna's Delight, Little Cayman. Gear: Olympus OM-D E-M5 Mark II camera, Olympus M.Zuiko 9-18mm f/4.0-5.6 lens at 15mm, Olympus PT-EP13 housing, Sea&Sea YS-D1 strobe. Exposure: ISO 200, f/8, 1/125s.

Pointed head of hawksbill turtle (above), Donna's Delight, Little Cayman. Gear: Olympus OM-D E-M5 Mark II camera, Olympus M.Zuiko 9-18mm f/4.0-5.6 lens at 15mm, Olympus PT-EP13 housing, Sea&Sea YS-D1 strobe. Exposure: ISO 200, f/8, 1/125s.

Large flippers of hawksbill turtle (top center), Donna's Delight, Little Cayman. Gear: Olympus OM-D E-M5 Mark II camera, Olympus M.Zuiko 9-18mm f/4.0-5.6 at 15mm, Olympus PT-EP13 housing, Sea&Sea YS-D1 strobe. Exposure: ISO 200, f/8, 1/125s.

Round face of green turtle (left), Man O' War, Saba. Gear: Olympus OM-D E-M5 Mark II camera, Olympus M.Zuiko 8mm f/1.8 fisheye lens at 8mm, Olympus PT-EP13 housing, Sea&Sea YS-D1 strobes. Exposure: ISO 200, f/8, 1/250s.

Sea Turtles

Text and photos by Sheryl Checkman

There is something about sea turtles that makes me happy. When I see a turtle underwater, I know it is going to be a good dive. Today's sea turtles are the living descendants of reptiles that have existed on Earth and in our oceans for 100 million years.

Sea turtles can be differentiated from tortoises, their land-based relatives, by their flippers. If a turtle has large flippers, it is a marine turtle. If it has claws rather than webbed toes or flippers, it is a tortoise. The patterns on the top (or carapace) of a turtle's shell can be used to identify it. The number of lateral scutes (shell plates) and whether or not they overlap is one way to identify a sea turtle species. Another is the shape of its face.

Green and hawksbill turtles have four pairs of lateral scutes, while loggerheads have five pairs, and leatherbacks have none. The green turtle has a round face, while the hawksbill turtle has a pointed face with a distinct overbite. The hawksbill turtles in the first three photos were taken at Donna's Delight in Little Cayman. You can see the pointed face and the overlapping scutes. The photo of the green turtle was taken at Man 'O War in Saba. Notice its round face and how its scutes do not overlap. Both of these species of sea turtles have large geometrically-patterned flippers. Visit: **Instagram.com/SherylCheckman**

Barberfish, *Johnrandalia nigrirostris*, cleaning a scalloped hammerhead shark, *Sphyrna lewini,* at Manuelita, Cocos Island, Costa Rica (above). Gear: Canon 70D camera, Tokina 10-17mm fisheye lens, Nauticam housing, dual Inon Z-330 strobes. Exposure: ISO 400, f/4.5, 1/160s. A close-up shot of the barberfish at Manuelita, Cocos Island, Costa Rica (left). Exposure: ISO 400, f/4.5, 1/160s.

Reef manta, *Mobula alfredi*, hovers effortlessly over a cleaning station at Four Kings, Raja Ampat, Indonesia (top right). Gear: Canon 70D camera, Tokina 10-17mm fisheye lens, Nauticam housing, dual Inon Z-330 strobes. Exposure: ISO 400, f/13, 1/160s.

The Heroic Work of Cleaner Fish

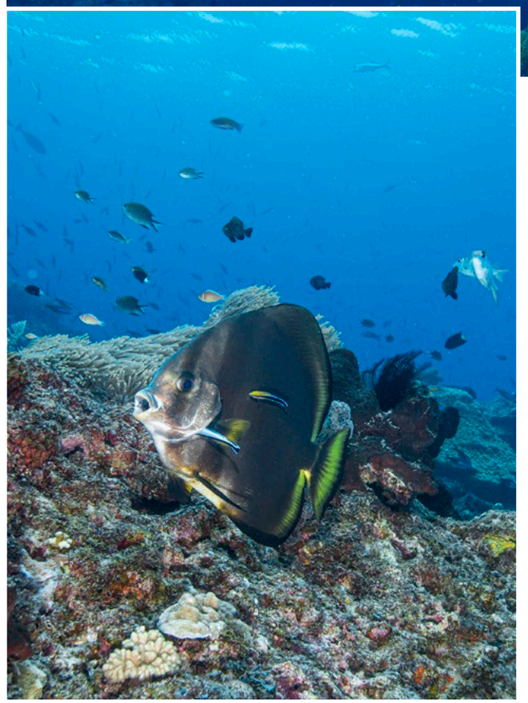
Text and photos
by Lureen Ferretti

The unsung heroes of the underwater world are the cleaner fish. Despite their tiny size, the ocean's most ferocious predators and largest winged wonders, as well as marine life in general, line up for the cleaner fish's invaluable "signature trait"—ridding their friends of pesky parasites, dead skin and infected tissue.

Cleaner fish position themselves in high-traffic areas of the reef to let passing marine life know they are open for business. These areas are referred to as cleaning stations. The community is diverse, with over 208 species of marine and freshwater cleaner fish.

Barberfish, *Johnrandalia nigrirostris*, are often seen gathered in small groups with lines of sharks waiting for a good cleaning. Especially after mating season, female sharks desperately need their wounds from mating bites attended to. They are graceful in their approach and nearly come to a complete stop as the barberfish work diligently as a team to remove dead and infected skin and parasites.

Reef manta rays, *Mobula alfredi*, are also known to frequent cleaning stations. Their approach is so slow that they seem to float motionless above the cleaning station while swarms of cleaner fish get to work. Not only do they clean the exterior of a fish, but they often enter the gills and mouths of their clients as well.



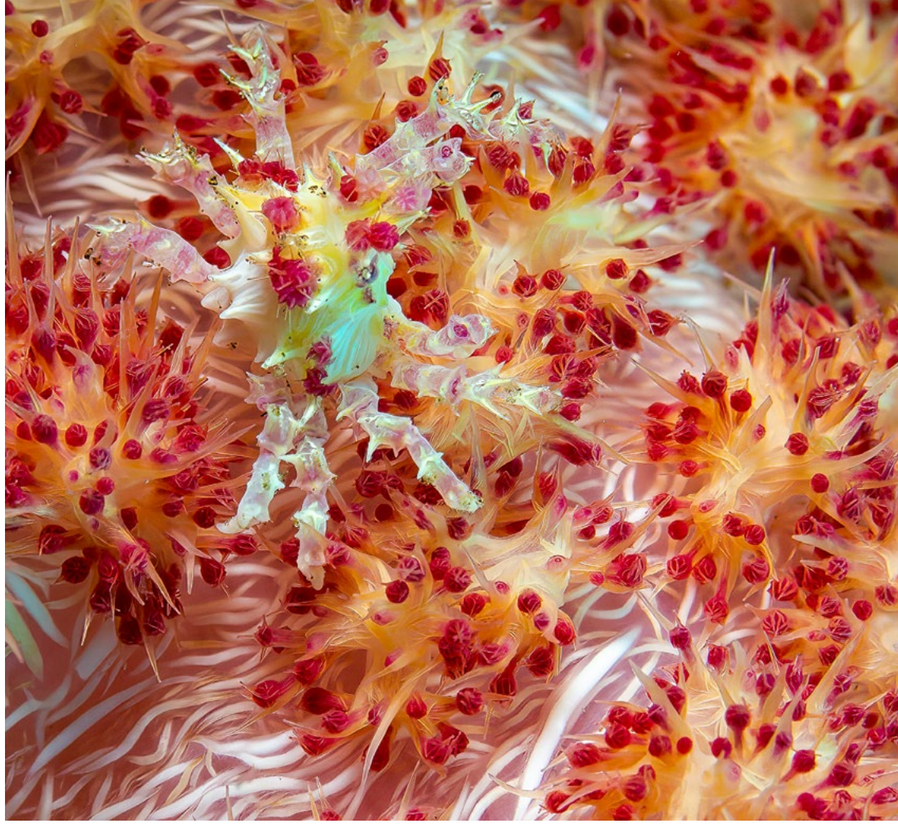
This is but a glimpse into the extraordinary lives and behaviors of cleaner fish. They may not be large or fierce, but they are definitely stars of the ocean floor. Visit: **instagram.com/lureenferrettiphotography**

An orbicular batfish, *Platax orbicularis*, changes color to alert cleaner wrasse at a cleaning station that it needs to be cleaned (center). A close-up detail of the same shot (above) shows bluestreak cleaner wrasse, *Labroides dimidiatus*, near and inside the gills of the batfish. The photo was taken at Four Kings, Raja Ampat, Indonesia. Gear: Canon 70D camera, Tokina 10-17mm fisheye lens, Nauticam housing, dual Inon Z-330 strobes. Exposure: ISO 400, f/9, 1/160s.

ANITA GEORGE-ARES

ANITA GEORGE-ARES

ANITA GEORGE-ARES



Celebrating Crustaceans

Text and photos by
Anita George-Ares, PhD

Crustaceans are noted for impressive diversity, including shrimps, crabs, lobsters and barnacles. Crustaceans share some similar traits, such as a hard exoskeleton, paired appendages and segmented body, but there are many exceptions. I enjoy photographing crustaceans because of their diverse forms and habitats.

Hingebeak shrimp (Photo 1) are found in groups near crevices or holes in a variety of habitats. I photographed two hingebeak shrimp that were in a vertical position. During post-processing, I cropped the image and rotated it 90 degrees to improve the composition.

Bubble corals have their own resident shrimp. In Photo 2, the bubble coral shrimp's translucent body with distinctive purple lines makes a nice contrast against its bubble coral home.

Soft coral crabs are well camouflaged and not easy to find. The spines on the crab's exoskeleton resemble the white spicules (support structures) of the soft coral (Photo 3). The crab attaches soft coral polyps to its body to mimic its host.

Hairy squat lobsters are a challenge to photograph. They are small, move continuously, and hide in the folds of giant barrel sponges. Our dive guide found the squat lobster in Photo 4. I cropped this image significantly to draw attention to the squat lobster's unique form. Visit: **facebook.com/profile.php?id=100016947967639**

ANITA GEORGE-ARES

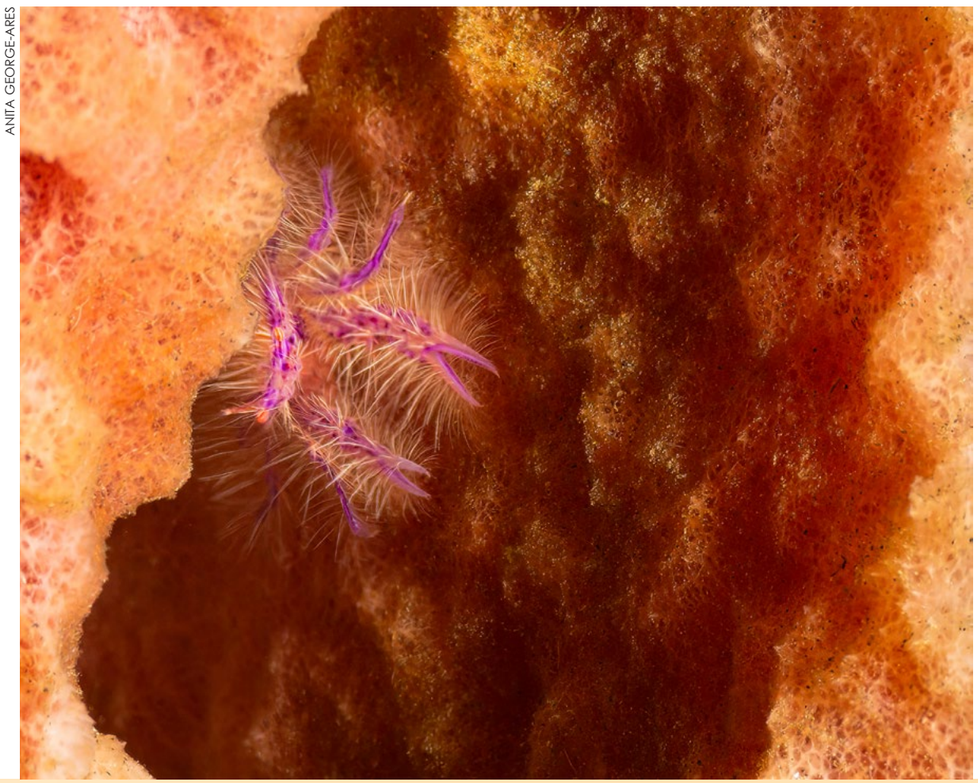


Photo 1. (top left) Hingebeak shrimp and *Cratena* sp. nudibranch, Bali, Indonesia. Gear: Canon EOS Rebel SL1 camera, Canon EF-S 60mm f/2.8 Macro USM lens, Ikelite housing, one Ikelite DS161 strobe, Bigblue VL4200P video light. Exposure: ISO 200, f/11, 1/160s.

Photo 2. (top center) Bubble coral shrimp, Puerto Galera, Philippines. Gear: Canon EOS Rebel SL1 camera, Canon EF-S 60mm f/2.8 Macro USM lens, Ikelite housing, twin Ikelite DS161 strobes. Exposure: ISO 100, f/11, 1/200s.

Photo 3. (above) Soft coral crab, Dumaguete, Philippines. Gear: Canon EOS Rebel SL1 camera, Canon EF-S 60mm f/2.8 Macro USM lens, Ikelite housing, twin Ikelite DS161 strobes. Exposure: ISO 200, f/8, 1/160s.

Photo 4. (left) Hairy squat lobster, Bali, Indonesia. Gear: Canon EOS Rebel SL1 camera, Canon EF-S 60mm f/2.8 Macro USM lens, Ikelite housing, one Ikelite DS161 strobe, Bigblue VL4200P video light. Exposure: ISO 100, f/11, 1/160s.

Signature Traits

Photo 1. (far left) Sticky podia (tube feet) of a sea star, Manasquan River, New Jersey, USA. Gear: Canon EOS 7D Mark II camera, Tamron 60mm macro lens, Nauticam housing, dual Inon Z-330 strobes. Exposure: ISO 1600, f/16, 1/160s.

Photo 2. (left) Nudibranchs feeding on hydroids, *Coney Island* shipwreck, New Jersey, USA. Gear: Canon EOS 7D Mark II camera, Tokina 10-17mm fisheye lens (at 17 mm), Nauticam housing, dual Inon Z-330 strobes. Exposure: ISO 400, f/10, 1/50s.

Photo 3. (right) Pair of cunners (bergalls), Old Ponquogue Bridge, Long Island, New York, USA. Gear: Canon EOS 7D camera, Tamron 60mm macro lens, Nauticam housing, dual Inon Z-240 strobes. Exposure: ISO 160, f/11, 1/250s.

Animal Behaviors

Text and photos by
Michael Rothschild, MD

To be a successful photographer of underwater sealife, you need some of the same talents as a hunter. You must understand animal behavior in order to capture the moment. A great photo can be the result of hours of patiently waiting for just the right composition. And if you do not know the animal's traits, you will not get the shot, no matter how good your camera gear and image-making skills are. A circling shark, a ducking blenny, a territorial damselfish defending its rock… Anyone can press the shutter button, but knowing the animal allows you to make art.

All of these images were taken in the shallow waters near New York City. Photo 1 shows the sticky podia (tube feet) of a sea star navigating over a rocky bottom. Photo 2 shows a group of nudibranchs feasting on their favorite meal, the flower-like and sessile (but carnivorous) animals known as hydroids. Photo 3 shows a pair of cunners (also known as bergalls), which are fighting, mating, arguing, or maybe singing karaoke? And Photo 4 shows a very pretty bed of mussels of various sizes, with their inhalant and exhalant siphons on display as they filter the water for food and oxygen. Visit: **dive.rothschilddesign.com**

Photo 4. (above) Bed of mussels with siphons on display, Shark River Inlet, New Jersey, USA. Gear: Canon EOS 7D Mark II camera, Tamron 60mm macro lens, Nauticam housing, dual Inon Z-330 strobes. Exposure: ISO 4000, f/14, 1/100s.

All images were taken in Sulawesi, Indonesia, with an Olympus E-330 camera, Olympus 7-14mm lens, Olympus housing, and Sea&Sea YS-01 strobes.

The green sea turtle's head is unique in that it has two prefrontal scales rather than four or five (above). Exposure: ISO 200, f/4.0, 1/60s.

The green sea turtle's flippers have a unique pattern and are used both for digging up food and for mating. Females use their flippers to move up onto a beach for nesting (top right). Exposure: ISO 200, f/4.0, 1/30s.

A green sea turtle's oval-shaped carapace with remoras attached (right). Exposure: ISO 200, f/4.0, 1/30s.

Green Sea Turtle

Text and photos by Larry Cohen

While diving in Sulawesi, Indonesia, I was fascinated by the pattern on the skin and shell of the green sea turtle. These turtles have existed for more than 110 million years. They allowed me to get extremely close and take photos that focused on the patterns, which are an example of nature's exquisite graphic design.

The green turtle's pattern is a signature trait. On its head, it has two prefrontal scales between its eyes, while most other turtles have four or five scales. The green turtle's shell (carapace) is oval. The patterned sections of the carapace are called scutes. Green sea turtles have five central scutes and four lateral scutes.

The turtles have four flippers with an interesting pattern on the skin. In addition to swimming, they use their flippers to dig up food and to mate. Female turtles use their flippers to move up the beach for nesting.

Visit: **liquidimagesuw.com**

Vagabond butterflyfish, Mantabuan Island, Tun Sakaran Marine Park, Malaysia. Gear: Olympus OM-D E-M5 camera, Olympus M.Zuiko 12-50mm lens, Nauticam NA-EM5 housing, Sea&Sea YS-D1 strobes. Exposure: ISO 250, f/11, 1/250s.

Spadefish (above), Mantabuan Island, Tun Sakaran Marine Park, Malaysia. Gear: Olympus OM-D E-M5 camera, Olympus M.Zuiko 12-50mm lens, Nauticam NA-EM5 housing, Sea&Sea YS-D1 strobes. Exposure: ISO 250, f/11, 1/250s.

Porcupinefish (top left) of the family Diodontidae, Mantabuan Island, Tun Sakaran Marine Park, Malaysia. Gear: Olympus OM-D E-M5 camera, Olympus M.Zuiko 12-50mm lens, Nauticam NA-EM5 housing, Sea&Sea YS-D1 strobes. Exposure: ISO 250, f/11, 1/250s.

Dark Eye Patch

Text and photos by Olga Torrey

The physical traits of fish show remarkable adaptability, with a limitless range of skin patterns and colors. These traits protect the fish, enabling them to blend in seamlessly with their surroundings. Many fish employ a vibrant array of colors for optical signaling, a complex and fascinating aspect of their biology. These colors can repel or attract other animals, mark territory, or even identify species or individuals. The ability of many fish to change their color through the movement of pigment within pigment cells adds another layer of intrigue. Black pigment cells, a common feature in fish, are often strategically placed alongside other pigment cells. Here are a few examples of fishes that share the dark eye patch as a physical trait. Visit: **fitimage.nyc**

Klein's butterflyfish (above), Mantabuan Island, Tun Sakaran Marine Park, Malaysia. Gear: Olympus OM-D E-M5 camera, Olympus M.Zuiko 12-50mm lens, Nauticam NA-EM5 housing, Sea&Sea YS-D1 strobes. Exposure: ISO 250, f/11, 1/250s.

Humbug dascyllus (top right), Papua New Guinea. Gear: Olympus OM-D E-M5 camera, Olympus M.Zuiko 60mm macro lens, Nauticam NA-EM5 housing, Sea&Sea YS-D1 strobes. Exposure: ISO 250, f/9, 1/100s.