

Sea Level Rise & Atoll Growth :: Reef Climate Resistance :: Contributors' Picks – Pairs



GLOBAL EDITION
January 2024
Number 123

West Papua
Triton Bay

Indonesia
Dive Safari

UW Photo
Sea Art

Sport Diving
Nitrox

Profile
Ricard Buxo

Climate Change
Coral Bleaching

PORTUGAL
Azores

COVER PHOTO BY RAINER SCHIMPF

PERMIT: DRAM/CETACEOS/2021/029

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COVER PHOTO: Sperm whale with calf, Azores
(Permit: DRAM/CETACEOS/2021/029)
Photo by Rainer Schimpf

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Pygmy seahorse on sea fan, Triton Bay, West Papua, Indonesia. Photo by Claudia Weber-Gebert.



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editorial

On the brink

I give up; I can't do it anymore. I cannot keep pretending or carrying on as if all is well in paradise.

Diving is a recreational pastime, meant to offer pleasure and respite from our hectic work schedules and the relentless flood of troubling news that seems to worsen daily.

We have always strived to write about and focus on the wonderful adventures, the beauty of the underwater realm, and to provide educational infotainment that enhances our experiences and appreciation of what lies beneath the surface.

I believe most of us need such a refuge to recharge, so we can return to work and tackle the world's problems with a refreshed mind. It has been a guiding principle in assembling this magazine to provide such a sanctuary, a break from the daily grind. That being said, it does not mean we should bury our heads in the sand when it comes to reporting on environmental challenges and realities.

We are probably all now acutely aware of the precarious state of the global natural environment. It is under siege everywhere. Most notably, coral reefs across the planet are in dramatic decline, if not outright dying. We must now ask ourselves: How did it get so bad and why did we let it happen?

There are positive signs and trends, such as the resilience of some corals and reefs against rising temperatures. In the past, it has been equally important to report on these glimmers of hope, and it still is.

In this issue, we publish a report by Robert Osborne on a coral bleaching event at one of his favourite reefs in Cuba, which he visited last fall. It brings me no joy, but we have reached a point where we must confront these issues head-on, if we are to stand any chance of effecting positive change. Ignoring them only perpetuates business as usual. But the "usual" is a dead end. The old ways have led us to this dystopian predicament. We must change course while there is still a chance to act.

Can we act? We certainly can, if we are willing and prepared to pay the price, because it will not come cheap. At countless COP summits, heads of state have wrung their hands and repeatedly promised decisive action, only to forget about it as soon as the press conferences end. But perhaps, as more countries are battered by climate change, droughts, floods and other calamities—all of which have major economic impacts—they will finally awaken and act.

Some changes are already irreversible, and developments have been set in motion that can no longer be stopped. But if we commit our hearts, minds and resources, much can be done to stem this accelerating deterioration of our natural ecosystems, and to repair and restore what has been damaged.

It is not a difficult choice. In fact, it is not a choice at all.

— Peter Symes
Publisher & Editor-in-Chief

NEWS

from the deep

Edited by Peter Symes



Bassas da India Atoll in the Indian Ocean

Can atolls grow as fast as sea levels rise?

The potential for coral atolls to grow in response to rising sea levels offers a hopeful perspective but requires further scientific investigation and targeted conservation efforts.

The fate of coral atolls amidst rising sea levels has been a subject of intense debate and concern. Recent studies and ecological restoration efforts suggest that these unique island formations might have

the potential to grow at a rate that could outpace sea level rise, offering a glimmer of hope for their future.

The challenge

Coral atolls, home to diverse ecosystems and human populations, face the threat of submersion due to climate change-induced sea level rise. Over 700,000 people residing on atolls worldwide are at risk of becoming climate refugees. The anticipated impacts include chronic shoreline erosion, destabilising islands, and

threatening the habitability of nations like the Maldives, Tuvalu, Kiribati and the Marshall Islands.

A study by Dr Sebastian Steibl from the University of Auckland and colleagues, published in the journal *Trends in Ecology & Evolution*, highlights that coral atoll islands naturally grow by accreting sediment, potentially up to 1 cm a year. This growth rate could outpace most predictions of sea level rise. The study emphasises ecological restoration as a key to enhancing this

NASA / PUBLIC DOMAIN

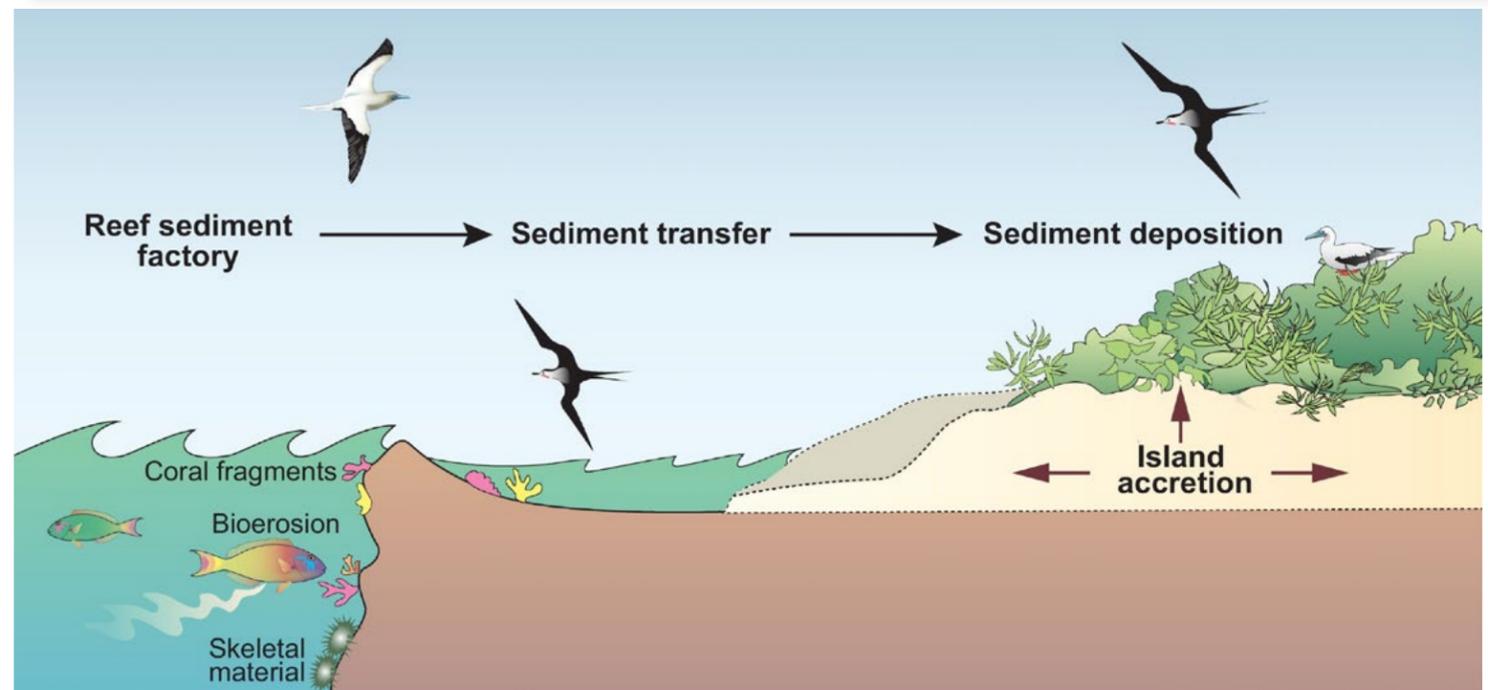
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The process of atoll island accretion

natural process and building climate change resilience.

Restoration efforts

Restoration of atoll island ecosystems, as seen in trials on atolls like Tetiaroa, Palmyra and Aldabra, involves improving the health of the surrounding coral reef habitat. This approach is particularly viable for sparsely inhabited islands, where human-engineered solutions may not be necessary.

Geological evidence suggests that island formation has occurred before, dur-

ing and after sea level *highstands* (intervals during which the sea level was above the edge of a continental shelf). Remote sensing observations have revealed that many reef islands are dynamic, changing shape and size, and in some cases, even showing rapid reformation under contemporary conditions. This counters the common belief that all reef islands are shrinking or disappearing.

Critical questions

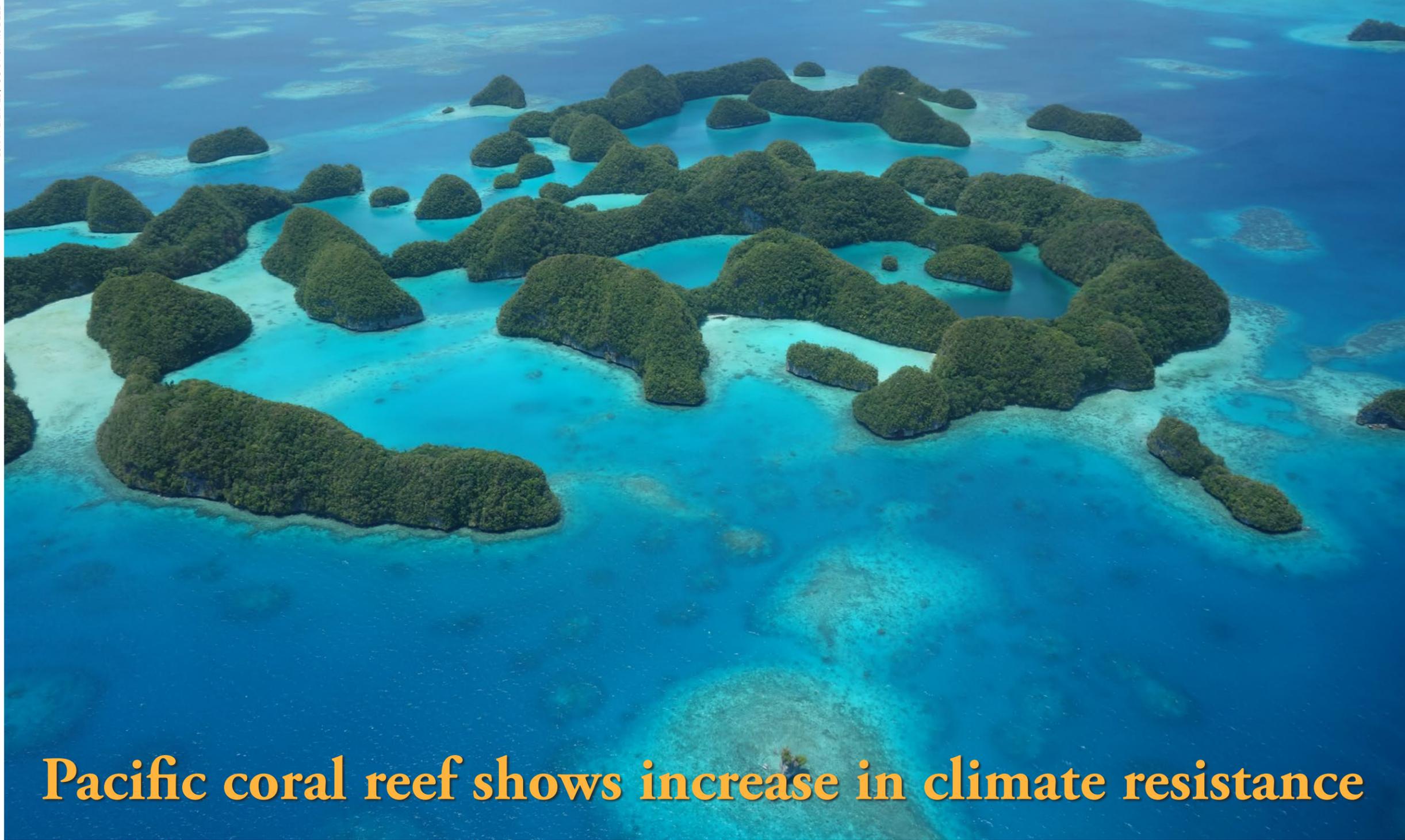
Key questions remain about

the ongoing growth of reef islands. Are they being actively fed with fresh sediments, or are they reliant on existing sediment reservoirs on the reef's flat surface? Understanding the source and contribution of these sediments is crucial for predicting the future persistence of reef islands as sea levels continue to rise. The integration of local knowledge and cutting-edge science in restoration programmes is essential. ■ SOURCES: TRENDS IN ECOLOGY & EVOLUTION, GEOPHYSICAL RESEARCH LETTERS

TRENDS IN ECOLOGY & EVOLUTION / CC BY 4.0 DEED

Edited by
Peter Symes

Corals in Palau did not suffer mass bleaching during the 2017 marine heatwave despite levels of heat stress and light intensity that were broadly equivalent to the conditions that led to mass bleaching in 1998 and 2010 at the same reefs.



Coral reefs in one part of the Pacific Ocean have likely adjusted to higher ocean temperatures.

The ability of coral reefs to adapt to changing ocean temperatures is a pressing question in marine biology.

Coral reefs are currently experiencing significant declines. These declines are primarily due to marine heatwaves, which lead to widespread coral bleaching and mortality. Understanding how coral communities can adapt to increasingly severe and frequent marine heatwaves is crucial for their survival in the face of climate change.

The rate at which thermal tolerance can increase naturally has remained largely unknown, despite its critical role in determining to what extent coral assemblages can keep pace with ocean warming.

To find out, researchers at Newcastle University embarked on a study to unravel how quickly coral reefs

can naturally increase their thermal tolerance. Their study paid particular attention to historic mass bleaching events, using Palau, a remote Pacific coral reef system, as a case study.

It is possible

The study showed historic increases in the thermal tolerance of coral reefs are possible. The results demonstrate how this capacity could reduce future bleaching impacts if global carbon

emissions are cut down.

Drawing on decades of field observations, the scientists modelled many possible future coral bleaching trajectories for Palauan reefs, each with a different simulated rate of thermal tolerance enhancement. They found that if coral thermal tolerance continues to rise throughout the 21st century at the most likely historic rate, significant reductions in bleaching impacts are possible.

However, the researchers also note that if mass coral bleaching conditions occur two or more times per decade at any given reef, it is likely this is too frequent to allow for reef recovery.

On the other hand, if the most likely historic increase in thermal tolerance could be maintained throughout the coming century, bleaching projections were substantially reduced across all emissions scenarios. ■

SOURCE: NATURE COMMUNICATIONS

Pacific coral reef shows increase in climate resistance

Our study indicates the presence of ecological resilience to climate change, yet also highlights the need to fulfil Paris Agreement commitments to effectively preserve coral reefs.

— Liam Lachs, study lead author, Newcastle University



Edited by
Peter Symes

The kelp forests within the sanctuary provide habitat for a variety of fishes and other animals.

A new study by UC Santa Barbara's Marine Science Institute highlights the significant benefits of Marine Protected Areas (MPAs) for the recreational scuba diving industry in California's Northern Channel Islands. This research underscores the importance of considering the diving community in decisions about the future of MPAs.



MPAs: Catalysts for both marine health & scuba diving

ROBERT SCHWEMMER / NOAA / CC BY 2.0 DEED

Office of National Marine Sanctuaries
National Oceanic and Atmospheric Administration

Channel Islands National Marine Sanctuary
Final Management Plan

channelislands.noaa.gov | March 2023

The findings from UC Santa Barbara's Marine Science Institute provide compelling evidence of Marine Protected Areas (MPAs) value to the scuba diving industry and local economies. As global leaders aim to protect 30% of land and water by 2030, understanding the diverse benefits of MPAs is crucial for informed decision-making and sustainable coastal management.

The Channel Islands National Marine Sanctuary's remote, isolated position at the confluence of two major ocean currents supports remarkable biodiversity and productivity. It is a special place for endangered species, sensitive habitats, historic shipwrecks and

other maritime heritage artefacts. Numerous important commercial and recreational pursuits, including fishing, shipping and tourism, flourish within the sanctuary.

Researchers analysed millions of Automatic Identification System (AIS) data points from recreational diving vessels. They identified vessel behaviours linked to non-extractive ecotourism, such as underwater wildlife viewing and photography, and compared these with activities like recreational lobster fishing within and around MPAs.

Findings

The study, spanning 2016-2022, found

a preference for MPAs among dive vessels engaged in ecotourism. A significant proportion of popular dive sites (38%) were located within MPAs, with 45% of unique dive events conducted in these areas. Conversely, vessels primarily conducting recreational lobster fishing showed a preference for MPA border zones, with 78% of lobster fishing dive events occurring outside MPAs.

The study highlights the "spillover effect" of MPAs, where species abundance in protected areas enhances nearby fishing experiences. Divers are attracted to the Northern Channel Islands' MPAs for encounters with sea lions, kelp forests, and giant sea bass.

Dive captains noted that MPAs facilitated more enriching experiences for their clients.

Implications

This research emphasises the dive industry's role in coastal economies and the importance of MPAs in supporting ocean ecotourism. As a fast-growing sector, ecotourism's stake in coastal biodiversity and planning is significant. The study's focus on scuba diving, a key component of Southern California's marine ecotourism industry, sheds light on an often-understudied benefit of MPAs. ■

SOURCE: MARINE POLICY

Edited by Peter Symes

DEMA Show and F1 race dates clash

DEMA Show 2024 and Formula 1 Grand Prix will take place in Las Vegas on partially overlapping dates. Will it be an issue?

During the DEMA Show in New Orleans, I encountered a dive industry colleague who appeared quite distressed. He had just discovered that a Formula One race was sched-

uled concurrently with the next DEMA Show in Las Vegas. His concern was that securing a hotel would be impossible, as he believed everything was already booked. At that moment, I was somewhat sceptical of his concern.

Considering the event was still a year away and Las Vegas, known for its abundance of hotel rooms and capacity to host

multiple large-scale events simultaneously, it seemed unlikely that accommodations would be completely unavailable. Nevertheless, this topic had already sparked considerable discussion on the show floor, prompting DEMA to address these concerns through press releases and newsletters.

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DEMA SHOW 2024 & FORMULA 1

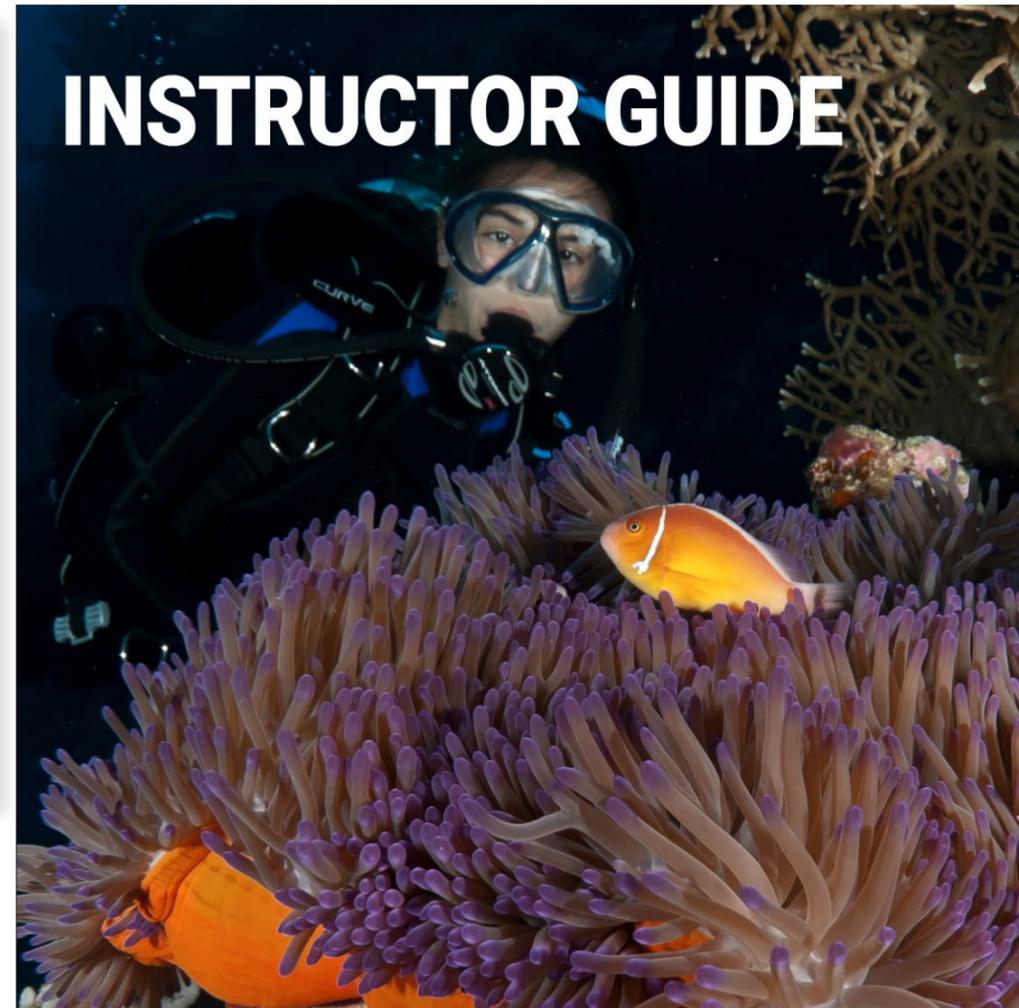


DEMA Show 2024 will take place in Las Vegas, NV, November 19-22, 2024 and recently the City of Las Vegas announced that the 2024 Las Vegas Grand Prix will take place November 21-23, 2024.

BUT LEAVE YOUR WORRIES IN THE DUST...

	<p>HOTEL RATES ARE LOCKED IN The DEMA Show 2024 host hotel block rate at the Westgate Las Vegas Resort has already been locked in at \$129-\$149 per night (single/double occupancy) and will not be affected by the F1.</p>
	<p>NEW HOTEL BLOCK ADDED In addition to the hotel block at the Westgate, DEMA has added a block at the Renaissance Las Vegas Hotel, securing rates for attendees at \$199 plus applicable fees.</p>
	<p>THE WORD ON THE STREET The demand for the 2023 Formula One staging this week has proven to have been grossly over-estimated, resulting in hotel rates dropping across the city, ticket prices plummeting, and more.</p>

SCAN HERE TO READ WHAT THE NEWS IS REPORTING ABOUT THE DISAPPOINTING TURN OUT FOR THIS YEAR'S F1



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COMPOSITE BY PETER SYMES

DEMA has proactively addressed any concerns regarding the overlap of the DEMA Show 2024 and the Formula One Grand Prix in Las Vegas. They have secured thousands of hotel rooms, with rates starting as low as US\$129/night, ensuring ample availability and affordable options for attendees.

The DEMA Show is scheduled for 19-22 November 2024, while the Grand Prix will occur from 21-23 November. Despite the overlap, DEMA's advance planning guarantees stable hotel rates at the Westgate Las Vegas Resort and the Renaissance Las Vegas Hotel, with prices locked in at US\$129-149 and US\$199 per night, respectively.

Interestingly, the 2023 Formula One event in Las Vegas experienced lower-than-expected attendance, leading to a drop in hotel rates and ticket prices. This trend suggests that attendees

of the DEMA Show 2024 might face even fewer issues regarding accommodation and enjoy the added vibrancy of the Formula One event.

DEMA advises participants to book in the official hotel block early in 2024 and arrange flights promptly to make the most of their experience.

- Book in the official hotel block as soon as it becomes

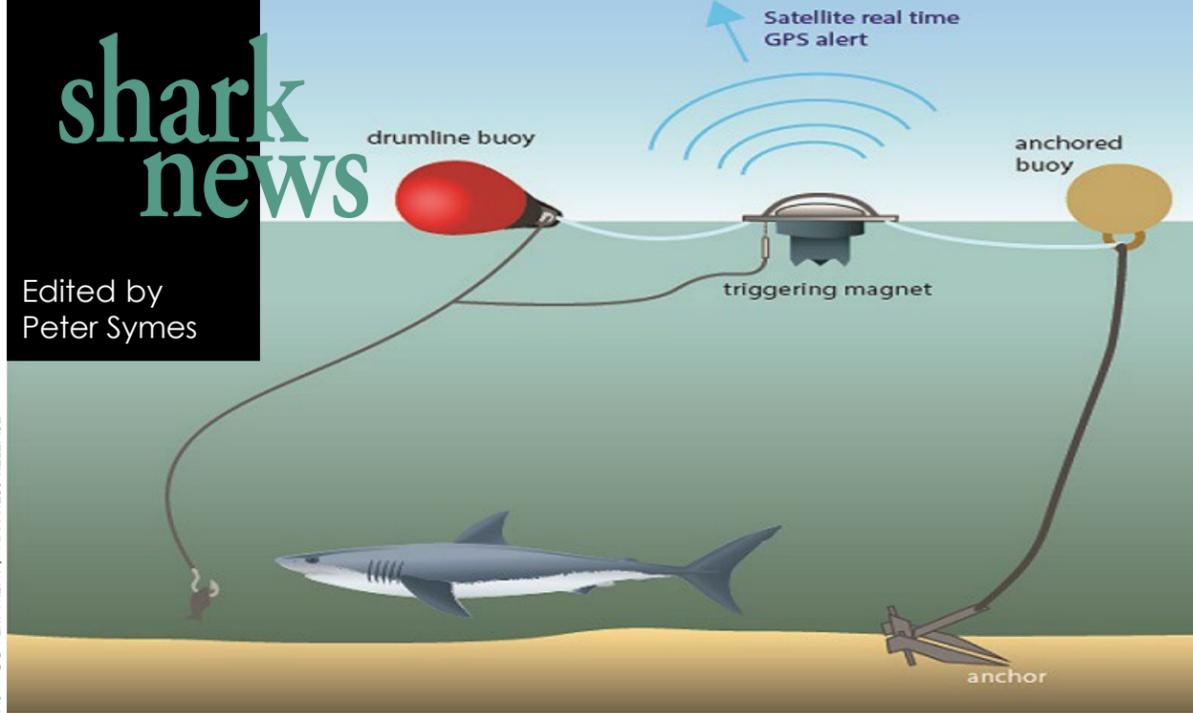
available in the first quarter of 2024.

- Book flights as soon as possible.
- Enjoy the additional excitement Formula One brings to the Las Vegas.

For the latest updates, DEMA encourages **subscribing to the DEMAIL and DEMA Show email lists.** ■

Edited by Peter Symes

NSW GOVERNMENT / VIA PRESS RELEASE



If a shark or other animal is captured, the pressure on the line triggers the communications unit, which then sends an alert via phone call, email and text message to a boat crew who will respond to the animal within 30 minutes. If it is a target shark, namely a white, bull or tiger shark, it will be tagged and then released one kilometre offshore. All other marine animals caught are released immediately.

Catch-and-release deter sharks from beaches

An approach to managing shark populations near beaches, involving catching and releasing them, not only deters sharks from coastal areas but offers a promising solution to the challenge of balancing human safety with marine conservation.

Researchers conducted trials using SMART drumlines in New South Wales, Australia, to catch and release sharks, particularly white sharks. The study aimed to quantify the short-term, post-release movements and the longer-term fate of these sharks.

Sharks were caught using SMART drumlines deployed about 500m from shore. Once captured, they were quickly secured to a research vessel, minimising potential injuries. The sharks were tagged with satellite-linked radio transmitting tags and acoustic transmit-

ters to monitor their movements post-release.

Effective short-term deterrent

The study found that after release, white sharks moved offshore before gradually returning to nearshore waters. This movement pattern suggests that the catch-and-release method effectively deters sharks from beaches in the short term. Additionally, the rapid response to SMART drumline captures indicated no long-term harm to the sharks, supporting the utility of this method as a non-lethal bather protection tool.

The approach aligns with conservation goals by minimising harm to sharks. It also provides a means of reducing shark-human interactions, a critical concern in areas with high recreational use. The study's findings are particularly relevant for endangered species like the white shark, offering a humane alternative to lethal control methods. ■ SOURCE: BIOLOGY

WHAT ARE 'SMART' DRUMLINES?

"SMART stands for Shark-Management-Alert-In-RealTime. SMART drumlines consist of an anchor, two buoys and a satellite-linked GPS communications unit attached to a hook baited with one sea mullet.

"A triggering magnet is attached to the communications unit. When a shark takes the bait and puts pressure on the line, the magnet is released, alerting the boat crew and DPI scientists that there is an animal on the line. Once alerted, the team responds immediately (within 30 minutes) to tag and release the shark or other marine animal.

"SMART drumlines are set every morning (weather dependent) approximately 500m offshore at a depth between 8-15m of water. They are collected at the end of each day and are not left overnight."

— NSW Government, Department of Primary Industries

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The revelation that basking sharks are partially warm-blooded adds a fascinating layer to our knowledge of these gentle giants. It underscores the complexity of marine life and the continuous surprises it holds.



GREEN FIRE PRODUCTIONS / CC BY 2.0 DEED

Basking sharks are not cold-blooded

In a surprising twist to our understanding of marine biology, recent research has revealed that basking sharks, known for their gentle, plankton-feeding habits, are partially warm-blooded.

The revelation that basking sharks are partially warm-blooded challenges previous assumptions about the physiology of these colossal creatures and has significant implications for their conservation and understanding of marine ecosystems.

An international team of researchers, led by Trinity College Dublin, conduct-

ed a study published in the journal *Endangered Species Research*. The team undertook dissections of deceased basking sharks and designed a new low-impact tagging method to record the body temperature of free-swimming basking sharks off the coast of County Cork, Ireland.

Elevated temperature

The research revealed that basking sharks possess cruise-swimming muscles located deep inside their bodies, similar to those found in apex predators like white sharks and tunas. Additionally, their hearts are stronger and more muscular compared to most fish species, likely aiding in generating high blood pressure and flow.

The tagging results showed that the muscle temperatures of basking sharks are consistently elevated above water temperatures, aligning closely with their regionally-endothermic predatory cousins.

This discovery of regional endothermy in basking sharks is groundbreaking. It suggests that the ability to maintain a warm body temperature is not exclusive to fast-swimming, apex predators but is also present in a species with a vastly different lifestyle. Haley Dolton, the lead author of the study, highlights the importance of this finding for conservation strategies, as it may change previous assumptions about the metabolism and poten-

tial distribution shifts of these sharks in response to ocean warming.

Conservation concerns

Basking sharks, the second-largest fish in the world, have experienced significant population declines in the North-East Atlantic over the last century. They gained legal protection in Irish waters only recently. Understanding their warm-blooded nature is crucial for developing effective conservation measures, especially as they might respond differently to ocean warming compared to other fish species. ■

SOURCE: ENDANGERED SPECIES RESEARCH



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A recent observation has revealed that reef sharks can rest, overturning the assumption that they must constantly swim to breathe.



Reef sharks do rest

Surprising discovery challenges long-held beliefs about shark physiology.

Contrary to long-standing beliefs, recent research has revealed that grey reef sharks can rest, overturning the assumption that they must constantly swim to breathe. This groundbreaking discovery, made in the

Seychelles, offers new insights into the physiology and behaviour of these marine predators.

Grey reef sharks are classified as obligate ram ventilators, believed to require perpetual motion to force water over their gills for respiration.

However, researchers observed these sharks resting under coral reef ledges, indicat-

ing a shift from ram ventilation to buccal pumping, a method allowing them to breathe while stationary, which was previously thought to be impossible for this species. This adaptation is significant, as it indicates a more complex and versatile physiology than previously recognised.

This discovery has profound implications for future shark research, particularly studies

on metabolic rates, energetics and behavioural strategies. Understanding that these sharks can rest alters assumptions about their energy expenditure and ecological roles. It also raises questions about the resting and potential sleeping patterns of other shark species, especially those considered obligate ram ventilators. ■

SOURCE: JOURNAL OF FISH BIOLOGY

Gray reef sharks (*Carcharhinus amblyrhynchos*) resting at a coral reef ledge in the Amirantes Islands, Republic of Seychelles (left) Image A: Dillys Pouponeau, © Save Our Seas Foundation; Image B: Craig Foster, © Sea Change Project. Permission: Open Access

PETER SYMES

Edited by Peter Symes



PETER SYMES

Lemon shark getting a facial

Mucus layer on shark skin may have medical use

Mucus layer on shark skin possesses properties that could be beneficial in medical applications, particularly in wound care.

Sharks are known for their remarkable ability to heal quickly from wounds. The mucus layer on their skin plays a crucial role in this process. Recent research has uncovered that the mucus layer on shark skin possesses properties that could be beneficial in medical applications, particularly in wound care.

Researchers at Sweden's Karolinska Institute, conducting

their investigation at the Marine Biological Laboratory in Massachusetts, found that the mucus layer on shark skin is chemically different from that of bony fish. This layer is less acidic (almost neutral), and shares more similarities with some mammalian mucus, including human mucus.

Wound care

The study's findings indicate that this layer could be instrumental in developing new wound care treatments, drawing parallels with products already derived from codfish. Understanding the biochemical properties of shark skin at

a deeper level could lead to significant breakthroughs in how we approach healing and tissue regeneration in humans.

Previous studies have led to several significant discoveries with potential applications in human medicine, such as the identification of the antibiotic squalamine in the liver and stomach of spiny dogfish sharks and research on chloride channels in the rectal gland of these sharks, which are relevant to cystic fibrosis. ■

SOURCE: INTERNATIONAL JOURNAL OF MOLECULAR SCIENCES



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Ecotourism increases the probability of sharks being in a disturbed behavioural state, likely increasing energetic expenditure and potentially leading to downstream ecological effects.

Ecotourism has been posited as a potential solution to many of the issues facing shark conservation, yet increasingly studies suggest that such activity may negatively influence aspects of shark ecology and so further pressure declining populations.

— Joel H. Gayford, et al.

Behavioural consequences of shark ecotourism

Shark ecotourism, a rapidly growing sector, offers both opportunities and challenges for marine conservation. Recent studies have delved into the multifaceted aspects of this industry, exploring its effects on shark behaviour, local economies and conservation efforts.

Ecotourism, particularly shark diving tourism, has become a significant global industry, attracting over half a million participants annually across approximately 85 countries. While it generates substantial revenue and raises awareness for shark conservation, concerns about its impact on shark behaviour and health, as well as human safety, persist.

A study by researchers from Imperial College London involved capturing whale shark behaviour using UAVs both in isolation and during human interactions in La Paz Bay, Mexico. The team employed deep learn-

ing algorithms to analyze the movement patterns of these sharks, focusing on changes in behaviour due to the presence of humans.

Key findings

The research revealed that human interaction increases the likelihood of whale sharks being in a disturbed behavioural state. This state is characterized by rapid, erratic movements, likely leading to increased energetic expenditure and potential downstream ecological effects. The study also found that behavioural responses to ecotourism are context-dependent, influenced by the sharks' initial behavioural state.

These findings raise concerns about the ecological impact of shark ecotourism, an industry aimed at conserving shark populations. The study suggests that ecotourism activities, even those without provisioning, can lead to behavioural disturbances in whale sharks, potentially affecting their foraging success and increasing the risk of injuries.

Research on Australia's marine World Heritage Sites, including Ningaloo Marine Park and Shark Bay Marine Park, employs the Marine Protected Area Governance framework to analyse governance effectiveness. This approach highlights the importance of balancing conservation objectives with tourism and local community needs.

Emotional engagement

Studies suggest that wildlife tourism, including shark-based tour-

ism, can foster a conservation ethic among participants. However, the effectiveness of these efforts varies, depending on the species involved and the nature of the tourist experience. Emotional engagement with wildlife is key to fostering pro-conservation attitudes and behaviours.

The growth of shark-based tourism has shifted public perception of sharks, once seen as a threat to coastal tourism, to an important attraction.

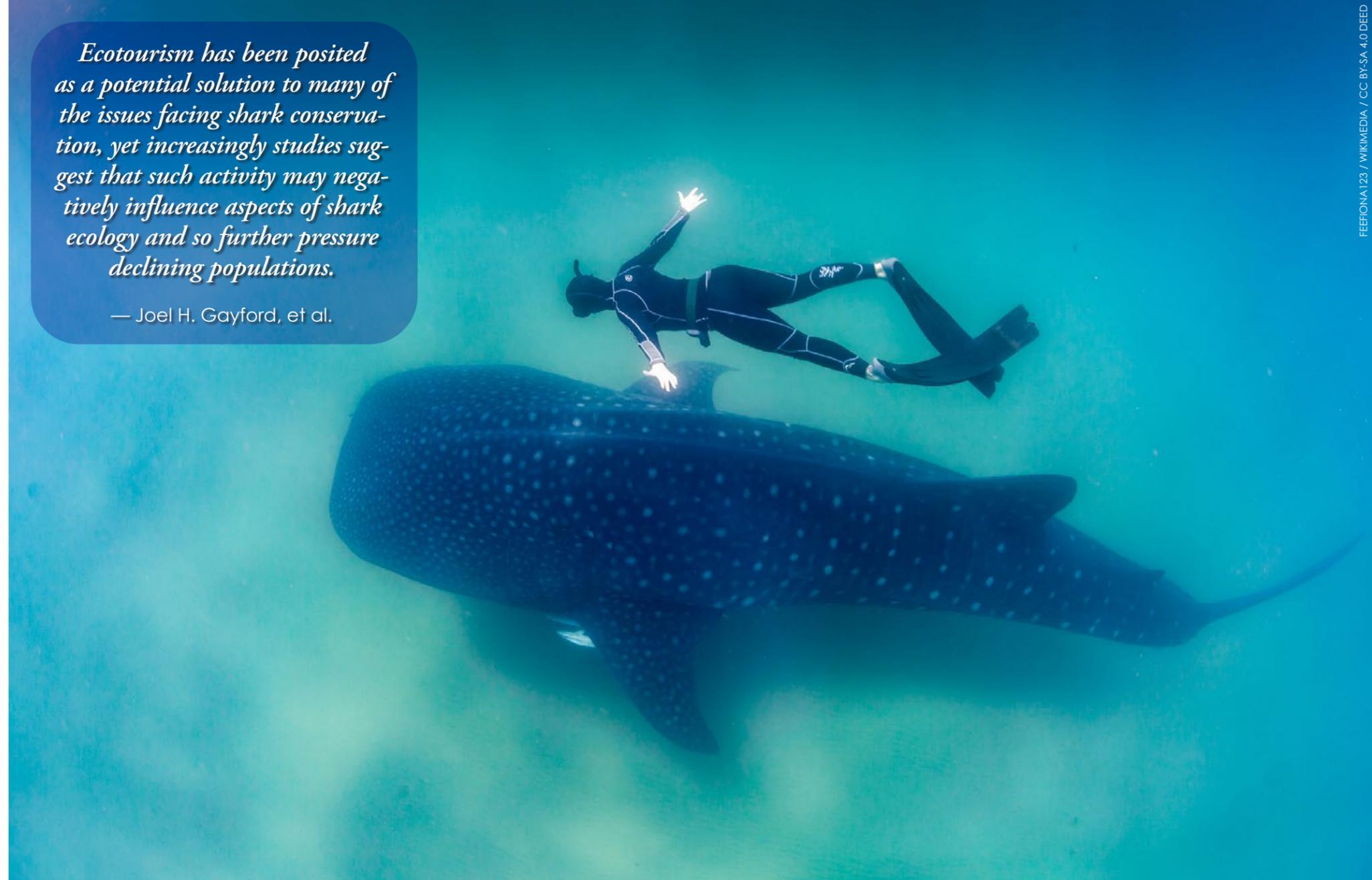
This change is crucial for the conservation of shark species, which face significant threats from global fisheries.

The relationship between shark ecotourism and conservation is complex. This study underscores the need for responsible ecotourism practices that minimize disturbance to marine life. While ecotourism has the potential to support conservation efforts, careful management and regulation are essential to ensure

that tourism practices are sustainable and beneficial for both sharks and local communities.

As the industry continues to grow, understanding and mitigating its impact on the behaviour and ecology of whale sharks is crucial for the sustainability of both the ecotourism sector and the species it seeks to protect. ■

SOURCES: NATURE, SCIENTIFIC REPORTS





US DEPARTMENT OF ENERGY, PUBLIC DOMAIN

Divers from the Naples Police underwater unit, based in Naples, Italy, have retrieved a substantial piece of obsidian from the remnants of a Neolithic shipwreck, off the coast of Capri (above); Example of obsidian arrowhead (right)

Discovery of a potential Neolithic shipwreck off Italy's coast

Underwater archaeologists have recovered obsidian cores from what is believed to be a Neolithic shipwreck, potentially one of the oldest maritime discoveries.

The discovery was made near Capri's famous Blue Grotto, a site historically used as a private bath by Roman emperors. Divers from the Naples Police Headquarters' underwater unit located the wreck, which contained obsidian core material at a depth of around 40m. One of the cores, showing clear traces of chiselling and carving, measures approximately 28 x 20 x 15 cm and weighs almost 8kg.

Little is known about Neolithic Capri, but archaeo-

logical evidence indicates human presence on the island during this period and the Bronze Age. The obsidian cores suggest a connection to ancient trade routes, as obsidian was a valuable material in prehistoric times.

Caution

While the find has been hailed as potentially groundbreaking, some experts urge caution. The term "Neolithic shipwreck" is speculative at this stage, with no concrete evidence confirming the wreck's age. The discovery could represent a cargo from a Neolithic vessel, but alternative theories suggest it might be an isolated case of jettison during a storm or even a ritual offering.

Future research

The National Superintendency of Underwater Cultural Heritage plans further recovery operations in collaboration with the Superintendency of the Metropolitan Area of Naples. These efforts aim to provide a more in-depth investigation of the island's prehistoric occupation and ancient Mediterranean maritime activities.

The potential Neolithic shipwreck off Capri offers a tantalizing glimpse into ancient maritime history. While the true nature and age of the wreck remain to be confirmed, this discovery opens new avenues for understanding early seafaring and trade in the Mediterranean. ■ SOURCE: NAPLES SUPERINTENDENCY FOR ARCHAEOLOGY

NAPLES SUPERINTENDENCY FOR ARCHAEOLOGY, FINE ARTS AND LANDSCAPE / VIA PRESS RELEASE



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The legendary wreck was discovered off the coast of Cartagena, Colombia, on 27 November 2015, by a team of international scientists and engineers during an expedition aboard the Colombian Navy research ship ARC Malpelo.

Colombia looks to recover treasures from the San José shipwreck

Colombia is set to embark on a historic underwater expedition to recover objects from the 1708 shipwreck of the galleon *San José*, which has been dubbed the “holy grail of shipwrecks.”

The *San José*, a three-decked galleon approximately 150ft long and armed with 64 guns, sank during a battle with British ships in 1708. It is believed to contain 11 million gold and silver coins, emeralds and other precious cargo from Spanish colonies. Researchers have identified bronze cannons, ceramic and por-



COLOMBIAN MINISTRY OF CULTURE / VIA PRESS RELEASE

celain vases, and personal weapons among the artefacts, confirming the wreck's identity.

Its recovery has been a subject of international intrigue and legal disputes, and its location, off Colombia's Baru peninsula, remains a state secret.

Juan David Correa, Colombia's culture minister, announced plans for the first recovery attempts between April and May 2024, depending on Caribbean ocean conditions. Emphasising the scientific nature of the expedition, Correa stated, “This is an archaeological wreck, not a treasure.” The Colombian government aims to position the country at the forefront of underwater archaeological research.

Legal & diplomatic challenges

The *San José*'s discovery in 2015 sparked legal battles in the United States, Colombia and Spain over the rights to the sunken treasure. In

2018, UNESCO urged Colombia not to exploit the wreck commercially, highlighting the potential loss of significant heritage. Colombia, not a signatory to the UN Convention on the Law of the Sea, faces international scrutiny over its handling of the wreck.

The ship's cargo is estimated to be worth between US\$4 billion and US\$20 billion. A US salvage company has also laid claim to a portion of the treasure, citing a 1980s agreement with the Colombian government. The outcome of these legal disputes could significantly impact the distribution of the recovered wealth.

By balancing scientific exploration with legal and ethical considerations, Colombia's endeavour could uncover a significant chapter of maritime history while potentially yielding an immense economic windfall. ■

SOURCE: COLUMBIAN MINISTRY OF CULTURE

WIKIMEDIA / PUBLIC DOMAIN



This painting by Samuel Scott (1702-1772) refers to Commodore (later Admiral) Charles Wager's assault on a Spanish treasure fleet off Cartagena in 1708.



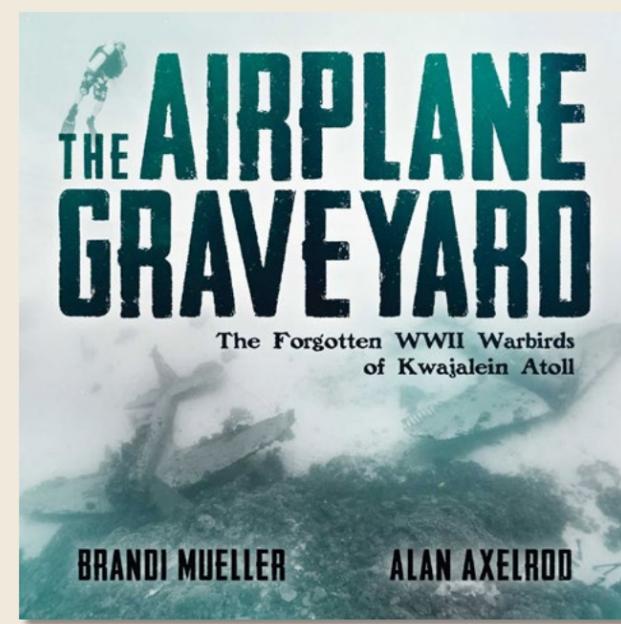

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Azores

Adventure in the Atlantic

Text by Silke Ptaszynski
Photos by Rainer Schimpf



Diver with circling mobula rays, off Santa Maria Island in the Azores (above);
PREVIOUS PAGE: Sperm whale with calf (Permit: DRAM/CETACEOS/2021/029)



Whale shark feeding on bait ball of snipefish in the Azores (above)

A powerful influencer of climate and ocean currents, the Atlantic Ocean is vast, stretching from the North Pole down to the South Pole. At around the middle of this massive system lie the Azores Islands, about seven hours flight from New York or approximately four hours from Lisbon. The island group comprises nine islands, each with very different characteristics. One thing they all have in common is their nickname: “The Green Islands.”

Winter rains are massive, and summers are mild, with temperatures seldom reaching above 27°C. Lush forests and desert-like areas are home to dairy cows and sheep. The locals are friendly, and safety is not an issue. Where else can you park at an airport for free, and leave the key in the ignition when you drop off your rental car?

The islands lie in-between the North American, Eurasian and African tectonic plates and are, of course, volcanic. Some of the islands still have enough volcanic activity to heat up the ground and create beautiful colourful lakes.

Santa Maria

The southernmost island in the Azores is Santa Maria. Here, the dominance of the Gulf Stream assures 16 to 20°C water temperatures most of the year; however, in summer, from August to September, water temperatures may rise to 27°C.

Santa Maria Island is where our adventure starts. The island is small; it takes only about two hours to drive around it and experience the highest point—close to 600m—at Pico Alto, with its dense forests of mammoth trees and tree ferns. The grassy areas at the foot of the mountain, where cows and sheep roam, are lush and green. Only two beaches can be



found on Santa Maria Island: Praia de São Lourenço and Praia Formosa. Much of the rest of the coast is made up of sheer cliffs. The topography underwater is similar, with a smooth sea bottom

close to shore, and some hundred metres or so off the island, there is a deep drop into the Atlantic Ocean. Deep trenches filled with tiny marine life such as plankton create amazing feeding opportuni-

ties for larger marine life, as the plankton move up towards the surface from underwater sea-mounts. The most renowned dive site is Ambrósio, which is only about seven nautical miles from the port.

The port of Vila do Porto is where it all begins. The marina is small and has a great restaurant called Clube Naval de Santa Maria, which offers snacks and drinks during the day, and superb dinners on most nights. Most dive centres on Santa Maria Island are based here as well, and head out to dive sites from the port on

semi-rigid rubber ducks with 300HP motors.

Diving

Divers assemble in the morning at the harbour area. All the dive centres have dressing areas, and there are public toilets and showers. Dive courses are available and recreational diving can be done at a variety of national parks and protected areas.

Even though most reefs are rocky and barren, one will find a plethora of fish, moray eels, barracuda and groupers. The reefs are full of life and sometimes have spectacular topography too. There are even some cave-like overhangs, where cleaner shrimp can be found.

In general, recreational dives are double tank (nitrox is available), and it takes about 45 minutes to

Divers with blue shark (above); School of ornate wrasse, *Thalassoma pavo*, on rocky reef at Formigas Islets (top right); View over Santa Maria Island (top left); Pair of spotted dolphins (far left); Green sea turtle (centre)



Underwater photographer with mobula rays at Ambrosio. The mobula ray in the foreground appears to be pregnant.

reach the dive sites, with intervals taking place on the dive boat. After the second dive, one can be back in port as early as 2:00 p.m. This gives you time to explore the island by car or scooter and enjoy the local sights and attractions.

Dive sites

Dive sites to visit if you are a certified diver or freediver are plentiful, but Ambrósio should definitely be on your must-do list. Ambrósio is like a superhighway and fast-food joint for all pelagic fish and sea life in the area, and is the best place to experience the abundance of marine life at Santa

Maria Island.

Mobulas or sicklefin devil rays (*Mobula tarapacana*) can be seen in huge groups of up to hundreds of individuals during the season between June and October. In sequence, they spiral around the Ambrósio seamount, moving up to the surface where a buoy is anchored. Many divers and snorkellers enjoy watching this spectacle. Not shy at all, the mobulas come so close that one can easily experience these creatures up close.

Pelagic fish like barracuda, wahoo and dolphin are seen most often. The best part is that this

area is also the hunting grounds for big tunas. Where else can one see both bigeye tuna and yellowtail tuna on the same dive?

Along with the entire archipelago of the Azores, Ambrósio has been declared a Hope Spot by Mission Blue (ed. – the ocean conservation nonprofit organization and alliance led by oceanographer Sylvia Earle), being a critical site for ocean biodiversity. However, more local governmental support is needed to make this a reality.

This place is very special. Fishing is prohibited here, but fishing boats are nearby, fishing for bait-



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fish such as snipefish, which fishers use to attract bonitos and tunas during the season. Sometimes, the fishing boats are so close that divers can see them while underwater. In the split shot (on this page), you can see the boats using water hoses, spraying salt-water onto the surface to create the illusion of panicked fish in order to attract bonitos. Funnily enough, snipefish will form a small bait ball under the keel of a fishing vessel to hide from the tunas.

occasions in which we saw bait balls of snipefish and loads of tuna in a feeding frenzy. More about that later...

Due to the deep trenches and topography, sea birds and marine mammals such as common dolphins, bottlenose dolphins and spotted Atlantic dolphins often followed our vessel or were engaged in bait ball action. On our trips to Formigas Island, approximately 40 nautical miles north of the harbour, we encountered sperm whales and pilot whales; some skippers even had the privilege of seeing orcas.

In the Azores, it is prohibited to enter the water when whales are around. However, in the past, we were lucky to have had a special permit on hand, which gave

Tuna

To see and experience fully grown tunas, one will need to travel a lot around this planet to find them. On our trip, during the season from August to September, we had plenty of



Fishing boat with snipefish hiding under the hull (above); School of tuna hunting snipefish in a bait ball trapped at the surface (top left); Tuna under bait ball (top right); Close-up shot of tuna (right)





Divers and black coral on wall at Formigas Islets (above); Grey triggerfish (top right) and grouper (far right) at Formigas

us legal permission to photograph these majestic animals.

Formigas Islets

On our trip, we also had a chance to visit the Formigas Islets, which were rated by Jacques-Yves Cousteau as one of the best dive sites in the Atlantic. Sometimes referred to as the Formigas Bank, the islets are a group of uninhabited rocky outcroppings in the eastern group of the Azores archipelago. They are 43km northeast of Santa Maria Island and cover a surface area of about 9,000 sq m. The submerged Dollabarat Reef is located in the same area. The only structure on the islets is a lone lighthouse, located on the largest islet,

Formigão (Big Ant).¹

The nearly 2.5-hour boat trip to the Formigas Islets was certainly worthwhile, because many of the previously mentioned marine mammals could be seen here, if one was lucky. The site offered a special dive with groupers, which were seemingly tame and generally enjoyed being photographed. There were also black corals in astounding formations on spectacular walls at deeper depths. Fish were plentiful as well; there were groupers, barracuda, jack fish and triggerfish, along with the odd mobula flying past. The chance to see hammerhead sharks was real as well. Absolutely

¹ [HTTPS://EN.WIKIPEDIA.ORG/WIKI/FORMIGAS](https://en.wikipedia.org/wiki/Formigas)

worth a trip.

Returning to land, be sure to explore Santa Maria Island. The villages here seemed like they were from another time, and some ruins even showed evidence of earthquakes, which take place occa-

sionally in the region. There were lots of great restaurants with offerings ranging from the local cuisine to Italian and German. Most restaurants were conveniently situated along the main road.



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the specialty of Expert-Tours, which has been conducting sardine run dive trips for over 20 years. The diving was part of this trip but almost secondary to the main objective, which was to experience the Atlantic Ocean and all it had to offer. As this did not come naturally, we had to search the seas and sail around quite a bit to capture underwater images of the unique aggregations of marine life that could be found here.

After launching the dive boat and assessing sea conditions, weather forecasts and the daily changing currents, we then focused on surface activity. Various bird species like shearwaters and seagulls would fly around a site, indicating the presence of prey, which meant fish could be found below.

At this time of year, there were mainly mackerel and snipefish. These fish were preyed upon by tunas, bonitos and blue sharks. So, to protect themselves, these small fishes formed bait balls.

Bait balls were what we were really after, with the best coming with schools of tuna in tow. Since the tuna were getting into a feeding frenzy, the surface



Expedition

The expedition was planned and executed in a different way. It was not an ordinary, "walk-in" dive trip, but a pre-planned and organised one. It was organised based on the operator's previous experiences conducting sardine run trips in South Africa, except that it had been customised and implemented in a manner suitable for Santa Maria Island and the specific dive boat. Such an expedition is

Pod of spotted dolphins (above); School of wahoo (top right); Diver and school of ornate wrasse on rocky underwater terrain at Formigas Islets (top left); Lone lighthouse is only structure on the islets (far left).



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Whalesharks with pilotfish, along with tuna and blue sharks, feed on bait ball (left and bottom left); The tiny snipefish form a bait ball to protect themselves from predators like tuna (right).

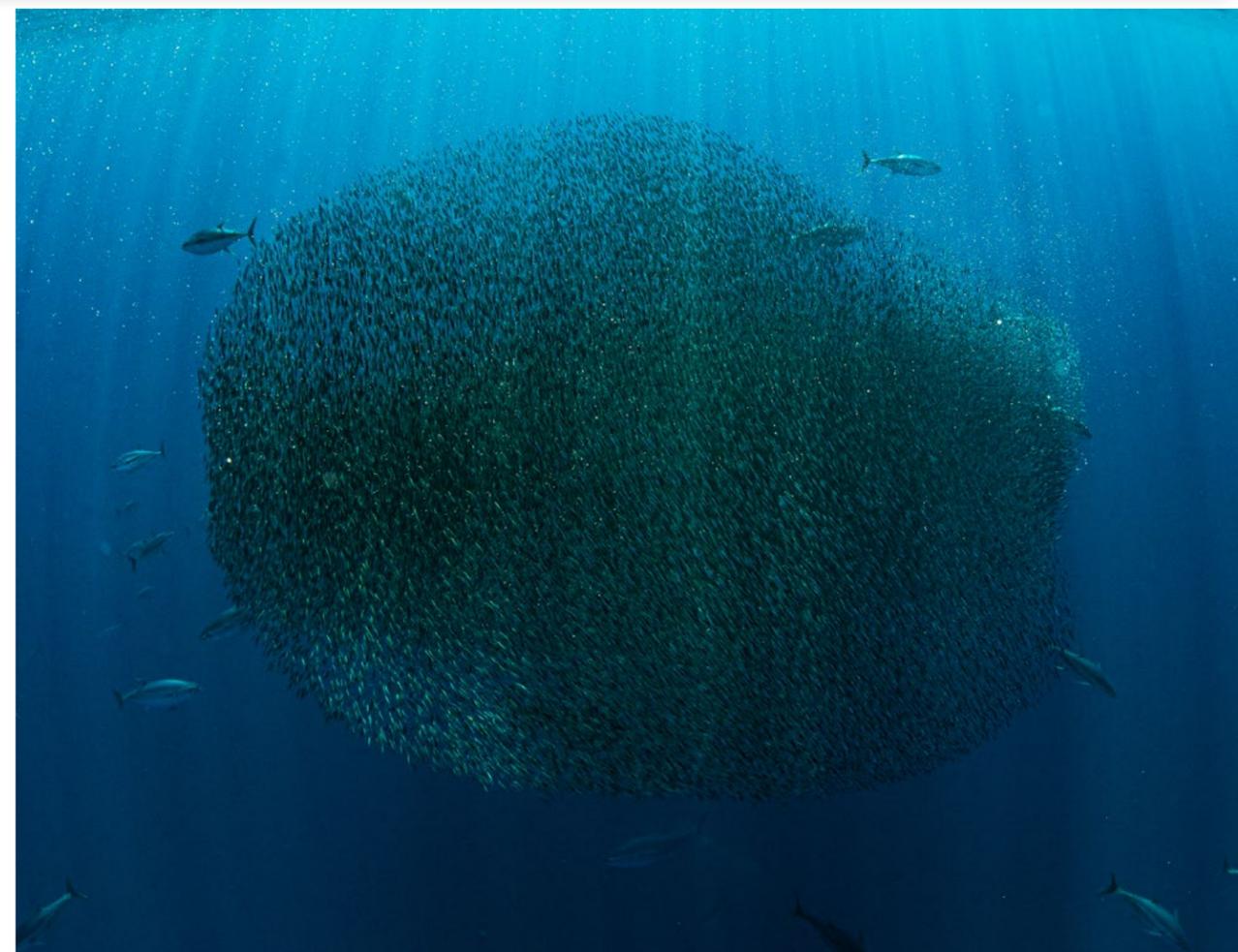


of the Atlantic appeared to be boiling, with splashes and sprays visible from afar. To locate these bait balls, the birds were important.

Whale sharks

The second goal on the trip was to find the biggest fish in the waters of Santa Maria—the whale shark. These apex predators feed predominantly on plankton, but small fishes like the snipefish are also high on their list. Since whale sharks are not present all year around, the expedition takes place in August to September to increase the chances of encountering these awesome gentle creatures. Different sizes of whale sharks, ranging from 4 to 12m, were spotted and documented in the 2023 season.

Ongoing research is being conducted by Jorge Miguel Rodrigues Fontes,



who has been tagging and marking whale sharks in the Azores to find out more about their distribution, movements and feeding habits. At present, little is known about where these giants travel to during the offseason and where they come from during the

season. Hopefully, the findings of this research will help to further protect the whale sharks and their habitats in the open ocean of the Atlantic.

Back to the expedition, the holy grail would be to find a bait ball situation, with lots of sea birds at the surface,



Whale shark with remora

feeding tunas below the surface, and a whale shark coming onto the scene to feed. The whale shark cannot initiate the formation of a bait ball, so it follows the fast-moving tunas, which would drive the small fish up against the surface of the ocean. There, the small fish lose a dimension and are trapped against the surface, thus forming a bait ball.

This situation happens naturally and cannot be evoked. No one knows where or when it will happen. Therefore, the expedition is different from a normal dive tour or scuba trip.

The dive boat actively navigates the seas for hours on end, reading signs, with dive staff getting in and out of the

Atlantic waters to check for bait balls, trying not to get too close to a potential bait ball or scaring away the sea birds and tuna, and potentially frightening the whale shark away. An experienced crew is essential for this.

It takes the entire team, finding the confidence and rhythm, to understand the best way to quietly enter and exit the water, and lots of sandwiches and energy bars to enable crew members to conduct this calorie-burning exercise for days.

With hard work, it eventually all came together for us, and we were finally in the water, slowly freediving and snorkeling close to a big bait ball of snipefish. The bigeye tunas were super-fast and enormous,

with some weighing more than 500kg. Being fish, they were not aware of what we human beings were and how fragile we could be in the water. So, one needed to have the big tunas always in sight, since you certainly did not want to be rammed by a tuna, inside the bait ball.

Rule Number One: Do not get into, or on top of, a bait ball!

We approached slowly. The sight of the tunas striking the bait ball at high speed was amazing to watch. The snipefish stood no chance.

Rule Number Two: Always scan for whale sharks.

Out of nowhere, the biggest fish on the planet, the whale shark, appeared out of the

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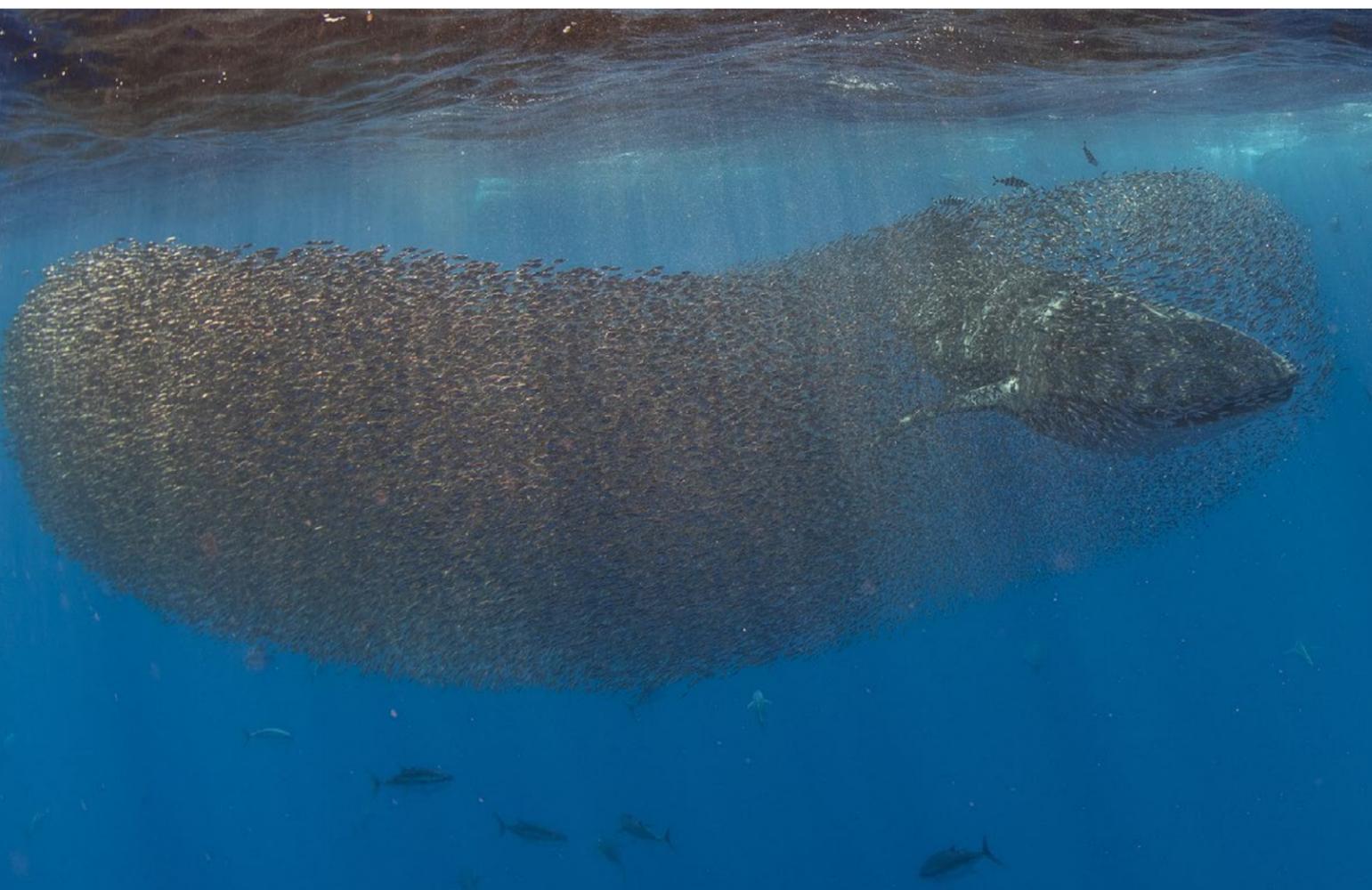
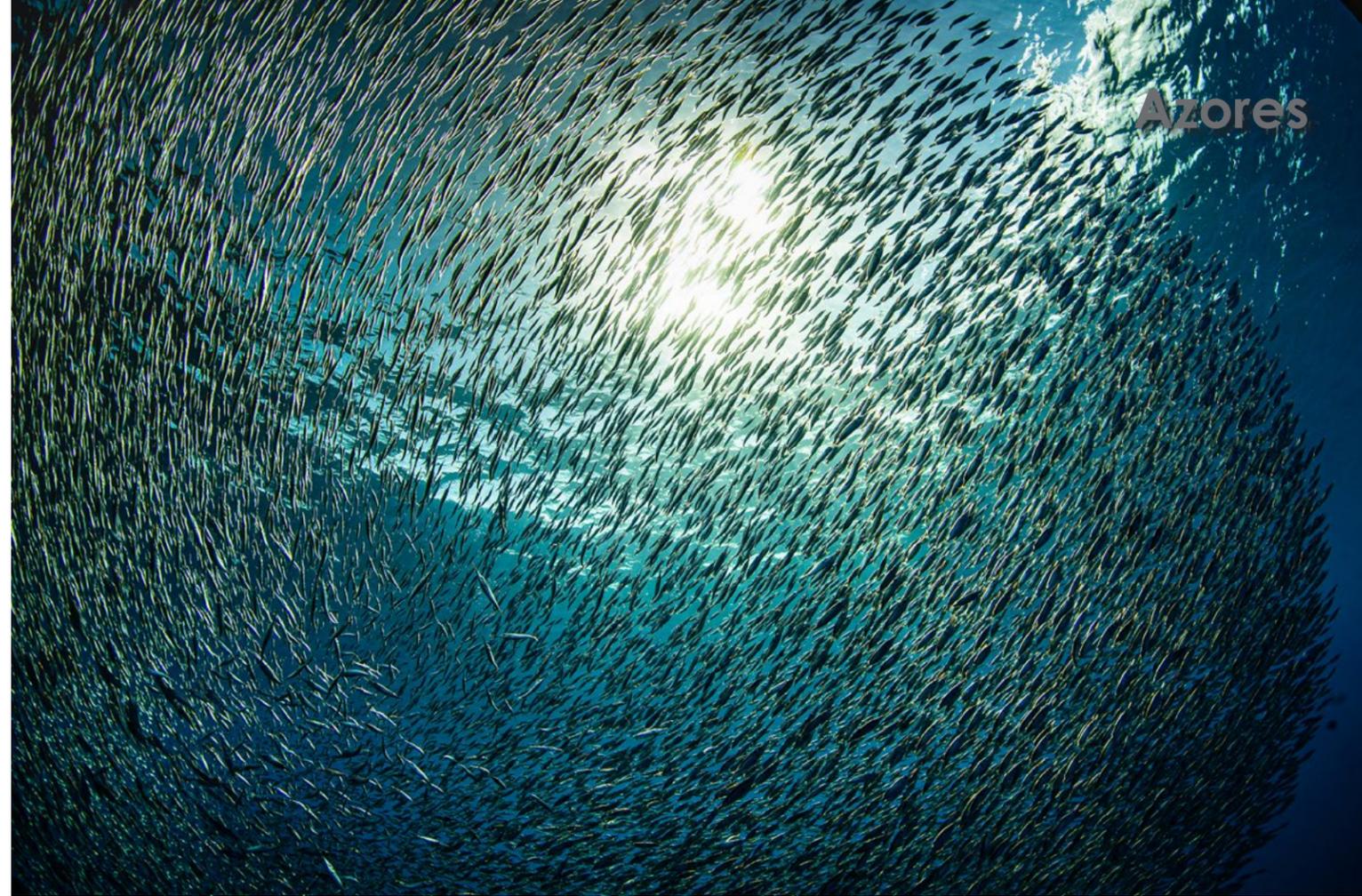
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Bait ball of snipefish at the surface (above)

blue Atlantic, with an unshakable objective—the bait ball! Like a movie star making an entrance, the whale shark carved through the water, as if in slow motion, moving towards the bait ball, opening its jaws and sucking in the snipefish.

Its ability to swallow fish and water and filtering everything though its gills decreased the size of the bait ball instantly. Close-up photographs show that some of the snipefish were still alive and swimming inside the whale shark's mouth for a while, until they were finally sucked into its stomach.

The waters around the bait ball were now full of particles, such as snipefish scales and excrement from the tuna, hampering the visibility in the waters

of the Atlantic. In general, visibility in the Atlantic Ocean around the Santa Maria Island is more than 30 to 60m.

Extraordinary experience

So, what is so special about this site? Well, there are countless places on this planet where one may encounter a whale shark, but there are only a handful of places where you can see them feed, and very few spots where natural feeding can be observed. In other words, it is extremely rare to see and document it, and it is difficult to find. Skippers, operators and crew need to know exactly what to look for, and divers and freedivers need to be briefed properly to really enjoy and watch this amazing sight.

Depending on the phase of the moon and the currents, activities of this kind can stretch from the area of Ambrósio and along the entirety of Santa Maria Island. Our four-week search for bait balls produced some amazing footage and left us with a deep respect for the coordinated hunting skills of the birds, tuna and whale sharks. As scientists continue to study this phenomenon, they will surely be able to glean much more knowledge from their data, so we all can learn more about it.

On days where a bait ball search was not in the plans, we dived several times at Ambrósio. Local government and tour operators maintain

Whale shark feeds on snipefish in a bait ball (above); One can see snipefish in mouth of whale shark (top left)





Azores

The graceful movements and synchronised swimming of the mobula rays (seen on this page with remoras attached) were enchanting.

Mobula rays

Another secret is where the mobula rays travel to or from. According to reports, some tagged individuals have been seen in winter in the Kap Verde Islands, a distance of almost 2,500km away. It seems they travel along the deep underwater trenches, following the best food sources of plankton and ideal temperatures. On our trip, mobula rays were spotted, some heavily pregnant, and we were able to document one that had a very "full" belly at Ambrósio.

Ambrósio is a protected dive site, approximately seven miles from the port of Santa Maria Island. The

underwater sea mount of Ambrósio is about 45m deep at its shallowest point. A set of buoys is permanently anchored there, where dive boats can tie up. Dive time was limited to a maximum of 60 minutes, but this gave one enough time to be enchanted by the fairy-like movements, acrobatics and synchronised swimming of the mobula rays.

At Ambrósio, they followed the upward current from the deep, at almost the exact same spot every 15 to 20 minutes. As they emerged from the deep, gliding up nearly to the water's surface, one first saw their white undersides in the distance. Like dancing ballerinas, they came closer and closer to us divers, who were either diving freely around the anchor line of the buoy or holding lightly onto it, depending on the current.

Getting as close as one metre



away, the mobula rays approached us in a cursory manner. We each got to shoot several images, and some amazing moments were captured! Several pregnant mobula rays were documented.

The hope in the scientific community is that Ambrósio may be a breeding ground or nursery for these majestic animals. Scientists like Alice Soccodato are doing their best to protect and study the species in the area.



protections in the area, so only specific slots for a limited number of boats were available.

PERMIT NO: DRAW/CETACEOS/2021/029



Sperm whale calf (left); Spotted dolphin (above); Picturesque coast of Santa Maria Island (right); Whale shark with pilotfish (bottom left)



Sperm whales

In the blue Atlantic, one may encounter sperm whales as well. However, it is prohibited to snorkel, swim or dive with these animals. We were privileged to have a special permit and thus had some in-water encounters with the sperm whales. Permits are only available for photo and film crews and can be applied for at the appropriate governmental institution.

Good to know

So, what does it take to have a successful expedition to Santa Maria Island? Choose the right tour operator. We did not just come for a dive trip, but for a sardine run adventure in the Atlantic. A minimum number of divers/freedivers on the dive boat is required. However, with more than six people, it becomes too crowded around the bait balls. This is also true at the Ambrósio site, as there would be too many bubbles from dive tanks in your underwater photographs.

A full charter option is best. An experienced crew and a proper briefing will

help to find the best way forward and guarantee success in taking underwater images. The best time to travel for what we experienced is definitely August to September; however, all the dive centres on Santa Maria Island are open from May to October each year.

Currently, there are three permanent dive centres on Santa Maria Island: Wahoo Diving, Haliotis Dive Centre and Manta Maria Dive Centre. Nitrox is available at all the dive centres.

Only one dive operator conducts full charter sardine run adventures in the Atlantic, and that is Expert-Tours. For a really great adventure experience, go to: expert-tours.de. Preplanning and booking is essential, so plan at least one year ahead!

Get a rental car in advance and book your accommodation. Some recommended hotels include Hotel Colombo, Charming Blue, Praia dos Lobos and Pousada de Juventude. There are

decompression chambers on some islands in the Azores, but NOT on Santa Maria Island. So, make sure you dive safely and within your decompression limits. There are no dangerous animals or insects on the islands, and no extra vaccinations are required to travel here. It is a safe destination with zero crime. Flights from Europe and the United States are available almost daily with layovers at São Miguel and a connecting flight to Santa Maria Island. ■

Expedition leaders and guides Silke Ptaszynski and Rainer Schimpf run Expert-Tours in South Africa. For more information, please visit: expert-tours.de.





Triton Bay

Indonesian Diving in West Papua

Text and photos by Claudia Weber-Gebert



Triton Bay. Untouched, remote, overwhelming... it is an underwater world that enchants. Claudia Weber-Gebert shares her liveaboard adventure there.

Raja Ampat is known and beloved by many divers. But a one-hour flight south from Sorong will take you to another gem in Kaimana—Triton Bay. My liveaboard adventure began here. However, the diving area in Triton Bay, south of Raja Ampat, was only explored in more detail just a few years ago. Only a handful of liveaboard boats go to these dive sites, and there is currently only one resort. Apart from a few local small fishing villages, there is no civilisation to speak of.

Old traces of civilisation can be seen here in the form of prehistoric wall paintings, dating back over 10,000 years. Our captain skilfully steered the *Gaia Love* liveaboard close to the spots where petroglyphs could be found, so that the guests could photograph these special works of art.

Rich biodiversity

On the coast of West Papua, an upwelling current brings nutrient-rich water to the surface. The resulting abundance of fish and biodiversity is indescribable. There are so many fish that you can no longer see the reef.



Enormously large and colourful soft corals are the hallmarks of these dive sites, even at a depth of just 5m. But beautiful hard corals can also be found, completely intact, as well as

Brilliant red whip coral on wall at Triton Bay in West Papua, Indonesia (above); Leather and soft corals on reef (top right); Petroglyphs dating back over 10,000 years (left); Bargibant's seahorse on gorgonian coral (previous page)

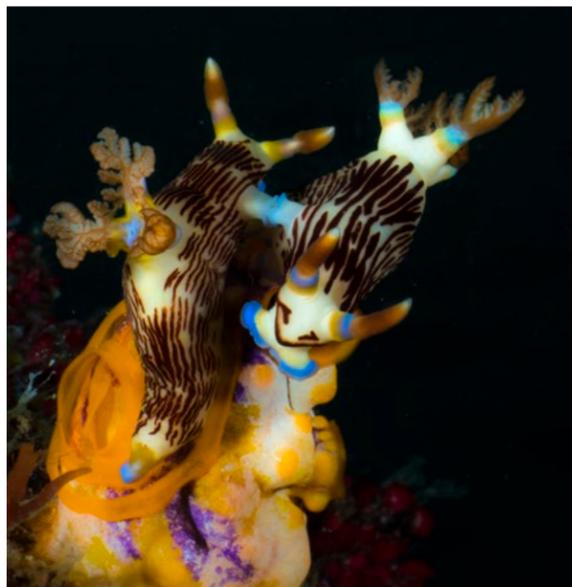


Soft corals and silversides (top left); Manta ray with remora (top right); *Nembrotha lineolata* pair with ribbon of eggs (right)

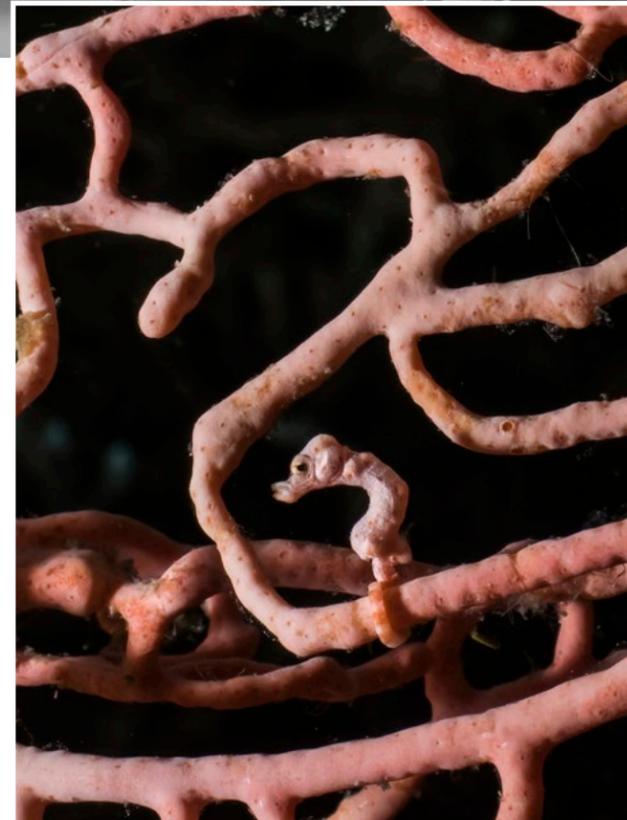
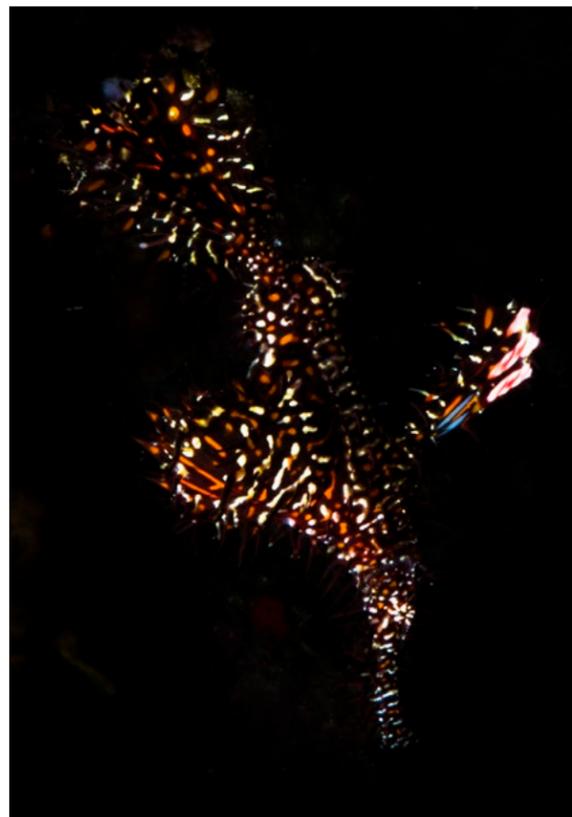
densely populated reefs, which can rarely be found elsewhere. There are large table corals under which various fish hide, barrel sponges standing like huge planters between the corals, and coral gardens with large colonies of black corals. The sight is overwhelming.

Diving

Although the water was slightly greenish, visibility was good. Underwater photographers would definitely consider this place an El Dorado, for both macro and wide-angle shots. The underwater landscapes were breathtakingly beautiful and varied, colourful and full of life. Dive sites like Little Komodo were reminiscent of



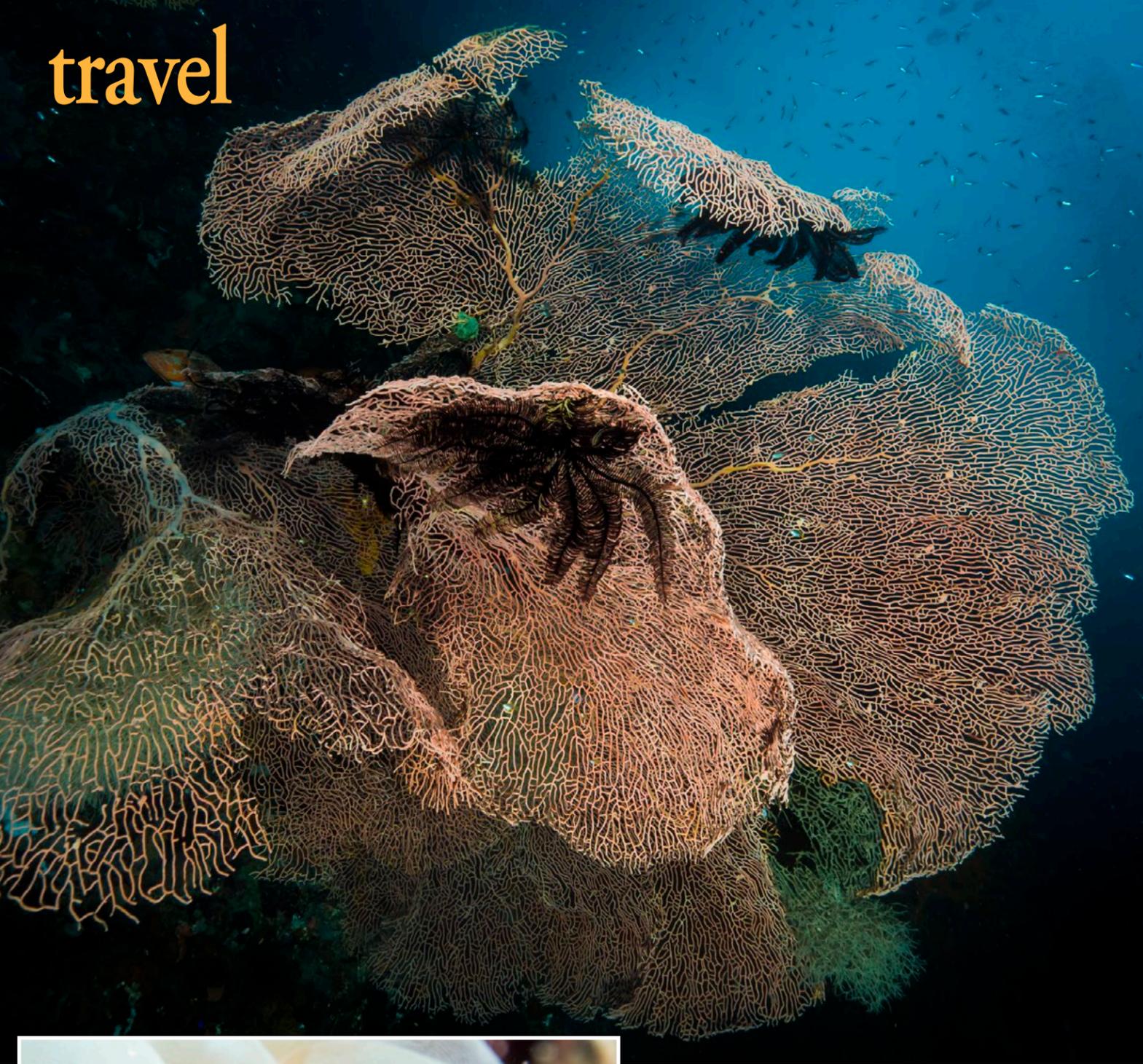
the underwater world of Komodo; and just around the corner, the underwater scene looked like Palau—so everything was very interesting to see. Where the currents passed the



Denise's pygmy seahorse (above); Ornate ghost pipefish (left)

Anemonefish in magnificent anemone, with school of blueshripe snapper





Sea fans up to 3m high populated the walls (top left); Schools of tang moved through the waters like endless ribbons (above); *Goniobranchus coi* nudibranch pair with ribbon of eggs (left); Seahorses like the Denise's pygmy seahorse (below) were popular with underwater photographers; Orang-utan crab in bubble coral (bottom left)



steep walls, one could see large sea fans, up to 3m high, in all colours and variations.

The most sought-after photo subjects were pygmy seahorses, and one could find them even at a depth of just 15m. Usually, these small seahorses can only be found at 25 to 30m.

Schools of fish moved through the water like endless ribbons; there were silversides, snappers, fusi-

liers, bumphead parrotfish, batfish and barracudas. Manta rays and mobula rays also circled above cleaning stations. And, of course, small macro subjects could also be found everywhere, including many different colourful nudibranchs, crabs or ghost pipefish, and blue-ringed octopus or wonderpus.

Underwater life was raging everywhere. Silversides formed tight schools, "flying" in formation and

moving along in an artful way to escape their predators. The fish were so densely packed that they blocked the sunlight.

The spectacle continued above the surface of the water where predators such as dolphins and sailfish jumped out of the water to hunt for smaller fish. This action could even be observed from the boat.

In this case, all one can really say is that pictures speak louder than



Triton Bay

Divers with whale shark with remoras attached to its underside (far left); Whale sharks gather to feed under a *bagang*, or lift net, which is used by local fishermen to catch small bait fish (left); There was a good chance of seeing whale sharks, sometimes up to five at a time, ranging from smaller juveniles to huge giants (below and bottom left)

words! Indeed, this legendary underwater world can hardly be described in words.

And then, there was a very special highlight. Whale sharks would gather at a *bagang* (lift net) where local fishermen captured small baitfish. The whale sharks got there on their own. They would be fed fish, but only when liveboards were at the site, which occurred one to two times per week. So, the liveboards stayed in the local area and offered the fishermen an additional source of income, namely through permissions from the village elder to allow divers to dive under the *bagang* for a fee. There was a high probability of encountering whale sharks here—sometimes up to five at a time, from smaller juveniles to huge giants.

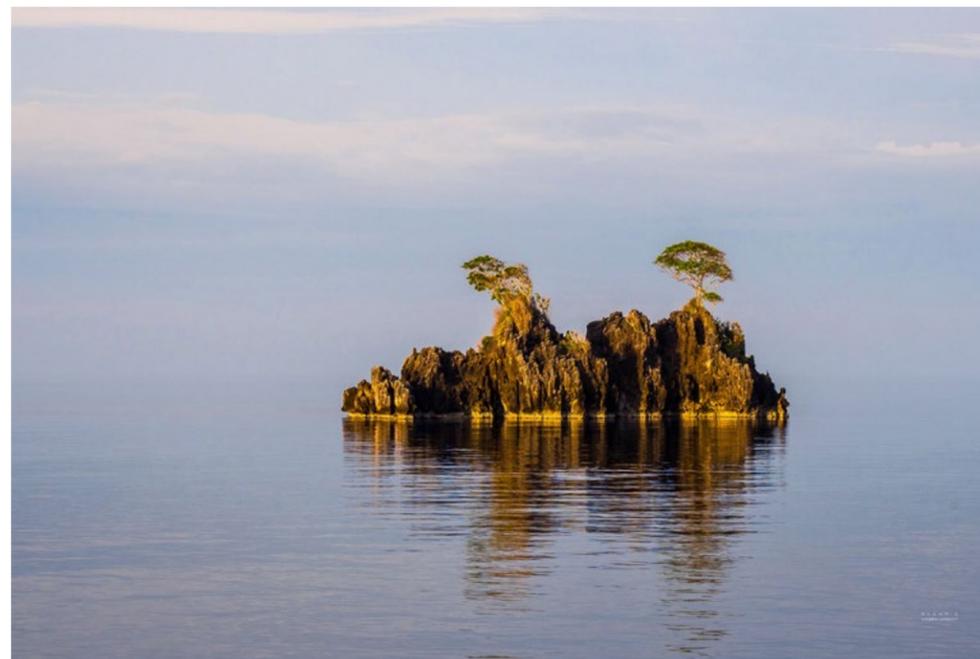




Scenic islands

It was not just the underwater landscapes that were exciting, but also the many small floating islands and rocks that protruded out of the water everywhere, covered with lush vegetation. Birds had brought seeds from the mainland to these limestone rocks, giving rise to the rich vegetation. Undercut by the water's edge, these rocks seemed to float above the sea at low tide, just like the famous rocks in the James Bond movies, filmed in Thailand or Palau.

And, of course, the coastal landscape of Papua also had the same beautiful charms. Colourful birds could be seen



Beautiful waterfalls cascade into the sea from the jungle landscape (top left); Rocky islets like this one seem to float above the water (above)



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Anthias and basslets among colourful soft corals (above); Coral grouper with elephant ear sponge, sea fans and sea squirts (top right); Hard corals and feather stars (right)

in the trees. Frigate birds and other seabirds circled over the sea, and at night, moths and butterflies came to the ship, attracted by the light. They were the prey of the bats which fluttered around the liveaboard at night. Ospreys could also be seen in the distance, but they were shy and did not come close.

The route is the goal

Even in this day and age, if divers want to visit remote places, some may have to travel long distances. From Singapore or Jakarta, one can get to Sorong in West Papua, and from there, to Kaimana. Some livea-

board tours start and end in Sorong, depending on the duration and route, but most of the time, the tour starts in Kaimana.

It is recommended to make a stopover in Singapore or Jakarta. Otherwise, the journey will be extremely long. A stopover helps with acclimatisation, so you will arrive at your destination rested and can enjoy your time on the liveaboard. Domestic flights from Singapore or Jakarta are operated by the Indonesian airlines Batik Air, Lion Air and Garuda Air.

The long journey is rewarded with the spectacular landscape, both above and below water. The running



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Lush soft corals decorate a wall (left); Large barrel sponge, feather stars and soft corals on reef with school of silver-sides, basslets and cardinalfish (above); A grouping of leopard anemones (bottom left)



joke on our tour in Triton Bay was: *It's not the end of the world—but you can see it from here!*

In Triton Bay, we only encountered one other liveaboard boat during the seven days of our tour. This meant that one had all the dive sites to oneself. No pack diving, no mass tourism. And it seemed that this area had so far been spared from the problems of modern civilisation. There was no plastic to be seen anywhere in the water.

Apparently, nothing is transported there by the currents. Or everything is kept away from the area by the upward current. So far, there is no further information about it. But

it is a very pleasing sight and nice to know that there are still places on our planet that are not polluted, at least not obviously.

With gentle tourism and boats that focus on sustainability, it will hopefully stay that way.

A paradise like this shows what our oceans and reefs once looked like everywhere: intact and densely populated reefs, with an abundance of fish, high biodiversity, clean waters and functioning ecosystems. It is a model for what other dive destinations should strive to become again. This can only happen if everyone does their part, by supporting sustainable fish-

ing practices worldwide, avoiding plastic waste, choosing travel destinations carefully and supporting those who are thinking about it. ■

Claudia Weber-Gebert is an advanced diver, underwater photographer and dive writer based in Germany. Her latest book, Maare, Quellen, Wasserfälle: Die faszinierende Unterwasserwelt der Vulkanneifel (Maars, Springs, Waterfalls: The Fascinating Underwater World of the Volcanic Eifel), is available at eifelbildverlag.de. For more information, please visit: designbuero.org/Unterwasser-Fotografie.



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Wobbegong shark resting on reef, with cardinalfish, anthias and a dense school of silversides.

ABOUT GAIA LOVE: INTERVIEW WITH HARRY TAN

I had the opportunity to interview Harry Tan, one of the four owners of the *Gaia Love* liveaboard and the director of Dive Gaia. Here is an excerpt from our discussion:

Claudia: I heard that one of the owners did some dive training to gain insight into how to adapt the design of the ship to the needs of divers and underwater photographers. Is that correct?

Harry: The owners put a lot of thought into building *Gaia Love* to create an experience for divers and photographers.

Claudia: Can you give some examples?

Harry: There are too many to list, but here are a few:

1. The main structure was built on a wider frame to create a square space with volume enough to create an open and spacious feeling.
2. Custom-made furniture and furnishings for optimal comfort.
3. The height and depth of the table in the camera room are adjusted to the optimal size for photographers.
4. Personalized towels for all divers to ensure the highest level of hygiene.
5. Carefully tailored spaces for diving equipment with personal wet and dry areas, rinse tanks with plenty of personal space and ideal seating height.
6. Rinse tanks are designed to fit the largest camera models available today.
7. Custom mattresses and pillows, and high thread count sheets and linens for all rooms.
8. Individual storage space for storing luggage in the rooms.

9. Designed and built custom dinghies to facilitate boarding and disembarking.

10. Strategically placed power access throughout the boat for guest comfort.

Claudia: How did you come up with the name *Gaia Love*?

Harry: The word "gaia" in Greek mythology is "earth or land." It shows the love for our Mother Earth.

Claudia: The *Gaia Love* concept includes sustainability. Why?

Harry: It is important to recognize that we are causing damage to our earth and our environment. Denial is often the excuse. We hope to inspire people to make changes and preserve our beautiful underwater landscape, which we could lose if we continue to damage our earth and environment.

Claudia: Do you think this concept gives you an advantage in the market?

Harry: In the dive travel market, more and more divers are looking for a special experience when booking a dive trip. We offer a tailor-made experience that makes guests feel more comfortable.

Claudia: What is your main concern for guests booking a trip on the *Gaia Love* liveaboard?

Harry: That they have a good impression of the high operating standards we have set. Our crew should provide every guest with the highest possible service.

Claudia: Do you have any special training for crew members, or did you just select the best?

Harry: A lot of time and money is spent training our crew to provide a higher level of service to our guests. ■

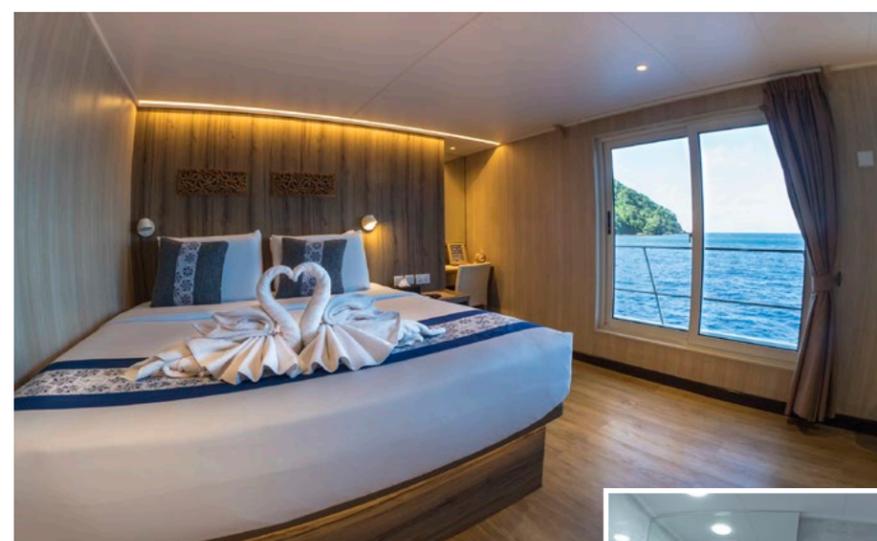
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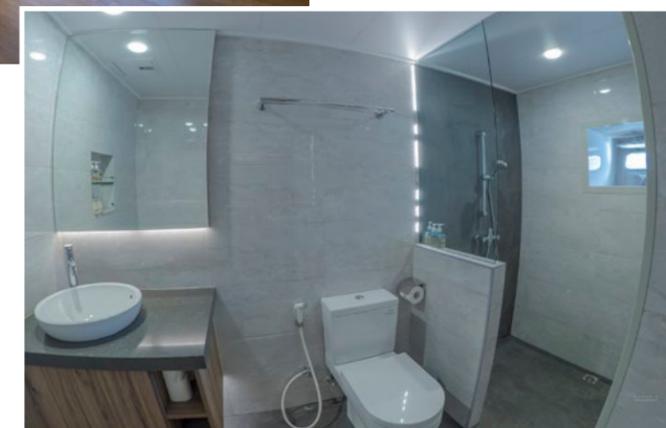
Dive Safari

Cruising Indonesia on Gaia Love

Text and photos by Claudia Weber-Gebert



Gaia Love takes divers to the best dive sites (top left); Diving deck with individual stations for each guest to store, don and ready dive gear (above); Spacious cabin with double bed and sea view (left); Each cabin has its own roomy shower (below).



Sponsored by Dive Gaia

The Gaia Love liveaboard offers a distinctive diving experience in Indonesia, blending luxury with the thrill of underwater exploration. Renowned for its exceptional service and attention to detail, this liveaboard is not just about comfort; it is a gateway to some of the most spectacular diving adventures in the world.

Upon arrival, guests are greeted at the airport and transported to the liveaboard, where the journey into Indonesia's underwater marvels begins. The Gaia Love is designed

with the diver's comfort in mind, featuring spacious cabins equipped with modern amenities. The upper deck cabins boast balconies, while the lower deck cabins have portholes, each with a spacious shower, comfortable beds and ample storage.

The liveaboard's design reflects a thoughtful approach to the needs of divers. One of the ship's owners, a diver himself, has infused his personal diving experiences into the boat's design, ensuring every detail caters to the diver's comfort and convenience. The steel construction of the Gaia Love offers a smooth sailing experience, a significant advantage for those who are sensitive to seasickness.

Sustainability is at the heart of the Gaia Love's operations. The live-

aboard takes measures to minimise its environmental impact, such as using biodegradable shower products and responsible waste disposal practices. This commitment extends to the protection of the marine environment, ensuring that the beauty of Indonesia's reefs can be enjoyed by future generations.

Dining

The culinary experience on board is a blend of local and international cuisine. Meals are freshly prepared by the chef and his team, offering a mix of European, American and Indonesian dishes. The dining experience is personalised, with meals served at your seat, creating a relaxed and intimate atmosphere.

Special dietary needs, including vegetarian, vegan and food allergies, are catered to with care.

Camera room

For underwater photographers, the Gaia Love provides a dedicated, air-conditioned camera room. This space is equipped with power outlets and ample storage, allowing photographers to maintain and prepare their equipment with ease.

Diving

The dive program is robust, offering three to four dives daily. Each diver has a designated spot on the dive deck, complete with personal storage and facilities to rinse cameras and gear. Post-dive, guests are welcomed

back with fresh towels and a hot cup of tea. The crew takes care of rinsing and drying suits and equipment, allowing divers to relax and prepare for the next adventure.

The dive guides are well-trained and knowledgeable about the local marine life and dive sites. They lead small groups to the most beautiful spots, deploying signal buoys for safe





Spacious dining room where the chef's delicious meals are served with a sea view (top left); Camera room with stations for each guest to store, assemble and recharge gear (far left); On deck, there is plenty of room to relax on comfy cushions and soak in the scenery and spectacular sunsets (left, right, top right).



Gaia Love

TECHNICAL DATA OF THE GAIA LOVE:

Hull construction: Steel
Length: 40m. **Width:** 10m. **Height:** 6m.
Engines: 2 main engines
Power: 839 HP each
Cabins: 10
Guests: 20 max.
Cabin size: 20m² to 200m²
Saloon: 90m²
Diving deck: 55m²
Sun deck: 150m² (56m² is covered)
Massage deck: 31m²
Camera room: 20m²
Crew: 22



ascents and ensuring a seamless diving experience. The skiffs, piloted by experienced skippers, are always nearby for safety and convenience. For those who prefer not to travel with their gear, the *Gaia Love* offers equipment rentals. Nitrox is also available.

Services

The tour managers excel in organising every aspect of the trip, from airport transfers to ensuring that any equipment issues are promptly addressed. Their attention to detail ensures a worry-free experience for all guests.

Between dives, guests can indulge

in relaxing massages or delve into a range of literature available in the saloon. The upper deck offers a serene space to enjoy the panoramic views of the Indonesian seascape, especially during the spectacular sunsets.

The *Gaia Love's* itineraries include some of Indonesia's most renowned dive sites, such as Raja Ampat, Komodo, and the Banda Sea. These cruises can be booked directly online, with a detailed schedule available on the liveboard's website.

Getting there

Travel to the *Gaia Love* is an adven-

ture in itself. Guests often transit through major hubs like Singapore or Jakarta, with various Indonesian airlines offering connections to the islands. The *Gaia Love's* team is available to assist with flight bookings and travel arrangements, ensuring a smooth journey to the heart of the Coral Triangle.

The *Gaia Love* experience is more than just a dive trip; it is an immersion into the rich tapestry of Indonesia's marine life and a testament to sustainable, luxury diving. It is a journey that combines the thrill of exploration

with the comfort of top-tier hospitality, set against the backdrop of some of the most spectacular underwater landscapes in the world.

Visit **Dive Gaia**. See interactive 360° panorama images at: [facebook.com](https://www.facebook.com)

Claudia Weber-Gebert is an advanced diver, underwater

photographer and dive writer based in Germany. Her latest book, Maare, Quellen, Wasserfälle: Die faszinierende Unterwasserwelt der Vulkaneifel (Maars, Springs, Waterfalls: The Fascinating Underwater World of the Volcanic Eifel), is available at eifelbildverlag.de. For more information, please visit: design-buero.org/Unterwasser-Fotografie.



Text by Don Silcock
Photos courtesy of Don Silcock
and Ricard Buxo

Undeniably one of the world's extraordinary destinations, Raja Ampat blends breath-taking, above-water landscapes with a staggering abundance of marine biodiversity, into a remarkable combination that draws divers from all corners of the globe. Don Silcock writes about one of the pioneers of diving in this region, Ricard Buxo.



COURTESY OF RICARD BU XO

Ricard Buxo



DON SILCOCK

Ricard Buxo

Pioneer of Diving in Raja Ampat

My introduction to this incredible region traces back to 1999 when I stumbled upon a post in an online underwater photography bulletin board (anybody remember them?). The author of the post was trying to assemble a group of like-minded divers for a trip to a newly established “eco beach camp” on Kri Island—providing an opportunity to explore

the recently discovered dive sites in the Dampier Strait.

At that time, Raja Ampat was an unknown quantity to me, but the remoteness of the location and the descriptions of the dive sites ignited my curiosity. It promised what seemed to be an epic adventure, albeit with limited logistical details and formidable costs.

What truly gave me pause, however, was the realisation that the journey from Sydney to Raja Ampat would take three days each way. My chance came six years later when the same person informed me she had found a new liveaboard that could take divers around all the key areas of Raja Ampat. And, it only took two days each way. I decided to



COURTESY OF RICARD BUXO

Enrique Rubio and Ricard Buxo in Tanah Beru, during the construction of the *Ondina*

go... which was how I came to make my first trip on the *SMY Ondina* and meet Ricard Buxo!

Background

At that moment in time, Ricard had been residing in Indonesia for more than five years, fully immersed in the adventure of a lifetime, and it was unmistakably evident. Back then, my experience with the country was limited to some business trips to the capital of Jakarta, together with a couple of dive trips to Bali and Komodo. But essentially, I was oblivious to the vast expanse of Indonesia's 16,000+ islands.

In stark contrast, Ricard had a deep understanding of the country, its diverse peoples and their rich cultures, which he graciously shared on that first trip. Moreover, he showed me how to dive in the strong currents that were the life-blood of the archipelago. I had no way of knowing,

but that voyage aboard the *Ondina* in Raja Ampat was the start of my enduring fascination with the enigmatic wonder that is Indonesia.

Mutual friends

The catalyst for Ricard's Indonesian adventure was a meeting in Barcelona with fellow Spaniard Enrique Rubio—brokered by a mutual friend who knew what they were both looking for. For Ricard, that was a new



COURTESY OF RICARD BUXO

A young Ricard Buxo



The underwater realm of Raja Ampat is rich in biodiversity and beautiful reefs.

and exhilarating chapter after five years of working on liveaboards in the Egyptian Red Sea, while Enrique was on a quest to find the ideal individual to transform his vision for a business in Indonesia into a tangible reality.

Enrique had been a regular visitor to Indonesia since 1982, when tourism had just begun to establish a foothold in Bali and yet remained largely absent throughout the rest of the archipelago. But it was not surfing and sandy beaches that brought him here all the way from Spain, rather, it was the highlands of what

was then referred to as Irian Jaya, the Indonesian western half of the huge island of New Guinea.

The highlands are formed by the Central Cordillera Mountain ranges, which stretch east to west across the vast expanse of New Guinea, the second largest island in the world. Cradled within those rugged mountains are a multitude of fertile river valleys which provide sustenance for a mosaic of agriculture-based tribal communities. Remarkably, it was not until the 1930s that these tribes experienced their "first contact" with outsiders.

West Papua

Irian Jaya (now known as West Papua) was, and continues to be, one of the most remote and untamed parts of Indonesia, and Enrique, together with a small group of fellow adventurers, was determined to explore those highlands. They embarked on a month-long trekking expedition through this wilderness, and numerous adventures unfolded as they journeyed from valley to valley, visiting and staying in remote tribal villages. Foremost of these was witnessing the sudden out-

DOIN SILCOCK





COURTESY OF RICARD BUXO



COURTESY OF RICARD BUXO

Ceremony for *pinisi* building at Tanah Beru in Sulawesi (above); *Ondina* keel laying ceremony (top right); *Ondina* under construction at Tanah Beru (right)



break of an inter-tribal war that left them all stunned and more than a little concerned about what could have happened!

That adventure turned into a series of annual assignments leading trekking expeditions in the highlands, and after a few years, Enrique decided the timing was right to start a tourism-focused business in Indonesia. Initially, the idea was establishing a resort for trekkers in the highlands, but over time the concept of building a boat and using it to take divers around the archipelago was born.

The Bugis

But not just any boat... the idea was to take the prov-

en design of the traditional Indonesian sailing ships and build a customised version that would enable journeys of discovery to some of the remotest corners of the vast archipelago. So, Enrique went to South Sulawesi, home of

the Bugis—the accomplished seafarers who roamed the seas long before the first Europeans arrived in what was then known as the Malay Archipelago.

Equally feared and revered, the Bugis are said to have

navigated by the stars as far as Madagascar to the west, China to the north, and the top-end of Australia to the south. They carry reputations as adventurers, warriors, slave runners and pirates, and are said to be the source of the English saying, “Watch out, the bogeyman will get you.”

In fact, they were also astute merchants who used their boats and seafaring skills to trade exotica far and wide. The Bugis built their own boats called *padewakangs* in South Sulawesi, and when the Dutch colonised what we now call Indonesia in the late 1700s, they did so in their European-style sailing ships. Over time, many of the key features of those

European schooners were incorporated into the sailing ships built by the Bugis. Eventually, the amalgamated design became known as the *pinisi*.

Building a *pinisi*

Enrique found the boat builders he needed in the village of Tanah Beru, near the town of Bira. While negotiating, he realised there was no standard design for a *pinisi*, with each build a function of individual wants, needs, customs and traditions. All these factors were discussed at length with the team building the boat—usually a family clan of shipwrights and carpenters, typically led by a construction manager who was a *haji*, a Muslim who

had completed his pilgrimage to Mecca and commanded great respect. But even when the final concept was agreed upon, there were no formal plans drawn up or budgetary estimates provided—the boat just evolved around what was discussed!

Finally, a deposit was paid, and the need for someone to supervise it all became rather urgent...

Living with the Bugis

Imagine, if you would, moving to a remote part of what was then a third-world country, to live among local boat-builders in basic conditions to supervise the construction of a traditional wooden boat—all without



The hull of the *Ondina* taking shape (left)



Pinisi building at Tanah Beru in Sulawesi (left, above and right)



an agreed final plan or budget, without speaking a word of the local language and with zero knowledge of local cus-

toms and traditions. But that was what Ricard did in June 2000, just as the keel of the yet unnamed boat was being laid.

Some 13 months later, the boat was launched and christened *Sailing Motor Yacht (SMY) Ondina*—the Nymph of the Deep Sea!

Ondina was not the first *pinisi* built for foreigners, but it was the first to be crafted as a dedicated liveaboard, and Ricard describes those 13 months as the most intense, challenging, but deeply satisfying period of his life, as the boat took shape on the beach at Tanah Beru.

His five years in Egypt had given him the strong foundation he needed for the total “cultural immersion” he went through in living with the Bugis, learning how to communicate

with them and ensuring that the pivotal details, which make *Ondina* such a great diving platform, were implemented.

A mystical process

Indonesia is the largest Muslim country in the world and is known for its secular brand of Islam and religious tolerance. Many of the racial groups that make up its almost 270 million inhabitants combine their version of Islam with historical myths and beliefs, which in many ways makes the country so interesting.

But the Bugis are amongst the most fascinating of those groupings, combining a deeply

superstitious nature with animistic traditions, rituals and legends, which are intertwined with how they build their *pinisi*. Everything has its place, with the overall process guided by

the haji, who has complete responsibility for the integrity of the construction and ensuring that all the traditions are followed properly and thoroughly. From a western perspec-





COURTESY OF RICARD BUXO



COURTESY OF RICARD BUXO



COURTESY OF RICARD BUXO

Laying the main deck of the *Ondina* (top left); Sealing the hull (top right); The *pinisi* under construction at Tanah Beru (right); The lounge and dining area under construction (left)

even out in the open oceans—sailing at the whim of the elements and finding their way using the stars.

No detailed plans for the *pinisi* are ever made, or ever will be... There is no manual, the skills and methodology are transmitted orally and taught to younger members of the clan, who in turn pass them on to the next generation.

And then the hard part!

After *Ondina* was launched, the priority was fitting out the boat in preparation for the customers booked on the first trip. Ricard was kept exceptionally busy supervising the fit-out

while also hiring and training the first crew, dealing with the considerable paperwork and working out the routes *Ondina* would follow around the archipelago—not to mention where to dive!

Then, just 30 days before the first trip was to depart, the devastating 9/11 terrorist attacks occurred in New York, effectively shutting down all air travel globally. If you had to pick a worse date to launch a business in a Muslim country that requires tourists to fly long distances to get on board, October 2001 would probably meet all the selection criteria.



COURTESY OF RICARD BUXO

five, it would be easy to simply dismiss the spiritual element of building a boat as irrational and irrelevant, but consider this

from the Bugis point of view. The boats take their people far and wide in the monsoonal seas of the archipelago and

Still, most of those who had booked made it to Indonesia, and *Ondina* left on that first voyage. So, maybe there is

something to those rituals and ceremonies the *haji* orchestrated as *Ondina* was built!



COURTESY OF RICARD BUJO



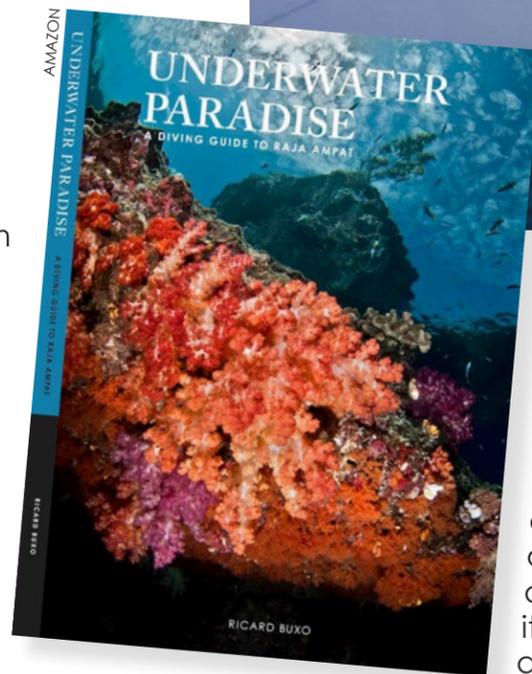
COURTESY OF RICARD BUJO

Ondina ready to be launched (above); A *pinisi* is born! (right); Ricard Buxo's book (centre); The prelaunch ceremony (left)

Ricard to follow in their footsteps and sail with the monsoonal winds around the archipelago.

He started with the Lesser Sunda Islands, along the southeastern rim of the archipelago, concentrating on the areas around Komodo and Alor. He did so with those first passengers discovering some of the very best spots—plus, they were the only boat in the area!

Then, after two years diving in the south, in October 2003, Ricard took *Ondina* north, across the huge expanse of the Banda Sea for the first time—a journey of some 1,000km to Sorong—and joined the small number of boats based in Raja Ampat through to March each year. The area became Ricard's favourite part of the archipelago. So much so that he was one of the first people to write



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COURTESY OF RICARD BUJO

a book about the area, *Underwater Paradise—A Diving Guide to Raja Ampat*, which has become the standard for all guides operating in the area because of its excellent maps and descriptions of the sites covered.

A life well lived

Ricard stepped back from *Ondina* in 2015 and is now based in Bali. With his wife Paulina, he runs its over-all operation, alongside that of its

sister ship *MV Oceanic*. I catch up with him regularly to find out what is happening underwater across the archipelago, because the regular updates from both boats, plus his extensive contacts across the live-aboard industry in Indonesia, keep him very well informed!

Every liveaboard trip I have done in Indonesia since 2005 has been on the *Ondina*—why, you may wonder, when there are now over 100 to choose from? Two basic reasons... first, I have been on board in horrendous weather in the Banda Sea—the sort where you know exactly where your lifejacket is, but we made it through, and I trust the boat.

Secondly, everything about

Ondina, from the way the diving is run to the way the meals are prepared and served, just works as it should. Essentially, Ricard may not be on board that often, but the system he established continues to function as he intended it to. For me, it is the perfect, proven platform to experience the many delights of underwater Indonesia! ■

Don Silcock is an Australian underwater photographer based in Bali, Indonesia. To see his extensive location guides, articles and images on some of the best diving locations in the Indo-Pacific region and "big animal" experiences globally, please visit his website at: indopacificimages.com.

Coral Bleaching

The Impact of Climate Change on a Reef in Cuba



Healthy corals on my favourite reef in Cuba in May 2023 (above), and bleached corals on the same reef in September of the same year (right)



Text and photos by Robert Osborne

As global warming heats up oceans around the world, coral bleaching events are increasing in frequency and severity. Robert Osborne reports on how climate change has impacted his favourite coral reef in Cuba.

I had found the perfect place for a diving getaway. It was only three hours away by plane from my hometown of Toronto—on the southern shore of the island of Cuba, near the city of Cienfuego. Flights and hotels were cheap, but best of all, the

reef was one of the most pristine I had seen in over 15 years.

Lucious soft corals positively gushed from the long stretches of finger reefs. Deep walls were festooned with sponges and lace coral. There was one monster piece of a pillar coral

that must have been 20ft high; local divers suggested it had been there for half a century or more. And unlike some parts of Cuba, fish life on these corals was thriving—though, as is often the case, the large predators were scarce.

Still, there were lots of green morays, barracuda and large snappers. The schools of yellowtail snapper, sergeant majors and various kinds of jacks were impressive. I decided that this location would be a regular destination. That was

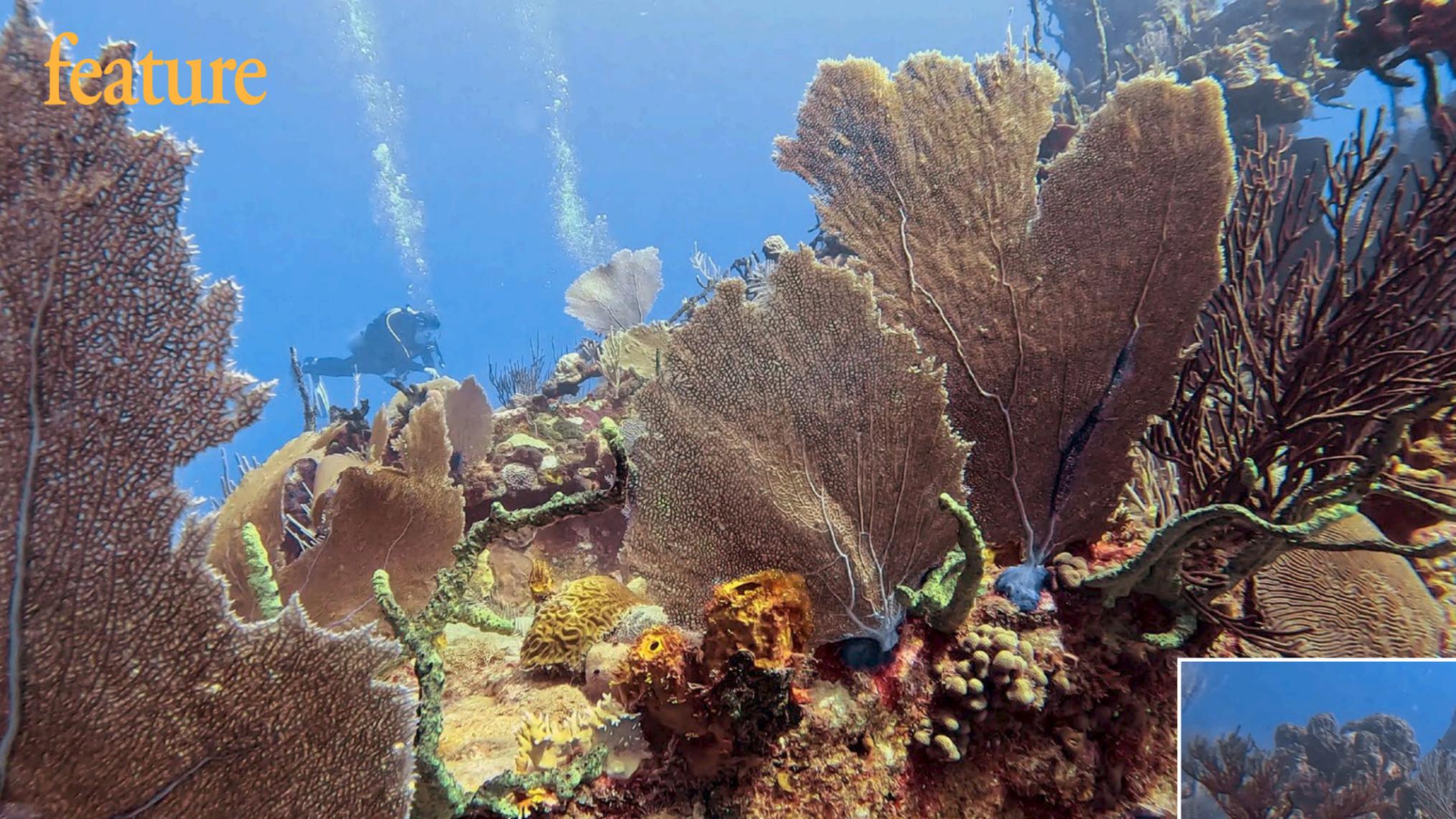
in May 2023.

In the first week of September 2023, I flew back to my treasured spot. But on the first morning, when I rolled off the back of the boat, I nearly spit my regulator out. In a little over three months, the reef had

undergone a dramatic transformation—it looked like some kind of aquatic battlefield, with the bones of the dead still littering the bottom.

As far as I could see—and visibility was pretty good—there was a vast expanse of





Diver with fan corals on healthy reef (left); View of the ocean along the scenic southern coast of the island of Cuba (below)

Coral Bleaching



bleached coral covering the bottom. By my estimate, almost half of the corals had been affected. A further 20 percent was in the process of “paling” (essentially starving to death).

I could not believe what I was seeing. I knew there had not been any major chemical spills in the area, and agricultural runoff was not an issue—there is not much farming in the area. I started thinking this might be the most direct example of global warming that I had ever personally observed.

Of course, I have seen the floods and fires on television, but that was somewhat removed. This was right in my face. But I did not want to jump to conclu-

sions. So, I decided to do some research, which would tell me more about what I was seeing.

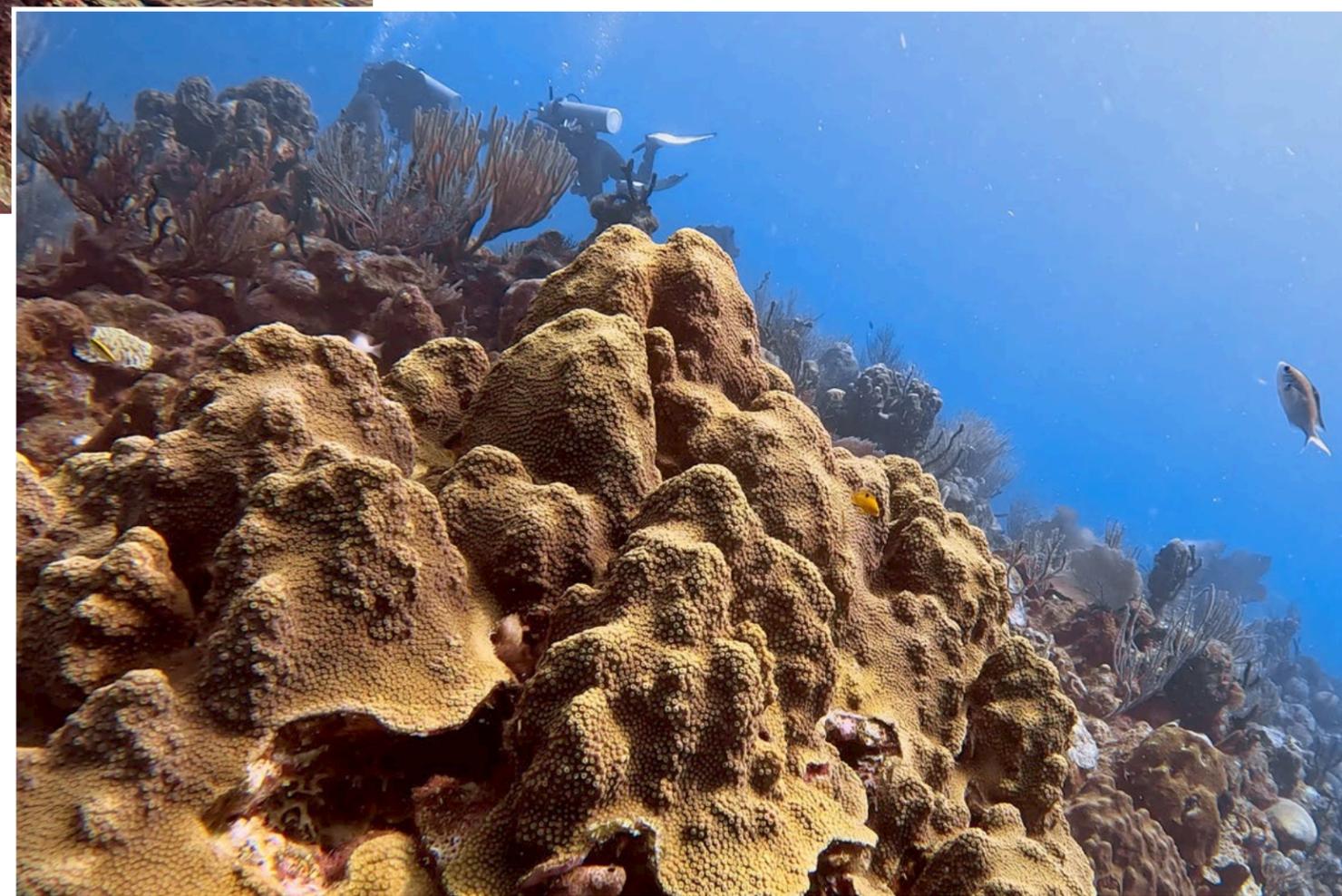
Coral Reef Watch

When I got back to Toronto, I reached out to the National Oceanic and Atmospheric Administration (NOAA) in the United States. I have corresponded with them in the past on ocean-related research, and their scientists, who are among the best in the world today, are open to questions. They also run extensive reef research in the Caribbean, so I thought they would have a good idea about what was going on.

I got a very quick response from Jacqueline De La Cour, the

operations manager of NOAA’s Coral Reef Watch. The staff at Coral Reef Watch seemed to be exactly the people I needed to talk with. On the Coral Reef Watch website, it states: “For more than 20 years, NOAA Coral Reef Watch (CRW) has been using remote sensing, modeled, and in situ data to operate a decision support system to help resource managers (our target audience), researchers, decision makers, and other stakeholders around the world prepare for and respond to coral reef ecosystem stressors, predominantly resulting from climate change and warming of the Earth’s oceans.”¹

¹ CORALREEFWATCH.NOAA.GOV



Healthy colony of plate coral on reef



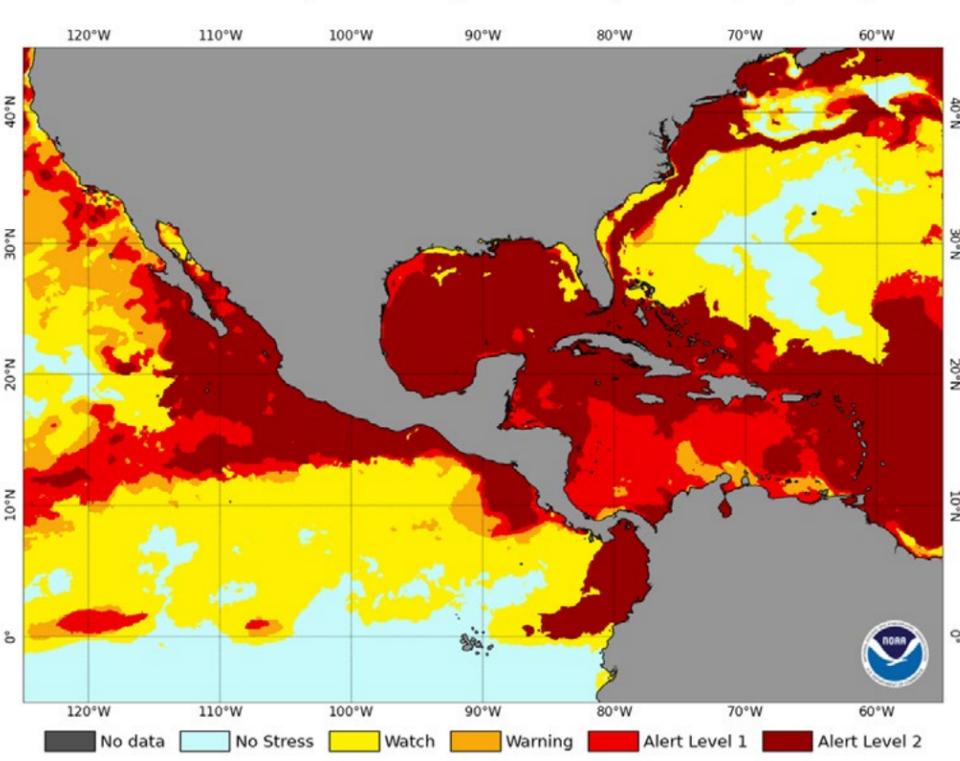
My first question to De La Cour was how could this coral bleaching have happened so quickly? The reef was perfect in May and half-dead by the end of August.

But according to De La Cour, it had not happened quickly: "... the current marine heatwave around Cuba has already been severe and prolonged. Heat stress has been accumulating for months. Additionally, the marine heatwave is projected to remain for another nine to 12 weeks. Mass coral bleaching and some mortality are expected under stressful conditions such as these."

In other words, this event had been building for some time, and NOAA had been watching it. What I saw was just the final small incremental increase in temperature that tipped the whole ecosystem over the brink. And apparently, it does not take



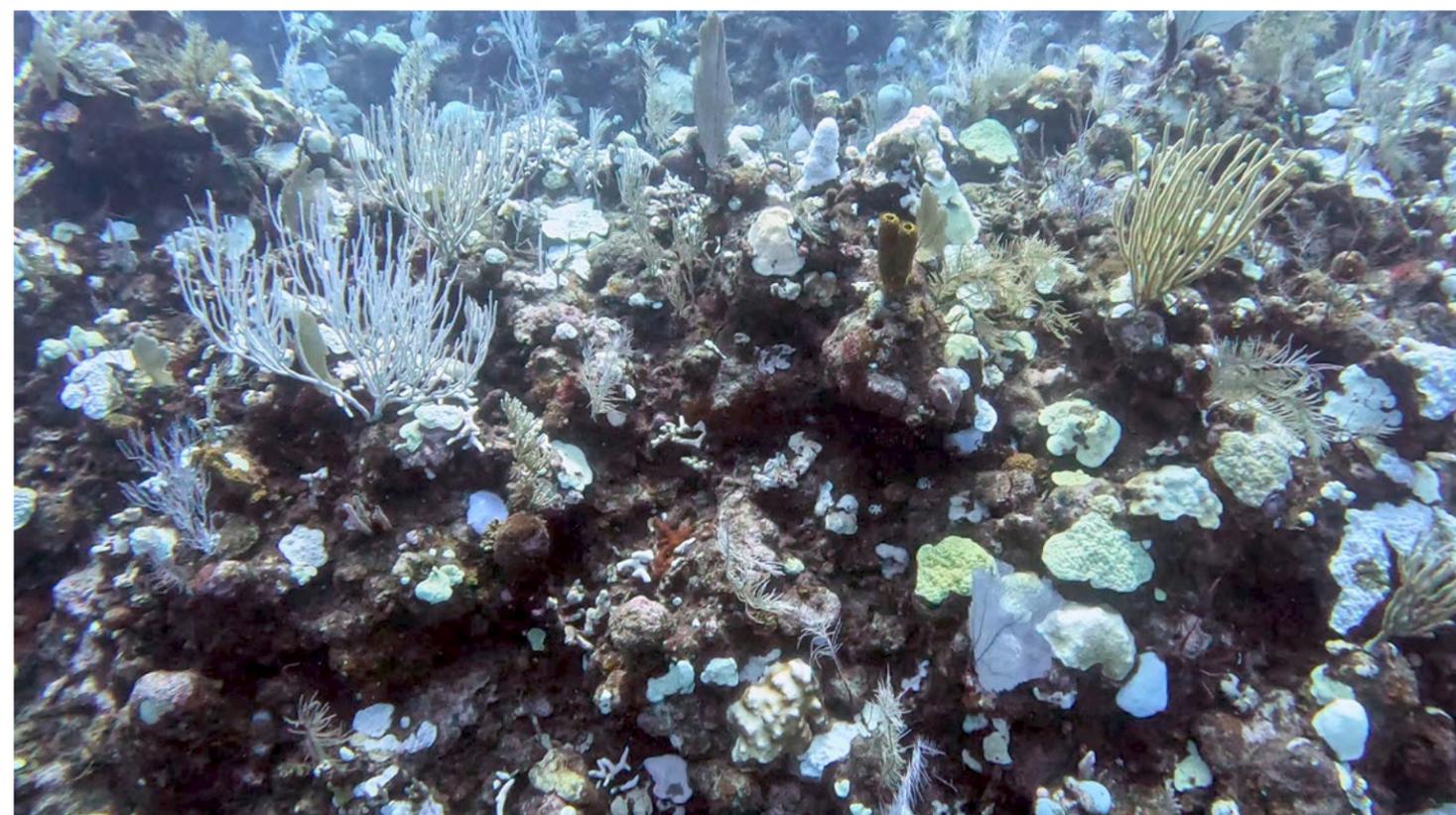
NOAA Coral Reef Watch Daily 5km Bleaching Alert Area 7-day Maximum (v3.1) 19 Sep 2023



much to do that.

When I was diving in May, my computer logged temperatures of 28°C, pretty much on every dive. When I went back in August and September, the average log temperature was 30 or 31°C. That is not much of a change, but according to NOAA, it is enough.

De La Cour stated: "Coral bleaching is expected to begin when water temperatures cross the bleaching threshold, when temperatures reach at least 1°C above the usual summertime maximum ... If you look at the **time series graph** for the NOAA Coral Reef Watch satellite-based Regional Virtual Station for southwestern Cuba, you will see that the [normal] temperature for the region is 29.6643°C, and the bleaching threshold temperature is 30.6643°C ... The sea surface temperature crossed the bleaching threshold on June 15, 2023... **Bleaching Alert Level 2 conditions** (where severe



Detail view of bleached corals on reef (above); NOAA Coral Reef Watch bleaching alert map (left)



Coral Bleaching

Fish life is still present despite coral bleaching (top left); Divers explore a wreck at a dive site with bleached corals (top right); Diver by wall with bleached corals (above).

coral bleaching and mortality are expected) were reached on July 17. Since July 17, severe heat stress has continued to accumulate in the region, and the sea surface temperature has remained firmly above the bleaching threshold.”

De La Cour went on to say, “It is very sad, but similar conditions are being witnessed on multiple other reefs around Cuba.”

So, the whole situation off the southern coast of Cuba had been building all summer. Once the temperatures crossed that critical mark of 30.6643°C, the coral started dying. Interestingly, local divers told us that the die-off had occurred very quickly during the month of August. That was when the coral all started turning white.

About coral bleaching

Now, before I go any further, I want to explain just what happens when corals bleach. It is not exactly dying; it is more about corals being abandoned by the algae they depend on to survive (see graphic).

Healthy corals have a symbiotic relationship with the microscopic algae that lives in their tissues. These algae feed the coral and provide its colour. When the coral comes under stress from overheating (or other causes like agricultural pollutants), the algae leave the coral. Without the algae, the coral turns white or very pale and essentially starts to starve. Corals can survive for a short time without the algae, but ultimately, they need them to return to thrive.

The value of reefs

Now, this is bad news, given that corals have a critical role to play, both environmentally and economically, in the world today. Some estimates place the economic value of reefs worldwide as being around 9.8 trillion US dollars. It is estimated that a billion people around the world benefit, either directly or indirectly, from coral reefs.

Coral reefs support the most diverse fish life on the planet and play a critical part in flood control in tropical coastal areas. The killing of reefs, and its echo effect, will be devastating for thousands of other species—most particularly, people.

Why coral bleaching occurs

Having learnt what had happened,

CORAL BLEACHING

Have you ever wondered how a coral becomes bleached?

HEALTHY CORAL

1 Coral and algae depend on each other to survive.



Corals have a symbiotic relationship with microscopic algae called zooxanthellae that live in their tissues. These algae are the coral's primary food source and give them their color.

STRESSED CORAL

2 If stressed, algae leaves the coral.



When the symbiotic relationship becomes stressed due to increased ocean temperature or pollution, the algae leave the coral's tissue.

BLEACHED CORAL

3 Coral is left bleached and vulnerable.



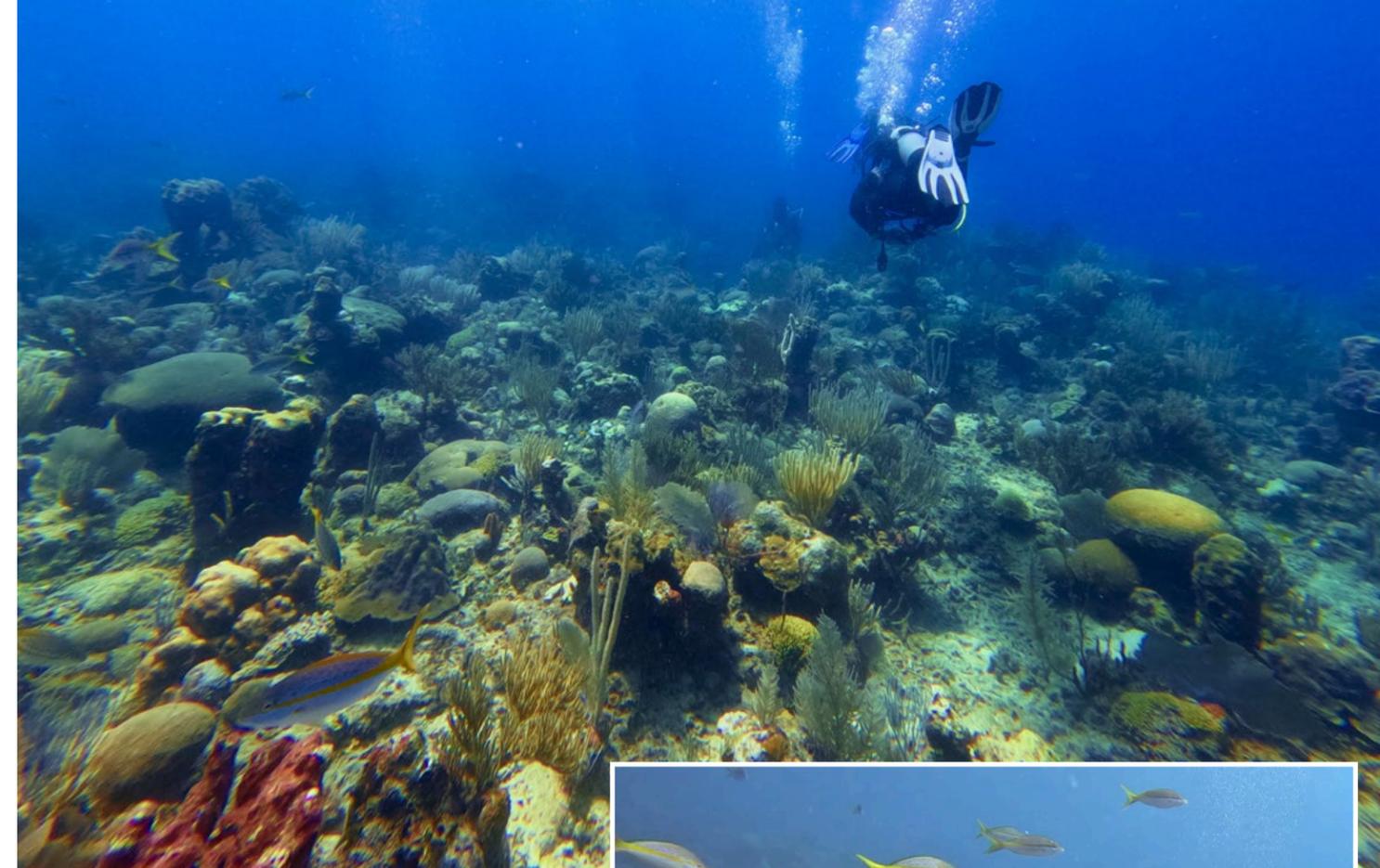
Without the algae, the coral loses its major source of food, turns white or very pale, and is more susceptible to disease.

WHAT CAUSES CORAL BLEACHING?

- Change in ocean temperature**
Increased ocean temperature caused by climate change is the leading cause of coral bleaching.
- Runoff and pollution**
Storm generated precipitation can rapidly dilute ocean water and runoff can carry pollutants — these can bleach near-shore corals.
- Overexposure to sunlight**
When temperatures are high, high solar irradiance contributes to bleaching in shallow-water corals.
- Extreme low tides**
Exposure to the air during extreme low tides can cause bleaching in shallow corals.



NOAA CORAL REEF WATCH / PUBLIC DOMAIN



Healthy corals and fish life on reef (left and above); Diver photographing healthy corals on reef (right).



I asked De La Cour the proverbial million-dollar question: Why had it happened? Could this event be linked to global warming? De La Cour was cautious, "There are a number of factors at play here, including **the current** El Niño, anthropogenic climate change and accelerated global warming ... Together, these are driving the severe marine heatwaves being witnessed and subsequent impacts to coral reefs, including those of Cuba."²

I appreciated her caution, but NOAA posts statements elsewhere on its website that affirm that "climate change is the greatest global threat to coral reef ecosystems. Scientific evidence now clearly indicates that the Earth's atmosphere and ocean are warming, and that these changes are primarily due to greenhouse gases derived from human activities."²

In addition, a quick check found that the World Wildlife Fund for Nature website states: "The leading cause of coral bleaching is climate change. A warming planet means a warming ocean, and a change in water temperature—as little as 2 degrees Fahrenheit—can cause coral to drive out algae."³ And, the Great Barrier Reef Foundation, which has been dealing with the issue for a number of years, states: "Rising ocean temperatures caused by climate change is the primary cause of coral bleaching."⁴

The bottom line is that, almost certainly, climate change is responsible for what is going on with my favourite reef in Cuba. There may be other factors at work, but a warming planet is the primary one.

³ WORLDWILDLIFE.ORG
⁴ BARRIERREEF.ORG

Recovery

However, there is a glimmer of hope—corals can recover from these events. It has happened before. Australia has had some success with reef recovery, and there is no reason why Cuba could not have the same good news in the future. "Corals can recover from bleaching, if the heat stress subsides, but the corals that are able to recover will have impaired growth, reproduction, and be susceptible to disease for about two to four years after recovery," according to NOAA Coral Reef Watch Director, Derek Manzello.⁵

Essentially, the corals around Cuba need a break. They need the water to cool down a degree. It is possible with the cooler months of fall and winter that they will get that break.

⁵ NESDIS.NOAA.GOV

This will start the recovery process. The real question will be next summer. Will the temperatures once again rise above that critical level?

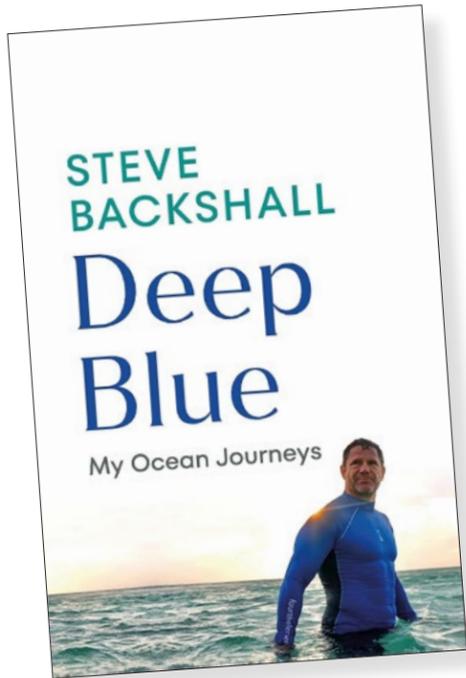
I will be going back to Cuba early in the year to see how cooler waters have impacted the coral and will probably also go back during the summer to keep an eye on the reef. Regardless of the impact on the coral, I will still go back to dive this area.

There are still some nice walls to explore, and the sponges and some species of coral that live in deeper waters have not been affected as much. There is lots of fish life to watch, and the wrecks and coral canyons are superb dives. It is still worth the

trip. Meanwhile, I will keep my fingers crossed that the coral recovers. ■

*Author Robert Osborne is an internationally published dive writer, television producer and reporter based in Toronto, Canada. His book, The Third Dive, was published by **Rocky Mountain Books** and is available on **Amazon**.*

Edited by Catherine GS Lim



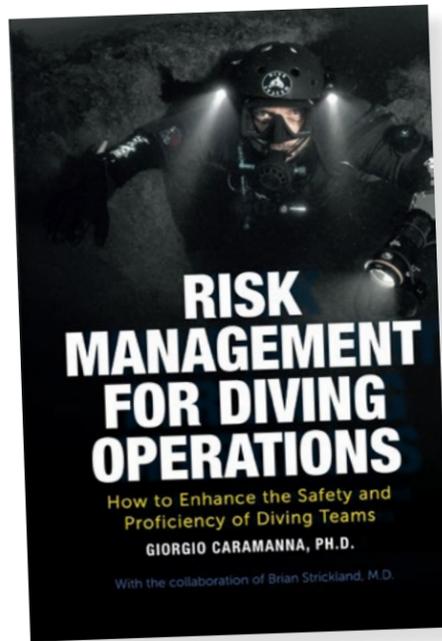
Dive Tales

Deep Blue: My Ocean Journeys, by Steve Backshall

This book is a blend of memoir, travelogue and marine science, born from the writer's lifelong fascination with sharks and ocean life. Since seeing his first shark at nine, Backshall's

career as a renowned naturalist and explorer has taken him to many uncharted underwater realms. The book reflects on the dramatic decline of marine life over the past 50 years, and addresses the critical state of polar seas and coral reefs. It journeys through diverse aquatic environments, from underwater deserts to rainforests, and discusses the evolution of oceanic species like sea turtles and great white sharks. This work serves as both a tribute to the oceans and an urgent call to action for their conservation.

Publisher: Witness Books
Date: 21 December 2023
Hardcover: 352 pages
ISBN-10: 1529144108
ISBN-13: 978-1529144109

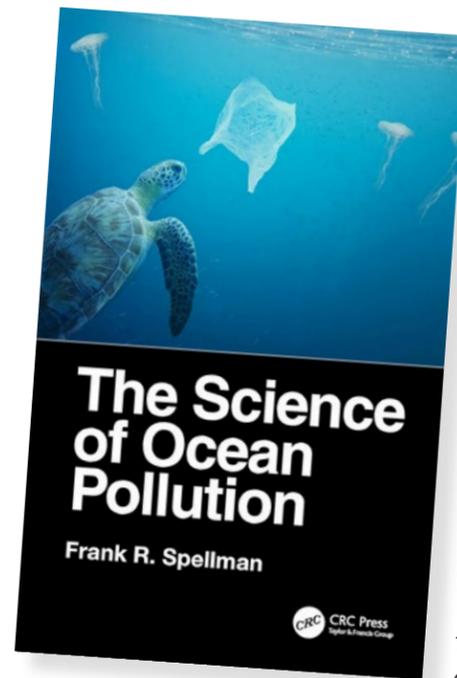


Risk Management

Risk Management for Diving Operations: How to enhance the safety and proficiency of diving teams, by Giorgio Caramanna, PhD, with Brian Strickland, MD, contributing

This book offers a scientific approach to risk management in diving operations. It acknowledges that while "zero risk" is unattainable, striving for "zero accidents" is essential. Covering 14 chapters, each focuses on a specific risk, ranging from human factors like stress and fatigue to environmental challenges like pollution and depth. The chapters include extensive bibliographies and cross-references for easy access to information. Each begins with a summary and concludes with a section that offers practical advice. The book also analyses past diving accidents to identify root causes and prevention strategies, and concludes with guidance on developing safe diving plans and comprehensive risk assessments.

Publisher: Imbrian Publishing
Date: 21 October 2023
Hardcover: 504 pages
ISBN-13: 979-8988399605

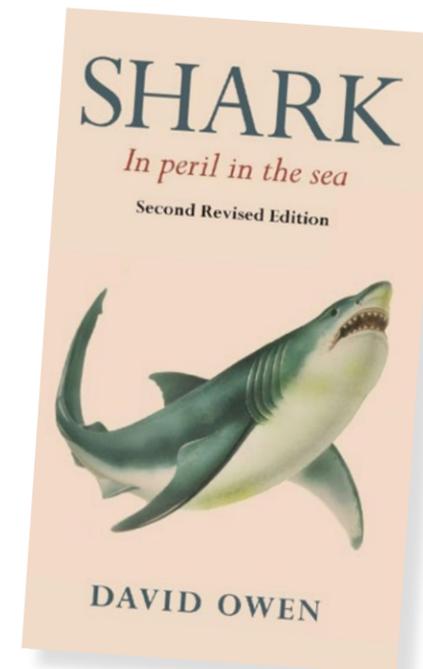


Ocean Pollution

The Science of Ocean Pollution, by Frank R. Spellman

This book offers a detailed look at the current state of pollution in the world's oceans. It covers various pollutants like runoff, plastics and oil spills, highlighting how human activities have drastically changed marine environments within a few centuries. The book, written in a conversational style, emphasises the strong connection between human welfare and the ocean's health. It also explores effective solutions for remediating these pressing environmental issues.

Publisher: CRC Press
Date: 2 October 2023
Hardcover: 264 pages
ISBN-10: 1032526408
ISBN-13 : 978-1032526409

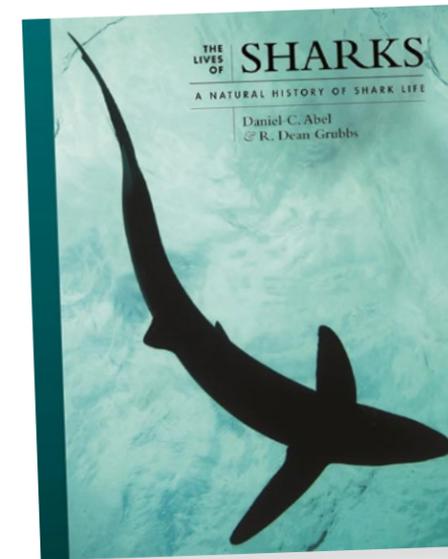


Sharks

Shark: In Peril in the Sea, by David Owen

This book offers an in-depth study of sharks, long the dominant predators of the oceans. It highlights their current threats from overfishing, pollution and habitat loss. Despite growing scientific knowledge, many aspects of these elusive creatures remain unknown, and for some species, it might be too late. The book challenges negative views about sharks, presenting well-researched information in accessible language, emphasising their critical role in ocean ecosystems.

Publisher: Edward Everett Root
Date: 13 December 2023
Hardcover: 364 pages
ISBN-10: 1915115248
ISBN-13: 978-1915115249



Shark Life

The Lives of Sharks: A Natural History of Shark Life, by Daniel C. Abel and Dr. R. Dean Grubbs

This book is a richly illustrated, comprehensive guide to the world of sharks by renowned experts. It delves into their physiology, behavior, ecology and evolution, offering insights into their complex and secretive lives across diverse marine habitats. The book also addresses conservation issues and the impact of human activities on shark populations. Featuring detailed photographs and species profiles, it provides an authoritative and engaging overview of sharks in today's global marine ecosystems.

Publisher: Princeton University Press
Date: 19 September 2023
Hardcover: 288 pages
ISBN-10: 0691244316
ISBN-13: 978-0691244310

School of jacks in Papua New Guinea parts for two divers.

Text and photos courtesy of Eric Hanauer

As more and more people get their dive news and articles digitally, print dive magazines have been disappearing. Freelance photojournalist Eric Hanauer looks back at his time as a dive writer over the decades and how dive journalism has evolved.

How do you get your news in the morning? Radio? TV? Internet? I'll bet it is not through the newspapers. Print publications are on life support.

That was not easy to write. For 47 years, I was a freelance photojour-



Eric Hanauer in the 1970s. This Niko-Mar housing was leaking during his deco stop on his *Alvin* deep-sea submersible shoot.



nalist, published in dive magazines internationally. Most of that coincided with the golden era of specialty publications, from the 1970s into the early 2000s. The pay ranged from adequate to good, but I had a day job at California State University, Fullerton. That allowed three months in the sum-

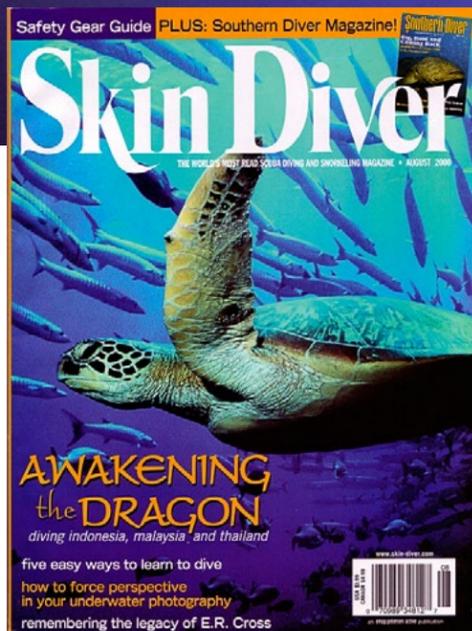
mer and six weeks over the new year holiday for travel assignments. It was an exciting lifestyle that led to many adventures and some hassles. I would like to share some of that with you.

The genesis of my career occurred some 25 years before my first published article. I was the swimming coach at

Morgan Park High School in Chicago. A slight freshman, Dan Rittschof, tried out for the team. He was too small and too slow to be a swimmer, so I suggested he try springboard diving. Within a couple of years, thanks to his talent and outside coaching, he became the city champion.

A quarter of a century later, I was giving a presentation at another California university. A bearded post-doctoral student came up afterward: Dan Rittschof, PhD. He informed me that his sister, Bonnie Cardone, had just been hired as editor of *Skin Diver* magazine. A couple of my friends,





Hanauer's photo (above) from Sipadan Island, Malaysia, for the cover of *Skin Diver's* August 2000 issue (left); On assignment in the early days, in Baha, Mexico, where a colleague fills a tank with a compressor, which took 45-minutes (top right); Offroading in a VW van (center and far right)



article and photos published in the world's largest dive magazine—at US\$35 a page. Rejections eventually came, but by that time, I was prepared to move beyond them.

Advertorial approach

Skin Diver was often criticized for its advertorial approach. I admit to having been part of that process. Among my initial assignments were equipment reviews. Bonnie advised that if I did not have something good to say about a product, to not say anything. That was put to the test when a product from a reputable company simply did not work. They sent me two

more copies of the same item, but the results were the same. The article was canceled.

On another occasion, I was asked to review the Aqua Vox, a plastic funnel-like device that substituted for a regulator mouthpiece. Its purpose was to allow divers to talk to each other underwater. There were two problems: 1) It did not work any better than talking into your mouthpiece; 2) It leaked.

When I explained the problems to Bonnie, she replied that the company had bought six months of page-two advertising. I declined to write the article. So, the publisher took

over. He did a great job of dancing around the issues, merely describing the product, never saying whether or not it worked. Within a few months, Aqua Vox was out of business.

For about a year, I was assigned to review inflatable boats. I was not a fan of being bounced and splashed, but by this time, the page rate had improved. Eventually, the writer who reviewed regulators got tired of his gig, so we traded. This was more like it. I obtained a tank with a Y-valve and attached my own regulator to one side as reference, and the

test unit on the other. I compared breathing effort, shallow and deep, in different body positions, while swimming hard, along with the ease of clearing and other additional tests.

Dive travel

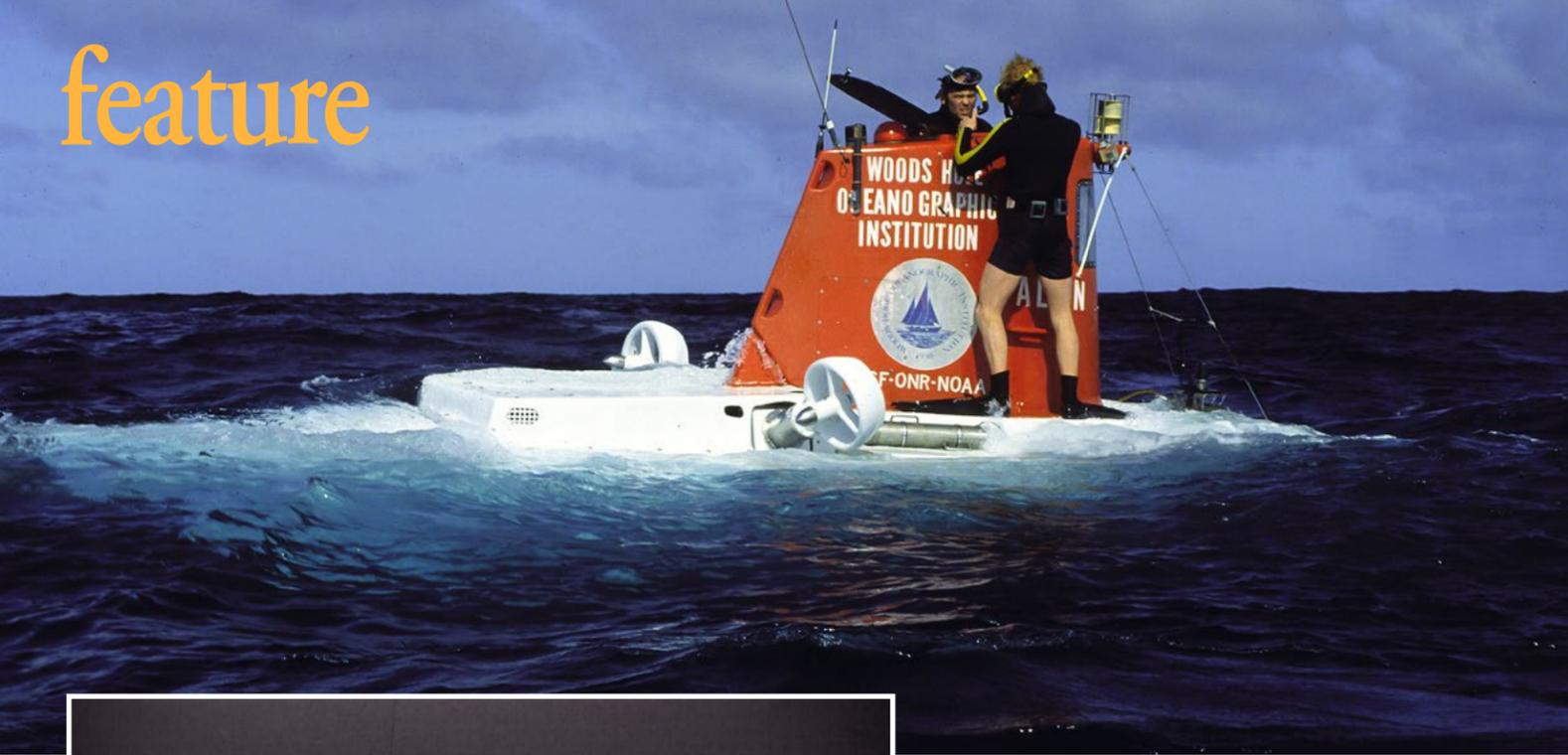
Travel assignments were my favorites. I would sometimes be paired with an advertising sales rep. We would be wined and dined, and flights and diving

were free. What's not to like?

On one of the trips, the rep and I were in southern Baja. He was driving our rental car too fast for safety, on the dark, narrow roads. One evening, we came upon a van that had turned on its side and landed off the road. Inside were two people, semi-conscious and bleeding. Until the authorities

Mike Curtis and Dave Bewley, had recently discovered the wreckage of a World War II Corsair fighter plane in the waters off Laguna Beach. I pitched an article to Bonnie, and she bought it.

My ego was so fragile at the time that if my pitch had been rejected, I might never have tried again. But now, I had an



The Woods Hole Oceanographic Institution's deep-sea submersible *Alvin* descending—the deepest photo Hanauer ever took (left); After the dive, crew members prepare *Alvin* for recovery (above); Reed Johnson of the Chicago Cubs on the way to a spectacular catch in center field (right); Chicago Cubs slugger Sammy Sosa hits a home run (far right).

came, we gave first aid and reassurance. The rep drove more slowly and carefully afterward.

Oceans magazine

Bonnie Cardone was a great editor. Among the most significant pieces of advice that she gave me was, "The way to be valued here is to write for other publications."

One of my first was *Oceans*. An opportunity arose to join an expedition of the deep-sea submersible *Alvin*, off the coast of California. The purpose was to examine the effect of a whale carcass on the bottom-dwelling community. There was no chance for me to be onboard the

shoot photographs. Alone. That could never happen today.

As the submersible descended, I began shooting. It did not take long for the water below to turn black, and *Alvin* looked like a colorful toy. By that time, I realized it was time to ascend. This was before the advent of computers, and I did not check my depth gauge. What I did know was that any dive on the US Navy tables over 190ft required a five-minute deco stop.

So, while hovering at ten feet, I looked inside my camera housing, and saw a small puddle through the viewing port. The housing was a cylindrical Niko-Mar, with the camera about three inches above the bot-

tom. As the minutes slowly ticked off, and the puddle kept growing, I decided my body was more important than the camera. When the five minutes finally ticked away, I surfaced and admonished the crew to keep the housing perfectly upright. There was less than an inch to spare, and some publishable images inside.

Scubapro Diving and Snorkeling magazine

In the 1980s, Scubapro launched their own magazine, *Scubapro Diving and Snorkeling*. The pay was good, so I wanted to climb aboard. The first question CEO Dick Bonin asked was, "Can you write anything besides puff pieces?" He must have become convinced I could because they kept giving me assignments.

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	DINING 2 Professionally trained chefs for the best dining on board		CAMERA ROOM Dedicated camera room with charging station



When they celebrated the company's 25th anniversary, I wrote the lead article, as well as three others in that issue. The editor, Ed Montague, called and asked me to use a pseudonym, so it would not look as though the issue was done by one writer. It did not take long for me to come up with Clark Addison. Bonin, an ex-Chicagoan, instantly knew the connection. Wrigley Field, the Chicago Cubs' ballpark, is located at the corner of Clark and Addison Streets.

On occasion, I was able to combine my scuba and baseball passions. A friend introduced me to Steve Green, the Cubs' team photographer. It turned out that Steve was a



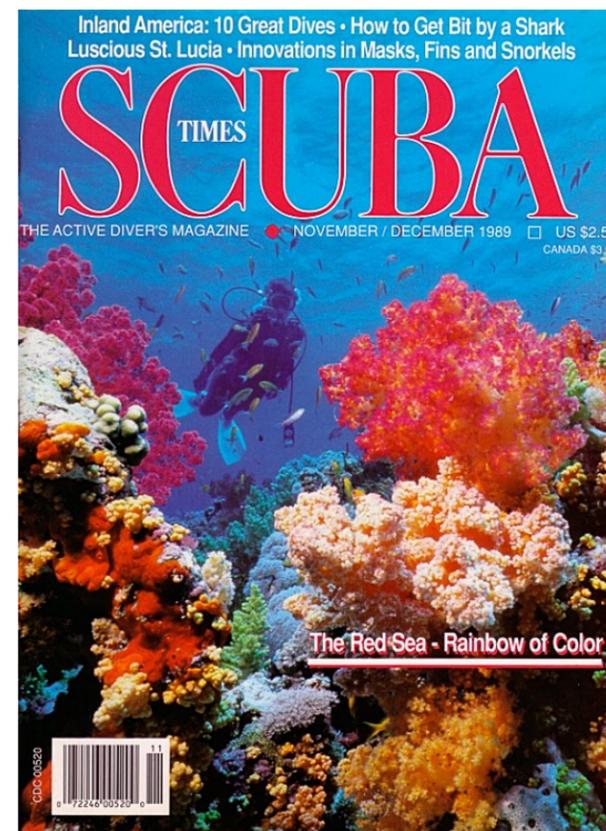
casual diver and his wife, Lisa, had been a dive guide in the Caribbean and in Thailand.

He got me a pass into the photographers' well at Wrigley Field, and I had the opportunity to shoot some games alongside the pros. That resulted in a *Skin Diver* article featuring Steve and a comparison between



Mia Tegner at Brothers Islands in the Red Sea (left); Sunset view of the Giza pyramid complex, from out in the desert, in Egypt (above)

Hanauer's photo from the Red Sea on the cover of *Scuba Times*' Nov/Dec 1989 issue



sports photography and underwater photography. For the next 19 years, I shot occasional Cubs games, and even got some images into their in-house publications. I also bled for the Cubs, having been hit in the chin by a foul ball, resulting in five stitches.

Advertising copy and books

Some of the best paying gigs did not include a byline. During the Scubapro days, I was asked to write some advertising copy. That may have been easy for *Mad Men*, but one paragraph usually took more time and effort than a full

project consumed us for most of 2017 and included trips to France and Italy for interviews.

The hardcover, boxed edition was subsequently translated into German, French and Italian. Although it paid better than my other four books combined, it was never released to the public. The book, entitled *Immersion*, was a corporate gift for executives, clients and VIPs connected to the company.

The Red Sea

My first Red Sea trip came a few months after the Sinai Peninsula was returned to

article. Later, I wrote the copy for two editions of the Scubapro catalog. That was like writing a book.

Just before the pandemic, Aqua Lung commissioned a coffee table book to commemorate the 75th anniversary of the invention of the Gagnan-Cousteau regulator. I assembled a team with my wife, Karen Straus, as editor, and Bonnie Toth as graphic designer. The

Egypt in 1982. Sinai was starting all over after the Israelis left. Hani el Meniawi, who had married an American and lived in California, had plans to sell Egypt travel to American divers. One of the keystones would be a guidebook. That was where I came in.

Hani, in conjunction with the tourist office, arranged for me to spend the next few summers traveling around the country. Dive boats were rickety, wooden fishing boats powered by two banger diesel engines. Accommodations were not luxurious.

Sometimes, Hani boarded me with friends and relatives, sometimes with fishermen. That turned out to be a blessing, because instead of the tourist experience, I got to know the country from the inside. I even learned some rudimentary Arabic.

One evening, we were on a boat, anchored off Marsa Bareka. The desert wind whipped the nighttime temperatures over 100°F, and nobody could sleep. So, the dive guides spent the night teaching me essential, imaginative Egyptian swear words. I use some of them to this day.

The Egyptian Red Sea book had a long, painful gestation. Richard Stewart, the founder of *Sport Diver* and *Ocean*

Realm magazines, was planning to publish it. He was on shaky financial ground, and after a couple of years, had to bow out. Herb Taylor, publisher of a series of dive travel guides, picked it up. But he and his wife died in a private plane crash. Finally, Ken Loyst, publisher of *Discover Diving* magazine, delivered the book in 1988. I would like to say it sold thousands of copies and made lots of money. But that is not reality. On the other hand, a book grants the author more credibility than dozens of magazine articles. Following its release, assignments became more frequent and desirable.

When we dived the Brothers Islands in the Red Sea in 1983, fewer than 50 divers a year had been there. Now, there are a hundred on a typical summer day.

Cabo San Lucas

A similar pattern was seen in Cabo San Lucas. Six friends and I made our first trip there in 1973, three months after the road was paved. We drove down in camper vans, slept on beaches and open fields, and brought an inflatable

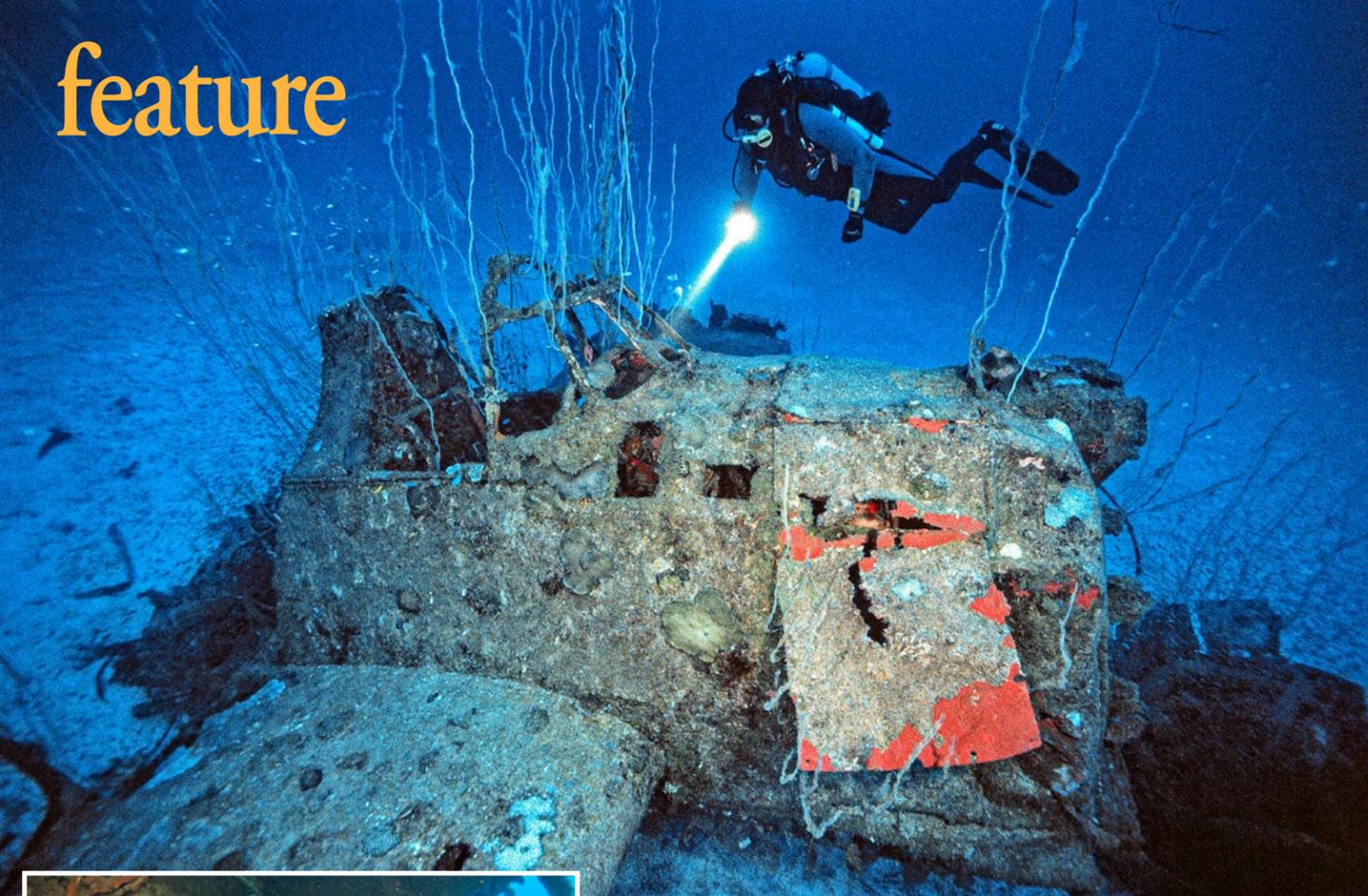
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Fighter plane at 170ft (above), which fell off USS *Saratoga*'s deck as it sank, at Bikini Atoll, Marshall Islands; *Saratoga*'s island (right) collapsed shortly after this photo was taken.

boat and a small compressor. Our only reference was a tiny map, printed on the sports page of the *Los Angeles Times*.

That first trip ended tragically when a teenage boy, whom we had just met that morning, died in a failed buddy-breathing attempt with his father. It happened in the canyon at Cabo. We attempted to do CPR on him on the way to the city's small hospital. After that, the joy of discovery turned to weary resignation.

Sipadan

Another friend, Charlie Gibbs, sent me to Sipadan a year after it opened to diving. There were ten divers on the entire island. I returned a year later, and there were twenty. It seemed crowded.

I had been pursuing a cover shot

at *Skin Diver*, and finally succeeded. A resident school of barracudas always hovered in the water column at Barracuda Point. As I was lining up a shot with my Nikonos 15mm lens, a sea turtle swam into the picture. Click.

Another feature of Sipadan was Turtle Tomb, a cave with a shallow entrance where turtles entered, got lost and drowned. Several skeletons remain inside. No matter how far in you go, there is a tiny pool of blue light indicating the exit. I was granted permission to go in any time and shot some dramatic images without other divers fouling the visibility. Like the *Alvin* dive, that approach would not fly today.

Bikini Atoll

Bikini Atoll was the site of US atomic bomb tests in the 1940s and 50s. Even after the Marshall Islands were granted independence, US Department of Energy divers continued to study the wrecks for several years. That kept them safe from looters.

Before it opened to sport divers, the Bikini Council consulted with cave and tech diving experts. Brazilian instructor Fabio Amaral put their ideas into practice, leading the fledgling operation for over half a decade. When it opened, I was invited to write about the first trip.

The publisher of my magazine wanted to come along, but could not make that date, so we delayed

Update On Diving Medicine

Gary Rose, MD, Tour Leader

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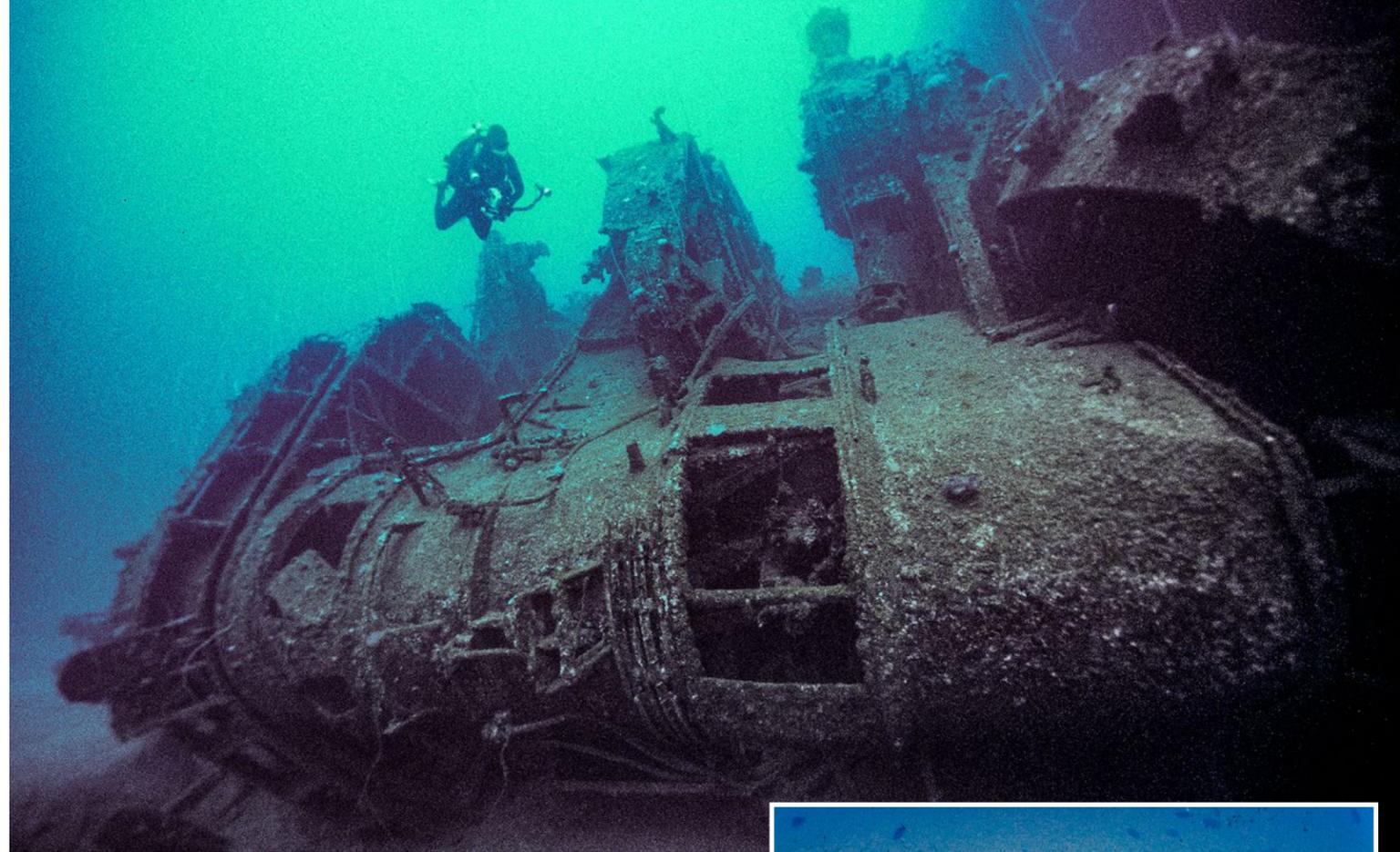
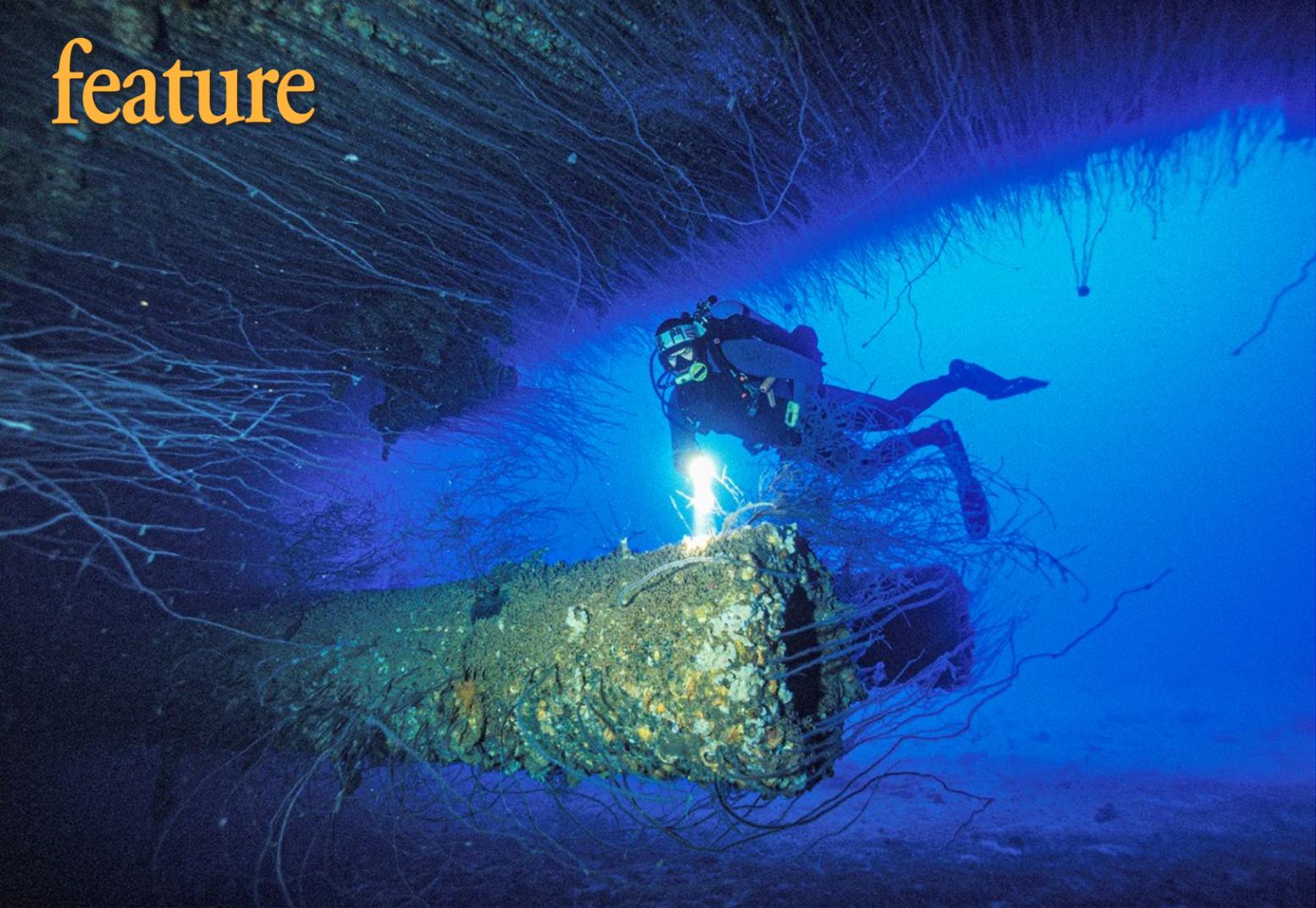
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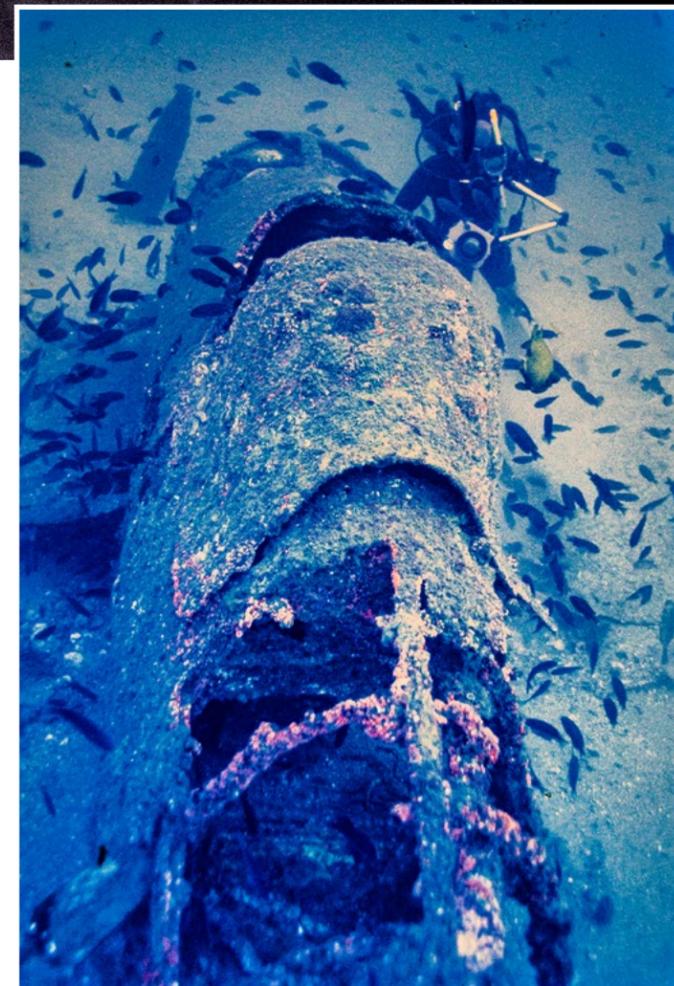
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The 16-inch guns (left) on the wreck of the Japanese battleship *Nagato*, at 180ft, and the bridge (above), which broke off when the ship sank upside-down at Bikini Atoll



The author photographing the wreck of a F4U Corsair. Photo by Charlie Gibbs.

a week. Arriving on the airstrip at Bikini, I was greeted by the editor of a rival magazine, who had just scooped us.

Nonetheless, Bikini remains among the most memorable experiences of my diving career. I made four trips there between 1996 and 2006, covering the entire era of the land-based dive operation. Today, only technical certified divers on a live-aboard can go there.

At Bikini, divers touch the face of history. Unlike World War II sites that have primarily tankers and freighters, Bikini has warships. The aircraft carrier *Saratoga* was Admiral Bull Halsey's flagship. Admiral Isoroku Yamamoto launched the attack on Pearl Harbor from the deck of the battleship *Nagato*. Additionally, there are destroyers, submarines and cruisers.

What makes things difficult is depth. The bottom ranges from 170

to 180ft. The shallowest dive is the deck of *Saratoga* at 100ft. Typically, we would make a deep dive in the morning, 35 minutes at 170ft, followed by an hour of decompression on 75 percent oxygen, supplied from the support boat at 30, 20 and 10ft. Afternoon would be penetration diving on the *Saratoga*, at 130 ft with the same deco protocol. Deep dives were made on air, with twin tanks.

There was international interest in Bikini, so I was able to recycle articles for magazines in other countries. When necessary, they handled translation. Eventually, additional articles found second homes in England, Australia, New Zealand, Germany, France and Israel.

Micronesia

At that time, I was writing my second book, *Diving Micronesia*. That

began when Bill Acker, founder of Yap Divers, pulled me aside at the DEMA show. He had seen my Red Sea guidebook, and suggested I write one on Micronesia. "Get me out there and I will," I replied.

Bill was as good as his word. He arranged passes on Continental Airlines, housing and diving on all the islands from Yap to the Marshall Islands. I spent three memorable summers bouncing around the Pacific, learning about the culture, World War II history and its underwater world. Meals often consisted of sashimi, because it was the cheapest thing on the menu, and the fish had probably been swimming that afternoon.

Downsides

Not all travel was fun. I was hired as a dive guide on an eco-cruise

ship, from Easter Island through French Polynesia to the Cook Islands. Thinking that this could lead to a good article, I began keeping a detailed journal. By the fourth day, I realized nobody would publish it. Everything that could go wrong did. But I kept on writing.

Soon afterward, Bret Gilliam began publishing *Fathoms Magazine*. He had the guts to run the article. I changed all the names and wrote it with a light, satirical touch. That turned out to be unnecessary, because shortly after, the cruise line went out of business.

Profiles of dive pioneers

I had always been interested in origins and history. When people like Chuck Nicklin, Jim Stewart and Andy Rechnitzer talked about the old days, I was an avid listener. When





Hanauer (right) interviewed Hans Hass (left) at the DEMA Show when Hass received a Reaching Out Award.



Astronaut Mike Gernhardt prepares for a training dive in NASA's Neutral Buoyancy Lab in Houston (left); Old couple in Havana, Cuba, photographed for Hanauer's article in the final issue of *Skin Diver* (above); Dive pioneer Lloyd Bridges (right)



Dr Wheeler North was retiring from Caltech, I asked to write his story.

After El Niños decimated southern California kelp forests in the 1950s, North developed a technique of transplanting healthy kelp from other areas. *Discover Diving* published the article, which eventually led to a series of interviews with pioneers. Among them were Zale Parry, Dick Bonin, Bob Hollis, John Steel and Tom Mount. They were eventually compiled into my third book, *Diving Pioneers*. After publication, I was able to reel in a few more historic fish: Lloyd Bridges, Commander Doug Fane, and the ultimate pioneer, Hans Hass.

Interviewing

The key to a good interview is to be prepared. Do your homework on your subject, and do not ask stupid, obvious questions. For the most part, I was confident, but there were a few whose intellect was so far beyond mine, that I was treading on shaky ground. Among them were Hans Hass, Dr Hugh Bradner (inventor of the wetsuit and a Manhattan Project scientist), astronaut Mike Gernhardt (a former scuba instructor and commercial diver), and Bruce Wienke, a Los Alamos physicist who developed the algorithm for the Atomic Cobalt dive computer.

For the Gernhardt interview, I traveled to NASA's Neutral

Buoyancy Lab in Houston. I tried and tried to gain permission to dive in the gigantic pool and shoot my own images, but the NASA bureaucracy was impenetrable. They did assign one of their divers to shoot photos and allowed me the run of the deck.

To top it off, Gernhardt invited me to the launch of his fourth shuttle mission, STS 104. We sat in the VIP section; the only ones closer were the astronauts. The 1 a.m. launch turned night into day, and I could feel the rumbling of the rocket deep within my chest. Even though I never got into the water, and had to spend my own money, it was one of my all-time favorite assignments.

When *Skin Diver* celebrated its 50th anniversary, they asked me to write the history of the magazine. By then, it had been bought and sold, and kept sliding down the new owners' priority lists. Publication ended a year later, in November 2002. My article on Cuba was the cover story in the final issue.

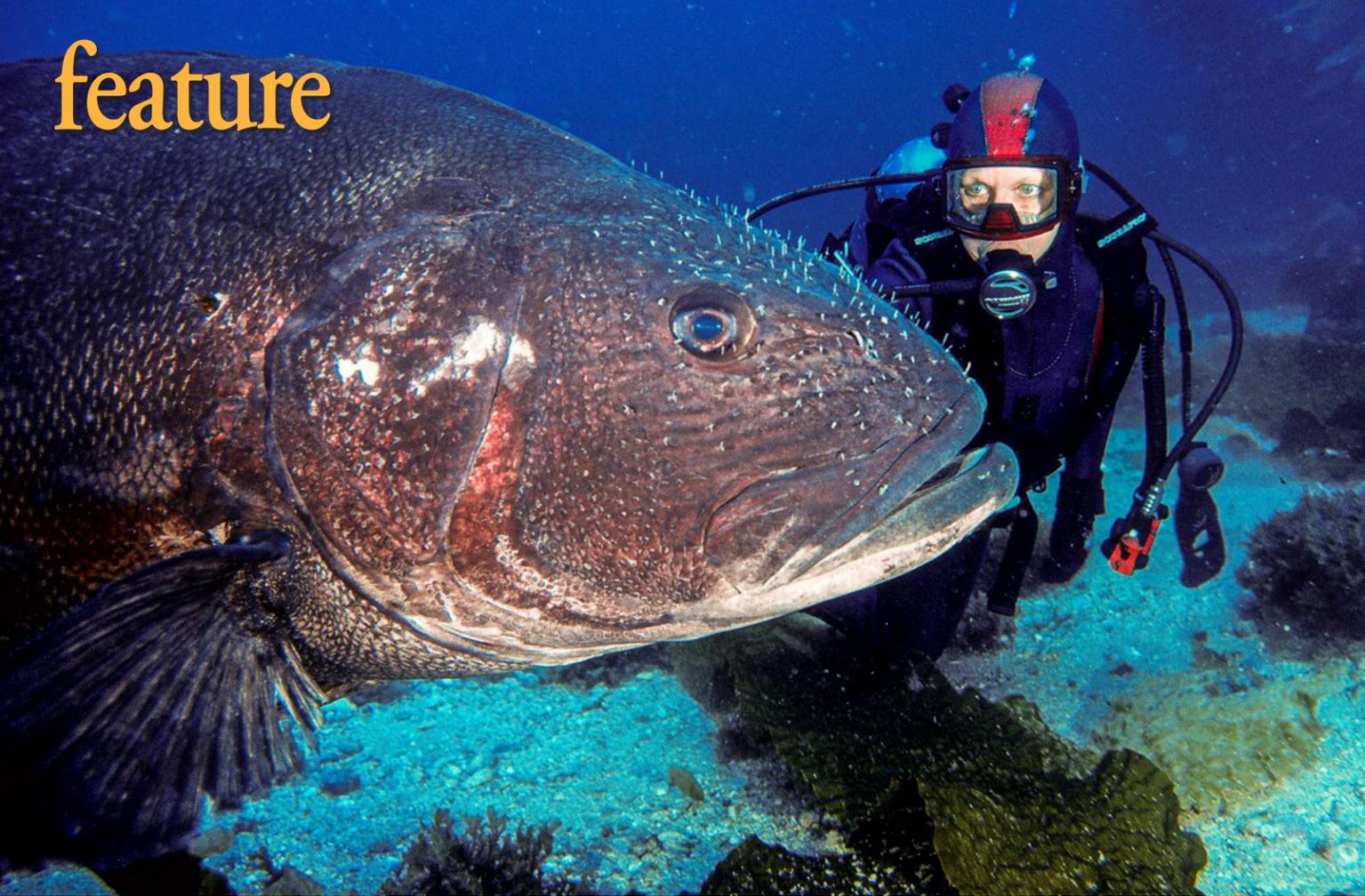
A golden era

Sometimes, when photo-journalists from that era get together, I would say, "We sure came along at the right time." We did not make much money, but the world was full of opportunities. Companies in the dive travel industry had connections and dollars to spend on coverage.

Richard Stewart had a deal with Pan Am, leading to the most memorable flight I had ever been on. First class. Polar route. Sport coats and ties were required when boarding the plane but could come off in the air. There were more flight attendants than passengers, as we were wined and dined from Los Angeles to Frankfurt (en route to Cairo). It was a midsummer day, and the highlight was watching the setting sun barely kiss the horizon over Greenland.

At the time, Pan Am was the world's premium airline. Some others did not quite measure up. One Middle Eastern carrier sold the flight attendants' emergency seats—to smokers.

On another, a flight attendant handed me a small bottle of wine as I entered the first-class cabin. When I finished my meal, she took away everything except the wine bottle. She said, "You throw it away. I don't touch that stuff."



Karen Straus, eye-to-eye with a giant sea bass, photographed at Catalina Island in the Channel Islands off California (above); Manta ray sunburst silhouette photographed in Baha (right)

Then, there was the time I was in the airport bound for Malaysia, I encountered a small group of airline pilots going to the same destination. What could be better than first class? How about a 747 cockpit? When they were invited in, they brought me along. Flying certainly was better before 9/11. But you knew that.

Acknowledgements

None of this would have been possible without the support of two great women. When I married Mia Tegner, a marine biologist at Scripps Institution of Oceanography, I realized that unless I achieved something, I would be known as Mr. Mia. That kicked the writing career

into high gear. In addition to being a wonderful dive and travel buddy, she taught me to thoroughly research what I wrote. Mia tragically died in a diving accident in 2001.

Shortly afterward, Karen Straus paid a condolence call. She had been a dive buddy in the 1970s but moved out of the area for over 20 years. With a long history in photojournalism, Karen was a published writer before I was. We married in 2004 and share a passion for many of the same things: diving, cars, photography and our cat, Teo. Both Karen and Mia have been elected to the Women Divers Hall of Fame.

In addition to Bonnie Cardone, I was fortunate to

work with some wonderful editors and publishers: Cathryn Castle, Mark Young, Tony Bliss, Cathy Cush, Bret Gilliam, Stephen Frink, Ed Montague, Ken Loyst, Steve Blount, Fred Garth, Peter Vassilopoulos, Phil Nuytten, Ty Sawyer and Al Hornsby.

Concluding thoughts

What have I learned in 47 years? Here are five takeaways:

1. Always meet deadlines.
2. Rewrite. Rewrite. Rewrite.
3. Check your sources.
4. When something is told to you off the record, keep it that way.
5. Have a day job to fall back on.

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Looking back, it has been a long, strange trip. Among the more than a dozen North American print magazines I wrote for, only two survive. Sometimes, I feel like Forrest

Gump, blundering my way through history. Would I have changed some things? Of course. But dive journalism has brought a lifetime of experiences that I could not have

envisioned when Dan Rittschof tried out for the Morgan Park High School swim team decades ago. ■

Scuba diver on nitrox at Flower Garden Banks National Marine Sanctuary in the north-western Gulf of Mexico

Text by Simon Pridmore

This article is an abridged version of an early chapter in Simon Pridmore's history of the early days of technical diving, *Technically Speaking—Talks on Technical Diving, Volume 1: Genesis and Exodus*. The nitrox saga would end up as the subject of vitriolic debate and bitter division in the sport diving community for half a decade. This is its origin story.

The tale began in 1977 at the US National Oceanic and Atmospheric Administration (NOAA), where diving programme head Dr J. Morgan Wells came up with the notion that, instead of air, NOAA scientists should start using a diving gas containing less nitrogen and more oxygen. This would enable them to carry out longer dives with no required decompression stops or planned decompression dives with less hang time than air dives with the same profile. It might also mean that

they could accomplish in a single nitrox dive a task that would otherwise require two air dives, making their diving safer and more straightforward.

When Wells came to choose a name for the mix of 32% oxygen and

68% nitrogen mix that he proposed, he called it NOAA nitrox one, or NNI, for short. Nitrox was a term used widely in NOAA's habitat work; however, in that context, it usually applied to breathing mixtures containing less

oxygen than air, rather than more.

Many scientists would have preferred to call this new diving gas Oxygen Enriched Air (OEA), but the term never caught on. In 1988, a scientific workshop convened

by NOAA and the Harbor Branch Oceanographic Institution proposed they call it Enriched Air Nitrox (EAN), with the three-letter acronym followed by the specific oxygen percentage. So, for example, a 32%O₂/68%N₂ mix



It's a Gas, Gas, Gas....

Nitrox in Sport Diving

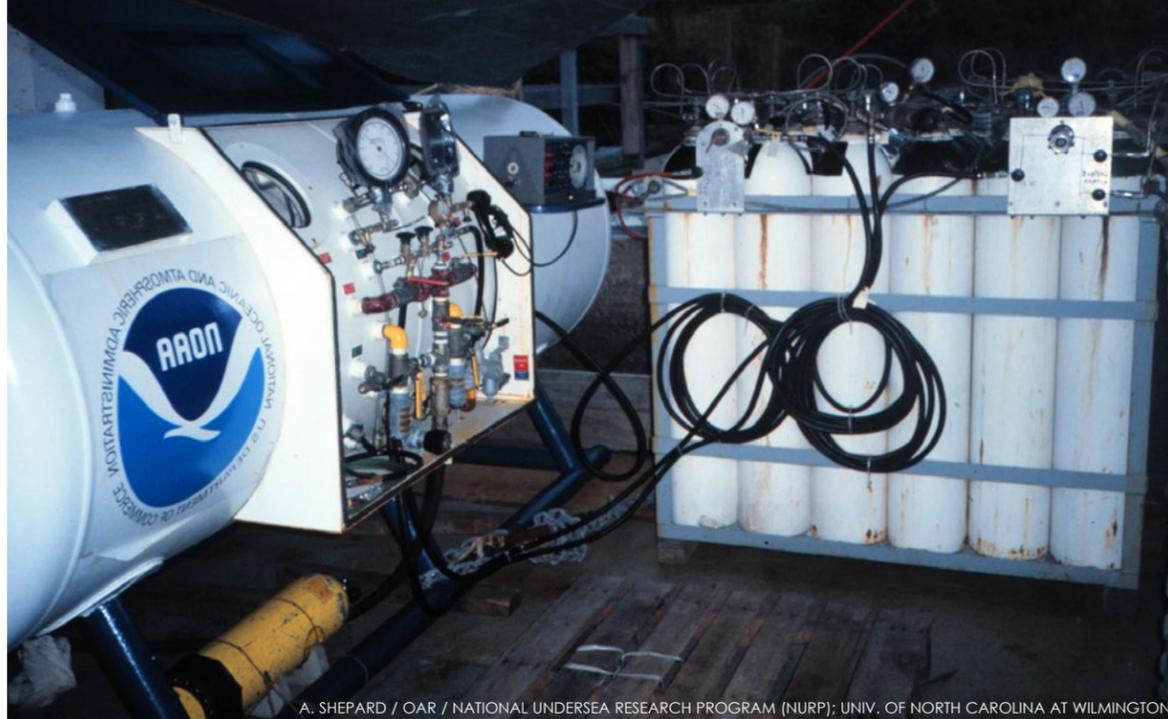
How It All Began

G.P. SCHMAHL/NOAA/NOS/NMS/FGBNMS, NATIONAL MARINE SANCTUARIES MEDIA LIBRARY/FLICKR/CC BY 2.0 DEED



opinion

NOAA nitrox gas mixing system and recompression chamber, 1988

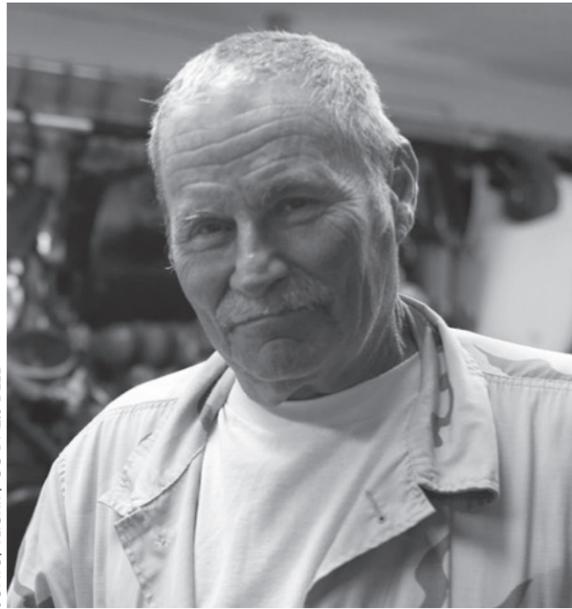


A. SHEPARD / OAR / NATIONAL UNDERSEA RESEARCH PROGRAM (NURP); UNIV. OF NORTH CAROLINA AT WILMINGTON

would be referred to as EAN32. That terminology lasted a little longer but, nowadays, everybody calls it nitrox and the other terms have disappeared. Wells may have been alone in his opinion but, nevertheless, it was he who won the day.

Why did Wells choose 32%?

It was just a question of mathematics and his preference for keeping things simple. At that time, the US Navy's working limit for diving with oxygen or mixed gas was 45 minutes at a pO₂ of 1.6. A diver breathing a gas mixture containing 32% oxygen would be breathing a pO₂ of 1.6 at 132ft (40m), and 130ft was the maximum depth limit for the NOAA diving programme.



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Dr. J. Morgan Wells (1940-2017) in 2011. Founding director of the NOAA Diving Program, he developed the NOAA Nitrox I and II mixtures in the late 1970s.

So, 32% was a good fit.

Using a concept he called Equivalent Air Depth, Wells created decompression tables for NNI based on the US Navy air tables. This involved comparing the depth at which a nitrox diver would be breathing a certain partial pressure of nitrogen (pN₂) with the depth at which an air diver would be breathing the same pN₂.

For example, a diver at 80ft (24m) on NNI breathes the same pN₂ as an air diver at around 63ft (19m). So, with conservative rounding up, the 70ft (21m) time limits on the US Navy air tables could be applied to 80ft (24m) on the NNI decompression tables. A period of testing using Doppler bubble monitoring suggested that the concept was valid, NNI was approved for use throughout NOAA in 1978 and the new decompression tables were published in the NOAA Diving Manual the following year.

Wells not only won in the naming stakes, but his idea of keeping everything as straightforward as possible has also stood the test of time, certainly as far as standard single-cylinder no-decompression-stop nitrox diving is concerned. As he explained: "I called it NOAA Nitrox

I, not referencing the content of the mix because I didn't want the divers messing around with that. It was all pre-packaged."

He did not want his diving scientists custom-building their own mixes. Giving NOAA divers a replacement gas for air was not an invitation for them to start experimenting with alternatives. They should just use it, follow the tables, and give no further thought to what gas was in the cylinder than they would if they were diving with air.

Multiple gasses

In technical diving, we use multiple gasses, we plan which gasses we will use, and we clearly mark our cylinders with the particulars of the mix they contain. In the late 1980s and early 1990s, nitrox diver students were encouraged to do likewise, that is, choose the right nitrox mix for the dive they planned. Most were taking a nitrox diver course as the entry point for technical diving, so introducing technical diving procedures at an early stage made sense.

The back of my dive shop in Guam in early 1997, set up with double filtration, a booster pump and everything required for nitrox and trimix fills.

A New Dive Book from Simon Pridmore

"Simon Pridmore's new book, 'Technically Speaking' is an outstanding tour de force from one of modern diving's most accomplished practitioners and best-selling authors."

— David Strike, Oztek & Tekdive Convenor

"Simon has completed a complex task with consummate skill and has accurately unravelled the when's, the who's and some of the why's, much of which would have been unjustifiably lost in the mists of time if not for this work."

— Kevin Gurr, Technical Diving Inventor & Innovator

"It will take some doing to better this account of tech's first steps... as no matter how much you know or think you know; you will still find many obscure historical gems..."

— Kevin Denlay, Early Adopter & Wreck Finder

Technically Speaking is the latest book from best-selling Scuba series author Simon Pridmore. It is a selection of themed talks telling the early history of technical diving—where it came from, how it developed, how it expanded across

the world, who the important movers were and how, in the decade from 1989 to 1999, the efforts of a few determined people changed scuba diving forever.

These ten years saw the greatest shake-up the sport has ever seen but technical diving's road to universal acceptance was anything but smooth, many obstacles had to be overcome and there were times when even viewed in retrospect, it seemed that its advocates might fail in their mission. Ultimately, success came down to perseverance, people power, good timing and more than a little luck.

severance, people power, good timing and more than a little luck.

Available in hardback, paperback and ebook at **Amazon Worldwide, Apple, Kobo, and Tolino.** See **SimonPridmore.com**



SIMON PRIDMORE





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NOAA diver on nitrox, documenting the wreck of USS Macaw at Midway Island

Tables were developed for a host of different nitrox mixes, from 26% to 40%, and the pile of nitrox cylinders on a dive boat would often include a wide variety of different blends. A contents label attached showing the diver's initials and the oxygen percentage was, therefore, crucial to avoid getting nitrox cylinders mixed up.

Today, things are very different. Comparatively few divers take a nitrox course as a stepping stone to technical diving. For most people, as for the NOAA divers in the 1970s, nitrox is just an air replacement gas that happens to contain 32% oxygen. To call it nitrox 32 would be tautological. It is just nitrox. There is only one. The cylinder might have a nitrox label, but the idea of a contents label has disappeared in non-technical diving circles.

Oxygen percentages

Wells added the Roman numeral I right from the start because he had

always intended to introduce a second standard nitrox for shallower diving. Initially, he chose 37.5% oxygen, but by the time he came to publish the tables, he had changed the oxygen percentage to 36%.

He did this because, according to the Equivalent Air Depth concept, a mix of 37.5% O₂/62.5% N₂ gave a diver 40 minutes of no-decompression and a pO₂ of 1.5 at 100ft (30m). However, although a 40-minute dive was well within the NOAA oxygen exposure limit of 120 minutes at 1.5, Wells worried that if the gas analysis was inaccurate, the oxygen percentage might be slightly higher than intended and a diver's pO₂ might be closer to 1.6 where the oxygen tables allowed a maximum exposure time of only 45 minutes. In this event, a 40-minute no-decompression dive could bring the diver close to the oxygen limits. This made him wary.

"I do not want to give them a

OMS oxygen analyser—with nitrox came the requirement for oxygen analysers in scuba diving

COURTESY OF SIMON PRIDMORE



chance to really hurt themselves badly through simple errors. Oxygen toxicity is going to get you if you mess around too far out there, and most divers do not even know it exists. All divers know is that you cannot dive deep on air because of nitrogen narcosis. That is probably why there are a bunch of bodies down in some of these caves. They had oxygen hits down there at 250 feet on air."

Reducing the oxygen percentage from 37.5% to 36% added a useful conservative cushion and made



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Dick Rutkowski in 2011. He was founder and director of the NOAA Diving/Hyperbaric Training and Diver Treatment Facility from 1973 to 1985.

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*

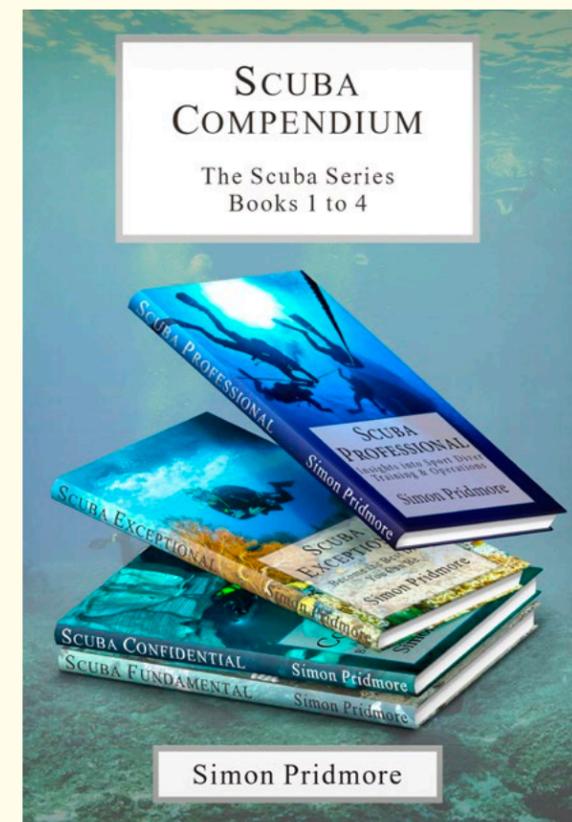
As Simon puts it, this is "a remastering and repackaging of the original albums rather than a greatest hits." Nothing is missing. *Scuba Compendium* gives e-book readers the advantage of being able to access all the knowledge contained in the four books in one place, making this a unique and easily searchable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

him more comfortable. He called his 36%O₂/64%N₂ mix NNII, and the new standards first appeared in the 1990 NOAA Diving Manual.

Rutkowski developments

Dick Rutkowski had a long pioneering history with NOAA and worked closely with Wells on the nitrox programmes. In 1985, he retired and started his own company Hyperbarics International, based first in Providenciales in the Turks and Caicos Islands and then in



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.

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Key Largo, Florida, where he formed the International Association of Nitrox Divers (IAND) to train sport divers to use nitrox.

Rutkowski would use two shipwrecks close to Key Largo for the course dives. They lay on the seabed at 122ft (37m), so they were perfect for demonstrating the advantages of NNI over air. The US Navy tables gave an air diver only 10 minutes of no-deco bottom time for these dives, but the NNI tables granted double that—a



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NOAA coral survey diver on nitrox at Kure Atoll, Northwestern Hawaiian Islands (left); IANTD Nitrox 40 decompression tables from 1996 (centre)

full 20 minutes. Allowing two minutes for the descent, an air diver would have eight minutes on site, whereas a diver on NNI would have 18 minutes. This was impressive.

Teaming up

In 1988, Rutkowski teamed up with Ed Betts from Freeport, New York to form American Nitrox Divers Inc. (ANDI). Nitrox was something completely new to sport divers. Over the years, scuba diving for fun in the United States had become strictly defined as using air with open-circuit equipment on dives to a depth no greater than 39m (130ft) and with no required decompression stops. These were not legal limits, they were just conventions, but they were almost universally followed. In other countries, different depth limits were practised, but, in the 1980s, air was the sole diving gas for sport

divers everywhere.

Rutkowski played a major role in changing that, but it was slow going. However, word was out. As Rutkowski revealed at the 1988 Harbor Branch Workshop: "I just came from the DEMA show and I passed out some literature and mentioned my programme. You should have seen the number of people that told me that they were already using nitrox... we had better take note that

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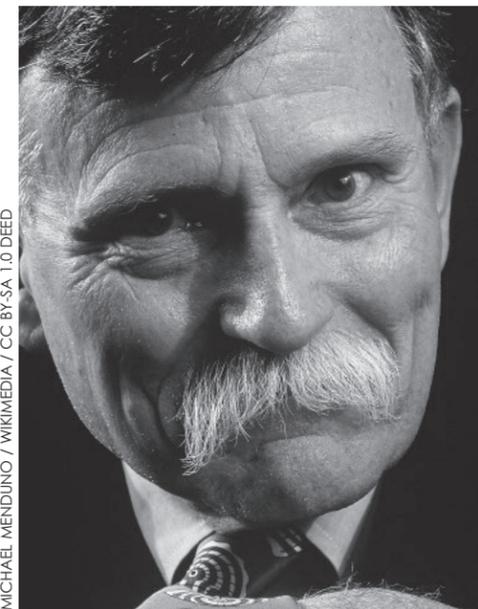
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they are out there and that they are doing it. They are doing it in a lot of crazy ways. Anything we can do here as part of this programme to ensure proper training to them I think should be brought up."

These "crazy ways" almost certainly included the dangerous practices of home-brewing and dropping off cylinders partially filled with oxygen at unwitting dive shops to be topped up from regular compressors. Rutkowski's contribution to "ensure proper training" was to write a formal training manual and in 1989, he finally got around to producing one. The following year, Rutkowski sold IAND to Tom Mount but remained on the company's Board of Directors, and subsequently, Mount would turn the agency into IANTD, the world's first technical diver training agency.



Pioneering cave diver and technical diver Tom Mount (1939-2022) served as CEO of IAND / IANTD from 1992 to 2005.



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Dr R.W. "Bill" Hamilton (1930-2011) was a physiologist who was known for his work in hyperbaric physiology. With NOAA, he developed "Monitor Mix" breathing gas (and decompression tables), which became NOAA Trimix I.



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Reception

Speaking in later years about Rutkowski's nitrox training programme, renowned diving physiologist Dr R.W. "Bill" Hamilton said:

"His course was responsibly delivered (give or take a couple of myths), and popular because it included an interesting dive as part of the deal. For a variety of reasons,

perhaps including Rutkowski's rather aggressive style and the perceived threat to others' 'turf,' the new practice was not well received by the recreational diving community, and an extensive and almost bizarre set of things 'wrong' with (nitrox) diving (some correct, some totally wrong) was widely promulgated."

To say that nitrox was not



NOAA divers on nitrox at Two Brothers wreck site, French Frigate Shoals, during a Reef Assessment and Monitoring program and monitoring expedition

TONI PARRAS / NOAA / PUBLIC DOMAIN



STEPHANI GORDON / NOAA / OPEN BOAT FILMS / FLICKR / CC BY-NC 2.0 DEED



NOAA maritime archaeologists on nitrox, at aircraft wreck, Midway Atoll, Papahānaumokuākea Marine National Monument (top right)

well-received by the sport diving establishment is an understatement. For many years in the United States, diving's leading individuals and organisations had conspired to throw an opaque veil over any underwater activity that contradicted the commonly accepted limits—air, open circuit, 39m (130ft), no deco—that defined the activity. Any diving beyond these limits was not sport diving. Sport diving was safe. Diving outside the limits was not safe.

Defending the status quo

Many of the top people in the sport diving world had been (some still were) involved in ultra-deep dives, cave diving and wreck exploration, but, as they were the key policymakers and opinion formers, they felt obliged to defend the status quo and protect dive businesses from anything that might cause insurance companies to withdraw professional coverage or the US government to intervene and regulate the sport.

These were their two major fears, and

this is why the idea of single-cylinder nitrox diving generated so much resistance in the early 1990s. It was seen as a threat to the survival of the sport as a recreational activity.

They claimed that:

- Its main advocates were untrustworthy.
- Nitrox could not be produced safely by divers or dive operators.
- Nitrox was incompatible with standard scuba gear.
- Nitrox marketing included lies and exaggerations.
- The nitrox advocates' statement that "nitrox is safe, air is dangerous" made sport diving sound risky.

Nitrox was at the thin end of a technical diving wedge that would end up breaching all of sport diving's established limits. If the "air only" domino was toppled, the rest would follow.

So, the self-proclaimed guardians of sport diving took aim at nitrox and

opened fire. Thus began the uncivil war that would consume much of the energy of the diving world for the next five years. ■ SOURCE: WIKIPEDIA

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 see his website at: SimonPridmore.com.

TONI PARRAS / NOAA / PUBLIC DOMAIN



NOAA diver on nitrox during Reef Assessment and Monitoring program expedition at Papahānaumokuākea Marine National Monument in Hawaii



Continuous flow nitrox blender... still in the future



marine mammals

Edited by Peter Symes



COMPOSITE BY PETER SYMES

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Recent studies have raised alarming concerns about the levels of toxic chemicals found in UK whales and dolphins (left).

Toxic chemicals in UK whales and dolphins: A growing concern

Persistent Organic Pollutants (POPs), once hailed as groundbreaking synthetic chemicals, have now been identified as a significant threat to marine wildlife, particularly apex predators like whales and dolphins.

Originally developed for use in pesticides, paints and fire-resistant materials, POPs are highly toxic and do not easily break down in nature. These chemicals have leached into the soil, air and waterways, eventually reaching the ocean. They are absorbed by plankton at

the bottom of the food chain and increase in concentration through a process known as biomagnification. As a result, marine mammals, which are at the top of the food chain, accumulate high levels of these toxins.

Impact

The accumulation of POPs in marine mammals' body fats can cause severe damage to their reproductive systems, immune system and hormonal cycles. Although the direct link between POPs and the death of marine mammals has

not been conclusively established, these chemicals add to the myriad of threats these animals face, which include fishing bycatch, noise pollution and climate change.

The presence of high levels of toxic chemicals in UK whales and dolphins is a stark reminder of the long-term environmental impact of human activities.

The harmful effects of POPs were recognised in the 1970s, leading to regulatory measures. The Stockholm Convention, which came into force in 2004, bans or restricts the production and use of the most damaging compounds. However, the persistence of these chemicals means that their impact

on marine life will continue for many years.

Findings

The United Kingdom's Cetacean Strandings Investigation Programme has been investigating the deaths of marine mammals that become stranded on UK coasts. Toxicology samples collected over more than 30 years are providing insights into the ongoing impact of pollutants on these animals. The findings indicate that the levels of toxic chemicals in UK whales and dolphins are exceeding safe limits, posing a significant risk to their health and survival. ■ SOURCE: ENVIRONMENTAL SCIENCE & TECHNOLOGY

ABOUT POPs

"Persistent organic pollutants (POPs) are organic compounds that are resistant to degradation through chemical, biological, and photolytic processes. They are toxic chemicals that adversely affect human health and the environment around the world. Because they can be transported by wind and water, most POPs generated in one country can and do affect people and wildlife far from where they are used and released.

"The effect of POPs on human and environmental health was discussed, with intention to eliminate or severely restrict their production, by the international community at the Stockholm Convention on Persistent Organic Pollutants in 2001."

— Wikipedia





Southern Resident killer whale holding in its mouth a harbour porpoise calf that was eventually drowned

Why are orcas killing porpoises?

Despite being primarily fish-eaters, orcas have been observed harassing and even killing porpoises without consuming them. Recent studies shed light on this enigmatic behaviour, offering several hypotheses.

A comprehensive study published in the journal *Marine Mammal Science* analysed over 60 years of recorded interactions between Southern Resident killer whales (SRKW) and porpoises in the Salish Sea. This endangered population of orcas, known for their fish-based diet, particularly Chinook salmon, has been involved in numerous incidents of porpoise harassment, leading to the deaths of many porpoises.

Possible explanations

The study proposes three main reasons for this behaviour:

1. Social play: Orcas are highly intelligent and social creatures known for their playful nature. The interactions with porpoises, including carrying them on their backs and passing them amongst themselves, could be a form of social play. This behaviour continues even after the porpoise's death, suggesting that killing might not be the primary goal.

2. Hunting practice: The harassment could serve as practice for hunting skills, especially for younger orcas. Porpoises, being fast and agile, might provide a moving target for the orcas to hone their hunting abilities, despite not being their typical prey.

3. Mismothering behaviour: Another intriguing hypothesis is that the orcas might be attempting to care for the porpoises, mistaking them for their young. This behaviour, known as mismothering or displaced epimeletic (relating to altruistic behaviour in which a healthy animal cares for an injured, ill or dead individual — ed.) behaviour, could stem from the orcas' limited opportunities to care for their young, as nearly 70 percent of SRKW pregnancies result in miscarriages or early calf mortality.

Cultural aspects

The study also highlights the cultural differences within orca populations. While the SRKW population primarily consumes fish, other orca ecotypes feed on marine mammals. This dietary specialisation is

deeply ingrained in their culture, influencing their interactions with other marine species.

The reasons behind orcas' aggression towards porpoises remain partially speculative, but the insights from recent research provide a deeper understanding of orca behaviour and ecology.

Understanding these interactions is crucial for the conservation of both orcas and porpoises. The decline in salmon populations, a primary food source for the SRKW, underscores the need for effective conservation strategies. The study emphasises the complexity of orca behaviour and the importance of preserving their natural habitat and food sources. ■

SOURCE: MARINE MAMMAL SCIENCE



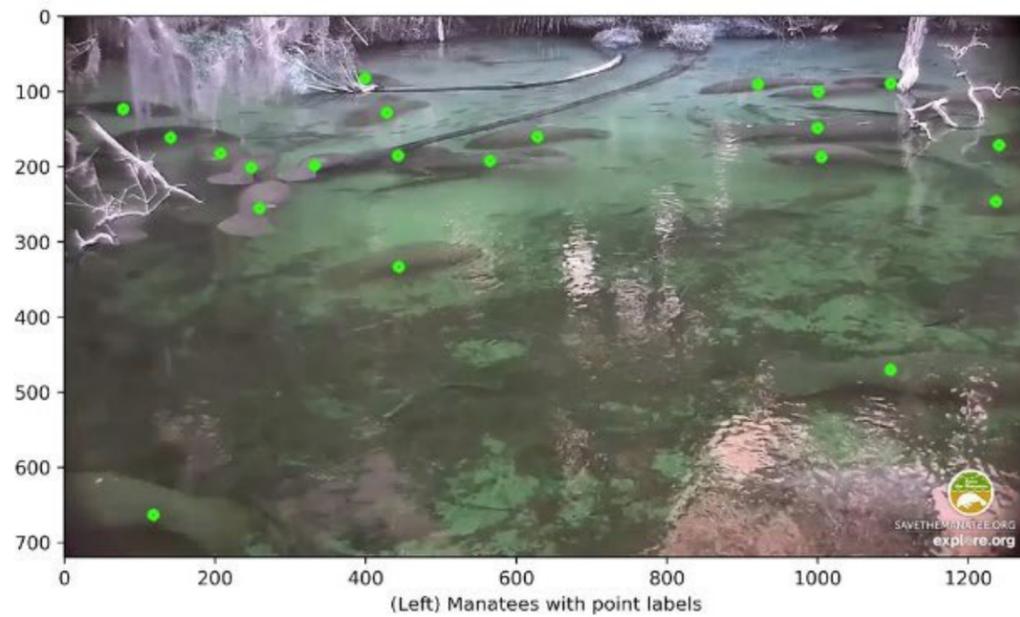
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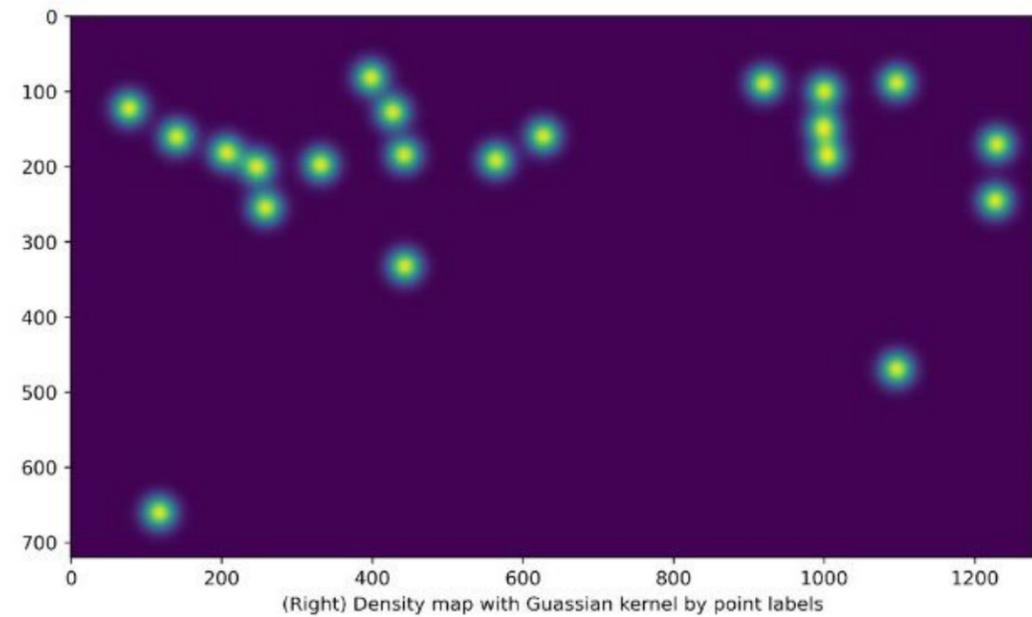
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(Left) Manatees with point labels



(Right) Density map with Gaussian kernel by point labels

The left panel shows an image with dot labels of manatees. The right panel shows the density map of the image generated by applying Gaussian distributions to the labeled points. Image credit: FAU College of Engineering and Computer Science

Innovative AI technique enhances real-time tracking of manatees

Researchers develop a cost-effective AI method to count manatees, aiding conservation efforts.

The conservation of endangered species receives a technological boost as scientists at Florida Atlantic University (FAU) devise an artificial intelligence (AI) method that accurately counts manatee populations in real-time.

Counting challenges & AI solution

Counting manatees has long presented a challenge due to their herding behaviour, weather conditions, time of day and environmental factors that obscure their visibility. Water reflections can also hinder the counting process. As such, traditional aerial surveys, though useful, are hampered by high costs, variable accuracy, and observer bias.

Addressing these challenges, FAU's researchers have implemented a deep learning-based, crowd counting approach that utilises closed-circuit television (CCTV) imagery, providing a real-time population estimate. This study, detailed in the *Scientific Reports* journal, leverages an Anisotropic

Gaussian Kernel (AGK) to match the manatees' distinct shape, transforming generic surveillance images into accurate density maps.

Cost-effective labelling and broad implications

The team adopted a deep learning-based, crowd counting approach to

automatically count manatees in a specific area, based on images from a CCTV camera. Then, they used line-label based annotation with a single straight line to mark each manatee.

This FAU-developed method outperformed other baselines. It worked particularly well when the image had a high density of manatees in a com-

plicated background.

"Our method considered distortions caused by the perspective between the water space and the image plane. Since the shape of the manatee is closer to an ellipse than a circle, we used AGK to best represent the manatee contour and estimate manatee density in the scene," explained senior author Xingquan (Hill) Zhu, Ph.D., an IEEE Fellow and a professor in FAU's Department of Electrical Engineering and Computer Science.

"This allows density map to be more accurate, in terms of mean absolute errors and root mean square error, than other alternatives in estimating manatees' numbers," he added.

Besides creating a method that surmounts previous counting obstacles, the researchers have also provided their dataset and source code to the public, fostering further research.

The neural network-based approach balances the cost of labelling against the efficiency of counting, offering a straightforward, high-



The Florida manatee and some other species of manatees are considered endangered by the International Union for Conservation of Nature (IUCN). These marine mammals can be found from Florida to Brazil and throughout the Caribbean islands.

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throughput counting method with minimal labelling effort. It underscores the potential of computational techniques to enhance our understanding of endangered species populations, leading to more informed conservation strategies. ■ SOURCE: SCIENTIFIC REPORTS

Keeping warm in the Arctic —how the Arctic seal does it

In the chilly expanse of the Arctic, where the struggle to conserve heat and moisture is paramount, Arctic seals have developed an unusual survival tactic—complex nasal passages.

A recent study in the *Biophysical Journal* reveals that Arctic seals are able to efficiently



MIKE PENNINGTON / WIKIMEDIA / CC BY-SA 2.0 DEED



SIGNE KJELSTRUP / CC BY-SA

Bearded seal, an Arctic seal species (above, left and right)

retain heat and moisture during respiration as a result of the elaborate structures in their nasal cavity.

Adaptations for the Arctic Arctic seals, specifically the bearded seal (*Erignathus barbatus*), have nasal cavities with more intricate structures compared to their subtropical

“If nature manages to create such great heat exchangers, I think we should copy that in engineering to create more efficient processes, for instance, in air conditioners.”

— Signe Kjelstrup, Norwegian University of Science and Technology

counterparts like the Mediterranean monk seal (*Monachus monachus*). This adaptation has helped Arctic seals to lose less heat through nasal heat exchange than the seals in the subtropics.

“This provides an evolutionary advantage, especially in the Arctic where heat loss is energy dissipation, which must



MICHAEL HAERKAMP / WIKIMEDIA / CC BY-SA 2.0 DEED

be replenished by food,” said corresponding author and physical chemist Signe Kjelstrup of the Norwegian University of Science and Technology.

She elaborated on this, saying that the seals retained 94 percent of the water when they breathed in and out. “This means that most of the water added to the air during inhalation is then recovered during exhalation,” he added.

Testing 3D models of nasal cavities

A previous study had showed that the nose of the Arctic seal was sponge-like and that of the Mediterranean monk seal had a more open structure. In this study, the researchers

created 3D models of the nasal cavities of the two seal species. Then, energy dissipation models were used to compare the cavities’ ability to warm and moisten air during inhalation and to reduce heat and moisture loss during exhalation. This was done in an environment that simulated Arctic conditions (−30°C), and a cold day in the subtropics (10°C).

The team found that in both conditions, the longer, more complex and dense nasal cavity of the Arctic seal was much more efficient at retaining heat and water exchange. According to the press release, “At −30°C, the subterranean seals lost 1.45 times as much heat and 3.5 times as much water per

breath cycle as the Arctic seals, and at 10°C, the subterranean seals lost 1.5 times as much heat and 1.7 times as much water.”

Implications of the study

Kjelstrup and her team hope to expand their study to include other species like the camel, an animal that needs to save on water in the desert environment. They intend to apply what they learn to make more efficient heat exchanges and ventilation systems.

“If nature manages to create such great heat exchangers, I think we should copy that in engineering to create more efficient processes, for instance, in air conditioners,” she said. ■

SOURCE: BIOPHYSICAL JOURNAL

Pairs & Companions

Contributors' Picks

Photo by Anita George-Ares. Thorny seahorses, Dumaguete, Philippines. Gear: Canon EOS Rebel SL1 camera, Canon EF-S 60mm f/2.8 macro USM lens, Ikelite housing, two Ikelite DS161 strobes. Exposure: ISO 200, f/11, 1/160s

Text and photos by John A. Ares, Larry Cohen, Anita George-Ares, Kate Jonker, Matthew Meier, Brandi Mueller, Gary Rose and Olga Torrey

We asked our contributors to share their favorite photos that show pairs and companions, or two of a kind, and they returned with a range of macro to wide-angle shots, featuring a variety of marine life large and small. Here, *X-Ray Mag* contributors share their favorite images from the tropical waters of Fiji, French Polynesia, Solomon Islands, Papua New Guinea, the Philippines, Indonesia, the Maldives, the Red Sea and Mexico, to the subtropical and temperate waters of South Africa, Vancouver Island in Canada, and the US East Coast.

ANITA GEORGE-ARES



Photo 1. (left) Papuan cuttlefish, Raja Ampat, Indonesia. Gear: Canon EOS Rebel SL1 camera, Canon EF-S 60mm f/2.8 Macro USM lens, Ikelite housing, one Ikelite DS 161 strobe, Bigblue VL4200P video light. Exposure: ISO 100, f/11, 1/160s



Photo 2. (bottom left) Orbicular batfish, Solomon Islands. Gear: Canon EOS Digital Rebel XTi camera, Canon EF 50mm f/2.5 compact macro lens, Ikelite housing, two Ikelite DS 161 strobes. Exposure: ISO 200, f/11, 1/200s

Photo 3. (right) Panda butterflyfish, Dumaguete, Philippines. Gear: Canon EOS Rebel SL1 camera, Canon EF-S 60mm f/2.8 Macro USM lens, Ikelite housing, two Ikelite DS 161 strobes. Exposure: ISO 200, f/8, 1/160s



Two's Company

Text and photos by Anita George-Ares, PhD

I was happy to find the pair of thorny seahorses (previous page) clinging to a sponge. Perhaps the female had already transferred her eggs to the male (on the right), or perhaps they were still courting.

I was also fortunate to find a Papuan cuttlefish pair displaying courtship behavior (Photo 1). The male dis-

plays raised arms above the female. I enjoyed watching the cuttlefish change body postures, colors and skin textures. The male later changed from golden to a dark red. At the same time, the female changed from a dark to a pale red with extensive white mottling.

At a shallow water dive site in the Solomon Islands, I was amazed at the extensive "meadow" of soft corals carpeting the bottom. Several orbicular batfish swam by as I photographed this pair (Photo 2).

A pair of panda butterflyfish swim in tight formation in Photo 3. Reproduction is not the only reason that butterflyfish form pairs. Same-sex pairs can also be formed to defend reef territory and food resources (Nowicki, et al. 2018). Visit: [facebook.com/profile.php?id=100016947967639](https://www.facebook.com/profile.php?id=100016947967639)

SOURCE: NOWICKI, J., S.P.W. WALKER, D.J. COKER, A.S. HOEY, K.J. NICOLET, AND M.S. PRATCHETT. 2018. PAIR BOND ENDURANCE PROMOTES COOPERATIVE FOOD DEFENSE AND INHIBITS CONFLICT IN CORAL REEF BUTTERFLYFISH. *SCIENTIFIC REPORTS*, ARTICLE NUMBER 6295.

feature

Photo 1. (bottom right) Humpback whales, Moorea, French Polynesia. Gear: Canon Rebel SL1 camera, EF-S 10-18mm f/4.5-5.6 IS STM lens at 10m, Ikelite housing, available light. Exposure: ISO 3200, f/14, 250s

Photo 2. (top right) Manta rays, Maldives Islands. Gear: Canon Rebel SL1 camera, EF-S 10-18mm f/4.5-5.6 IS STM lens at 10mm, Ikelite housing, twin Ikelite DS-161 strobes. Exposure: ISO 1600, f/16, 125s

Photo 3. (top left) Manatees, Three Sisters Springs, Florida, USA. Gear: Canon 10D camera, Sigma EF-S 10-17mm f/4.5-5.6 IS STM lens at 10mm, Ikelite housing, twin Ikelite DS-161 strobes. Exposure: ISO 100, f/3.5, 100s

Photo 4. (right) Great white sharks, Guadalupe Island, Mexico. Gear: Canon 10D camera, Sigma EF-S 10-18mm f/4.5-5.6 IS STM lens at 17mm, Ikelite housing, available light. Exposure: ISO 400, f/4.5, 60s



Pairs



Large Animal Pairs

Text and photos by John A. Ares

Photographing pairs of large animals is exhilarating and is a largely regulated activity. Wherever you find them, government organizations will likely be watching you very carefully and setting limits for physical distances during encounters. Most often, encounters will be allowed if the animals approach you.

The mother humpback whale and female calf in Photo 1 were photographed in Moorea, French Polynesia.

The best whale encounters almost always include a mother and calf, sometimes with an “escort” male. Photographing humpbacks are almost always regulated to surface snorkeling with no freediving. Patience and a lot of finning to get relatively close to the whales is required.

The manta rays in Photo 2 were photographed in the Maldives near a cleaning station. At cleaning sta-

tions, regulations keep divers at a distance. By keeping my head on a swivel, I was able to get this pair about five feet away, by spotting them approaching the cleaning station from behind and over my right shoulder.

The mother and nursing calf manatees in Photo 3 were photographed in very shallow water at Crystal River in

Florida. Swimming with the manatees is a great experience. Photographers will be watched carefully by volunteer docents. It is best to go early and plan on being in the water near sunrise.

The pair of great white sharks in Photo 4 was photographed off Guadalupe

Island in Mexico. I saw up to three great white sharks at any one time. However, earlier this year, it was reported that the Mexican government had shut down shark tourism that allowed cage diving.¹ Visit: JohnAres.com

¹ SMITHSONIANMAG.COM





Photo 1. (above) Twin-spot gobies, Tufi House reef, Papua New Guinea. Gear: Olympus OM-D E-M1 camera, Olympus 60mm f/2.8 macro lens, Aquatica housing, Sea&Sea YS-D1 strobes. Exposure: ISO 200, f/11, 1/250s



Couples

Text and photos by Larry Cohen

It is always safer and more fun to dive with a buddy. It seems like some marine species also like to travel in pairs. I spotted a pair of twin-spot gobies while diving at the Tufi House reef in Papua New Guinea (Photo 1). These tiny fish looked as if they were taking a morning walk on the sea bottom. Instead of swimming, they shuffled along the bottom and looked like they were enjoying each other's company. These gobies have large spots on their fins. The spots fool predators into thinking they are the eyes of a large fish.

In Papua New Guinea, it is common to spot different anemonefish. At the Hanging



Pairs

Gardens dive site, I captured an image of a couple of false clown anemonefish (Photo 2). These fish are monogamous, but males can turn into females if no females are available. These fish live in an anemone. Mucus on their bodies prevents the fish from being stung. The anemone's stinging tentacles, however, protect the anemonefish and their nests from predators.

At the Papua New Guinea dive site Leslie's Knob, there was a single hawksbill sea turtle that seemed to enjoy interacting with the divers. This turtle swam in close and seemed to enjoy looking at his reflection in my dome. I used my strobes to light the turtle and the ambient light to capture a diver swimming away in the background (Photo 3). Visit: liquidimagesuw.com

Photo 2. (above) False clown anemonefish, Hanging Gardens dive site, Papua New Guinea.

Gear: Olympus OM-D E-M1 camera, Olympus 60mm f/2.8 macro lens, Aquatica housing, Sea&Sea YS-D1 strobes. Exposure: ISO 200, f/8, 1/125s

Photo 3. (far left) Hawksbill sea turtle, Leslie's Knob dive site, Papua New Guinea. Gear: Olympus OM-D E-M1 camera, Olympus 9-18mm f/4-5.6 lens, Aquatica housing, Sea&Sea YS-D1 strobes. Exposure: ISO 200, f/5.6, 1/60s



Pairs



Photo 1. (right) Black nudibranch, *Tambja capensis*, with amphipod friend, Blousteen dive site, Gordon's Bay, South Africa. Gear: Canon EOS 7D Mark II camera, Canon 60mm macro lens, Sea & Sea housing, two Inon Z-240 strobes. Exposure: ISO 320, f/25, 1/200s

Photo 2. (top left) Gasflame nudibranch, *Bonisa nakaza*, with hermit crab, Stone Dog dive site, Gordon's Bay, South Africa. Gear: Canon R5 camera, Canon 100mm macro lens, Marelux housing, two Scubalamp SUPE D-Pro strobes. Exposure: ISO 320, f/20, 1/200s

Photo 3. Chinese klipfish, *Clinus nematopterus*, Steenbras Deep, Gordon's Bay, South Africa. Gear: Canon R5 camera, Canon 100mm macro lens, Marelux housing, two Scubalamp SUPE D-Pro strobes. Exposure: ISO 100, f/25, 1/200s

Unexpected Companionships

Text and photos by Kate Jonker

Diving deep uncovers a world teeming with unexpected companionships. On a recent dive, sheer serendipity played its part as a black nudibranch unwittingly played host to a playful amphipod, resulting in a comical snapshot of surprise (Photo 1). The encounter caught both the nudibranch and me off-guard, freezing a moment of spontaneous underwater charm.

Another peculiar duo unfolded when I zeroed in on a gasflame nudibranch (Photo 2), only to find it hitching a ride on a hermit crab. Trying to capture both pairs of "eyes" in this unusual partnership turned into a lively challenge, with the elusive crab

engaging in a playful game of hide-and-seek with my lens—a comical ballet beneath the waves.

Nature's instinctive pairings also unfold, as witnessed with the rare Chinese klipfish nestled together in the crannies of Steenbras Deep (Photo 3). The sight of these elusive creatures side by side was a thrilling rarity, their partnership creating a charming image against the backdrop of the reef.

These stories serve as a reminder that beneath the waves, life crafts its own tales of companionship, survival and even humour. Whether documenting accidental encounters or purposeful partnerships, the underwater realm is a canvas of unexpected unions waiting to be explored. So, on your next dive, keep a keen eye out for the distinctive couples that nature, in its boundless creativity, reveals beneath the surface. Visit: katejonker.com



Photo 1. (right) Pair of large whip gobies stay close to their eggs, which they laid on a bare patch of the whip coral, Lembeh Strait, Indonesia. Gear: Nikon D810 camera, Nikon 105mm macro lens, Subal housing, two Sea&Sea YS-250 strobes. Exposure: ISO 200, f/29, 1/125s



Photo 2. (top right) Pair of yellow pygmy gobies living in a discarded glass bottle on the sea floor, Lembeh Strait, Indonesia. Gear: Nikon D810 camera, Nikon 105mm macro lens, Subal Housing, two Sea&Sea YS-250 strobes. Exposure: ISO 200, f/25, 1/125s



Photo 3. (far right) Pair of Coleman shrimp perched on top of a large, magnificent fire urchin, Lembeh Strait, Indonesia. Gear: Nikon D810 camera, Nikon 105mm macro lens, Subal Housing, two Sea&Sea YS-250 strobes. Exposure: ISO 200, f/25, 1/125s

Photo 4. (above) Pair of reef lizardfish resting on the coral reef, Taveuni, Fiji. Gear: Nikon D3 camera, Nikon 105mm macro lens, Subal Housing, two Sea&Sea YS-250 strobes. Exposure: ISO 200, f/22, 1/160s

Mated Pairs

Text and photos by Matthew Meier

For this Contributors' Pick segment, I selected pictures of various species in mated pairs, showcasing courtship behavior. The still images do not tell the whole story of the behaviors themselves, but I tried to portray the intimacy through their proximity to one another. For instance, the whip gobies guarding their eggs (Photo 1) had obviously already mated, but they were diligently protecting and aerating their brood through frequent movement forward and back and around the whip coral strand. Capturing this image of the pair lined up in unison required patience and many failed attempts as one or both readjusted their positions often.

Similarly, the yellow pygmy gobies (in Photo 2) swam patterns around their wine-bottle home, and not always together—only staying at the opening for brief inspections of the imposing intruder at their doorstep before darting back inside. I spent half my dive attempting to time my shutter release with their swimming sequence in hopes of getting both of them in the same plane of focus.



The Coleman shrimp (Photo 3) cleared a space among the fire urchin spines and settled in as they gently swayed side to side and forth and back, in a rhythmic movement. It was quite hypnotic to watch.

Lizardfish, in my experience, are some of the more skittish creatures on the reef and usually flee from me, so it is only a guess that this is truly courtship behavior (Photo 4). I was just excited that they stayed still long enough for me to get this photo. Visit: MatthewMeierphoto.com

Symbiotic Companions

Text and photos by Brandi Mueller

Commensal behaviors are some of my favorite underwater pairs or companions to photograph. Living together, neither causes a problem for the other; the relationship may possibly be symbiotic and they may actually help each other by being together.

Take, for instance, the starfish or sea star shrimp (*Zenopontonia soror*). These tiny shrimps are hitchhikers on the lovely sea stars. They may help the starfish by feeding on and cleaning it of parasites, although they also may eat algae or plankton drifting past in the water. In return, the shrimps get a mobile home.

They live on many types of starfish and can change their color to blend in better with their starfish. I love coming across a starfish and on closer inspection, finding one or more of these tiny shrimps camouflaged to match. Here are a few from the Red Sea and the Philippines living on starfish species, including the crown-of-thorns and blue starfish. Visit: brandiunderwater.com



Sea star shrimp on a blue starfish, Philippines (above). Gear: Nikon D90 camera, 105mm, Ikelite housing, dual Ikelite DS161 strobes. Exposure: ISO 200, f/20, 1/200s

Sea star shrimp on the arm of a starfish, Red Sea (right). Gear: Nikon D850 camera, 105mm lens, Ikelite housing, dual Ikelite DS230 strobes. Exposure: ISO 200, f/20, 1/200s



Sea star shrimp on a crown-of-thorns starfish, Red Sea (above). Gear: Nikon D850 camera, 105mm lens, Ikelite housing, dual Ikelite DS230 strobes. Exposure: ISO 200, f/25, 1/200s



Pairs

Photo 2. (left) *Ghost sharks*. Shooting down on a pair of sandbar sharks. Natural light with a dusting of strobe. Exposure: ISO 200, f/8, 1/125s, FL 17

Photo 3. (below) *Flyby*. I had prepared my negative space for a silhouette and waited for a pair of lemon sharks to line up. The diver balances the tableau. Exposure: ISO 200, f/22, 1/160s, FL 10

Photo 4. (center) *Reflection*. At first glance, this appears like a reflection. Strobe lighting enhances the effect. Exposure: ISO 100, f/8, 1/125s, FL 10

All photos were taken with a Nikon D500 camera, Tokina 10-17mm lens, Nauticam housing, Inon Z-330 strobes. Photo 1. (left) *BFFs*. Pair of adult tiger sharks, Tiger Beach, Bahamas. Natural lighting with a touch of strobe. Exposure: ISO 100, f/8, 1/320s, FL 17

Tell a Visual Story

Text & photos by Gary Rose, MD

In the past, I have written articles for this magazine regarding enhanced photographic techniques, including the use of negative space, natural lighting, silhouette, framing, shooting up, and shooting down. For this article, I am going to utilize “pairs” as a theme and will be applying, varying and adapting my technique to the ever-changing conditions of the sea, and my oceanic environment. The pairs of sharks in the photos were wonderful models and effectively helped me demonstrate how important it is for an underwater photographer to be flexible and have many techniques at his or her disposal to tell a visual story.

Photo 1 was taken in the warm, clear and tranquil waters of Tiger Beach, Grand Bahama

Island. At any given time, there were 12 to 18 tiger sharks gliding by, and interestingly, these females often swam in pairs. In this photo, I added a touch of strobe lighting, directed at the snouts of this beautiful pair, to enhance the natural sunlight that bathed the reef.

Among the summer sharks at Jupiter, on the Florida coast, I always marvel at the mysterious appearance of our “ghost sharks” or sandbar sharks. They almost always first appear from the dark blue abyss as nearly invisible blue wraiths, ascending to the surface in a slow spiral. To capture this magical dance, shooting downwards, I utilized natural lighting and barely dusted this pair with my strobes to capture their mystical blue coloring (Photo 2).

Upon entry, arriving at depth, and leveling off by controlling my buoyancy, I will always rotate in a full 360° to take in my



surroundings. I particularly love to shoot upwards and will take a few test shots to create the most appealing negative space (uncluttered background) to showcase my chosen subject. Then, I wait. In most cases, the photo creates itself. This pair of

lemon sharks appeared, followed by a diver, and then they drifted right into my previously prepared canvas—the negative space (Photo 3).

At first glance, most viewers think that Photo 4 is a photograph of a lemon shark, with



its reflection illuminated in the inky blackness of night. Then, after a few moments, the viewer invariably realizes that this is a photo of two lemon sharks passing each other at 90 degrees. I always enjoy the exclamation of surprise. This effect was created by vignette framing, that was created with the bright lighting provided by my strobes, bouncing off the reflective surface of the sharks in the center of the photo. All of the remaining light

was completely absorbed by the surrounding black sea.

In addition to having technical knowledge, the underwater photographer will benefit greatly by having a broad skillset. To photograph sharks in the wild, and to capture more than the usual portrait photos, the underwater photographer should become comfortable stepping out of the box to plan, design, set up and tell a visual story. Visit: garyrosephotos.com



Photo 3. (left) Two-stripe damselfish, *Dascyllus reticulatus*, Belinda's Reef, Papua New Guinea. Gear: Olympus OM-D E-M5 camera, Olympus 60mm macro lens, Nauticam NA-EM5 housing, Sea&Sea YS-D1 strobes. Exposure: ISO 500, f/9.0, 1/125s

Photo 4. (below) Schoolmaster snappers on Molasses Reef, Key Largo, Florida, USA. Gear: Olympus OM-D E-M5 camera, Olympus M.Zuiko 12-50mm f/3.5-6.3 EZ micro lens, Nauticam NA-EM5 housing, Sea&Sea YS-D1 strobes. Exposure: ISO 320, f/7.1, 1/200s

Photo 1. (left) Pair of whitefin sharksuckers, Cozumel, Mexico. Gear: Olympus OM-D E-M5 camera, Olympus 7mm-14mm lens, Nauticam NA-EM5 housing, Sea&Sea YS-D1 strobes. Exposure: ISO 400, f/7.1, 1/200s



Unusual Duos

Text and photos by Olga Torrey

I went scuba diving in Cozumel, Mexico, to see the female bull sharks. Every year, female sharks return to their breeding locations in the Gulf of Mexico near Playa del Carmen. I went down with a group of divers and waited for the sharks to arrive. Then, I saw a large pair of whitefin sharksuckers swim and sit by my side on the sandy bottom, waiting for the sharks to arrive (Photo 1). The sharksuckers looked comical as they patiently waited for the sharks, so they could catch a free ride and feed on leftovers discarded by their host. Some time passed before we saw two pregnant sharks swim toward us and circle in the distance.

I traveled to British Columbia to photograph marine life I had not seen before. I went on a night dive to see the hooded nudibranchs, *Melibe leonina* (Photo 2). It was my first time in this area. The hooded nudibranch is a trans-

lucent sea slug which is colorless to pale yellow or green, and spends time amongst seagrass and kelp. They swim at night by bending their bodies from side to side, to propel themselves forward, forming a "C" shape. The hooded nudibranch mates during the day and feeds on planktonic invertebrates by swallowing them whole.

It is born with a shell and loses it after it hatches. If I describe an animal as an omnivore, aggressive, mean, hellish, territorial, and always in war mode with neighbors, you might think I was talking about great white or bull sharks. But I am talking about the cute and tiny two-stripe damselfish, *Dascyllus reticulatus* (Photo 3). This tropical fish has a laterally compressed disc-shaped body, two vertical stripes, and a blue-green tail. This animal will turn its neighborhood

into an underwater war zone.

While diving in the clear, warm coastal waters on Molasses Reef in Key Largo, Florida, I noticed a pair of schoolmaster snappers slowly swimming by. I wondered why these two fish, found in large schools, were separated from the rest of the school. It seemed that these female and male schoolmaster snappers were in courtship (Photo 4). Visit: fitimage.nyc



Photo 2. (above) Hooded nudibranch, *Melibe leonina*, British Columbia, Vancouver Island, Browning Pass, Canada. Gear: Olympus OM-D E-M5 camera, Olympus M.Zuiko 12-50mm f/3.5-6.3 EZ micro lens, Nauticam NA-EM5 housing, Sea&Sea YS-D1 strobes. Exposure: ISO 250, f/13, 1/250s



“Abstractionism arose from the artists’ choice to deny the representation of reality in order to enhance their feelings through shapes, lines and colours ... The term ‘abstractionism’ is thus often used to designate all non-figurative forms of visual artistic expression, where there are no footholds that allow the painted image to be traced back to any representation of reality...”

— Stefano Fake, Italian contemporary artist and video designer

Text and photos by
Claudio Ziraldo
Taxonomic search by
Alessandro Ziraldo

How can one capture “abstractionism” in an underwater photo? Underwater photographer Claudio Ziraldo discusses abstract underwater photography and shares some examples of sea art.

“Abstractionism is an artistic experience that arose in the early 20th century ... The term indicates those pictorial and plastic works that go beyond the objective representation

of reality.” (it.wikipedia.org)

Even in underwater photography, we can search for forms of a kind of “abstractionism.” We can thus make use of the infinite possibilities that

the “Blue Continent”¹ offers us, capturing images based on the shapes, colours and harmonies that are charac-

1. REFERS TO THE 1954 UNDERWATER DOCUMENTARY FILM BY FOLCO QUILICI, SESTO CONTINENTE (THE BLUE CONTINENT) (WIKIPEDIA, IMDB)

teristic of the details found in marine organisms or animals, show associations between life forms, or more simply, can be identified in the incredible and infinite geometries that are a

Photo 1. Close-up detail of sea urchin, *Astropyga radiata*, Lembeh Strait, Indonesia

Sea Art

Abstractionism in UW Photography



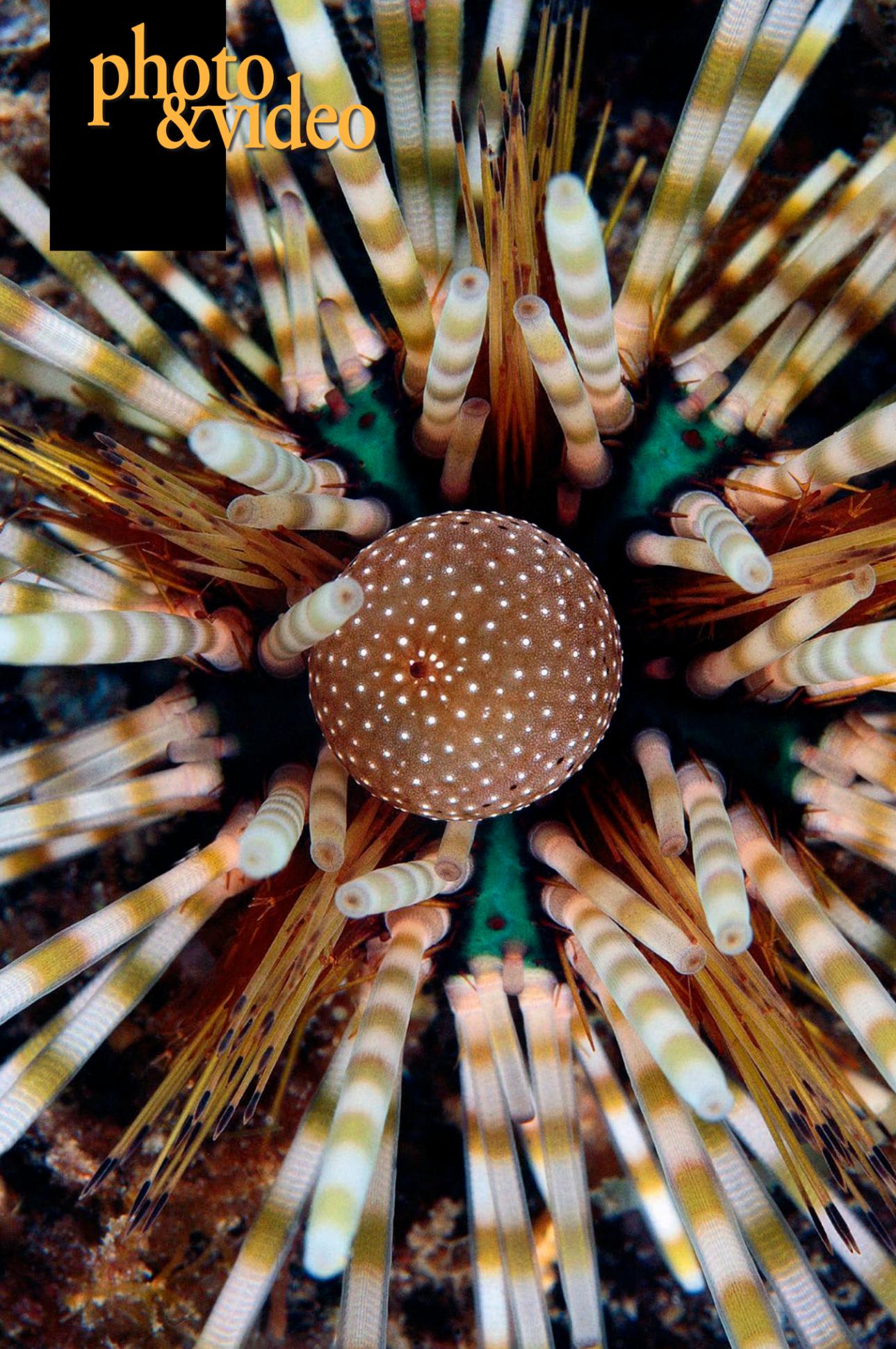


Photo 2. (left) Close-up detail of banded sea urchin, *Echinothrix calamaris*, Indonesia
Photo 3. (above) Spines of sea urchin, *Asthenosoma* sp., Red Sea, Egypt

constant in underwater life.

Thus, even the underwater photographer taking unusual and interesting photographs can express graphic or chromatic creativity. And why not even a bit of the “mysterious,” sometimes? Of course, even in this type of photography, rigorous and clean shooting must form the basic foundation for the construction of a good image.

It is obviously necessary to get into a certain kind of mindset—without, of course, forgetting all that one has learnt in previous experiences—and to try our hand at a new kind of visual research, aimed at enhancing our

ability to capture details and nuances—to “pick up” mixes and nuances of colours, and to interpret patterns and surface shapes. This “modus fotografandi” is generally referred to as “sea art.”

Sea urchins

Photo 2 shows a detail of the banded sea urchin (*Echinothrix calamaris*). It was taken in Indonesian waters with a 60mm macro lens.

In Photo 1 (previous page) and Photo 3, the same lens was used, plus two strobes to capture the detail of the sea urchin *Astropyga radiata*, photographed in the waters

of Lembeh Strait. Very characteristic of this species are the blue dots (seen in the images), which appear almost luminescent.

And from the magical waters of the Red Sea is an image of the spines of a sea urchin *Asthenosoma* sp. (Photo 3), a close relative of the fire urchin *Asthenosoma varium*, which provides shelter for the Coleman shrimp. It was photographed with a 100mm macro lens and a strobe.

This sea urchin is smaller in size than its Asian relative and, to the best of my knowledge, has no symbionts. As can be seen in the image, the spines are formed in a

Photo 5. (below) Colony of *Palythoa* sp. coral polyps, featuring intricate and repeating patterns



spiral, and at the top are the vesicles with venom and the spikes that inject it. I had a close encounter on the wreck of the *Rosalie Moller*, a cargo ship of the Barclay Curle & Co shipyard in Glasgow, which sank in 1941 due to bombing. It now lies on the bottom, at a depth of 50m, in the waters of Gubal Seghir island, north of Hurghada.

The sea urchin was resting on the wreck's broadside, in a shaded area.

Given the depth and time of day, there was little light, and I did not see it. I practically just grazed it with the inside of my wrist and almost fainted from the pain.

Corals

In Photo 4, a 60mm lens was used to capture the tentacles of *Pseudocorynactis* sp., a rather rare corallimorph coral that grows in somewhat dark crevices. The photograph was

taken in Lembeh Strait. These corals look a lot like sea anemones but are instead related to madrepores (stony coral).

Photo 5 shows an extensive colony of *Palythoa* sp. coral polyps covering a vast wall space, captured at full frame, resulting in a fascinating image that has a very pleasing composition and is ultimately also a bit "mysterious." The photo was taken with a 60mm macro lens and two strobes.



Photo 4. (above) Tentacles of *Pseudocorynactis* sp., a rare corallimorph coral photographed at Lembeh Strait, Indonesia



Photo 6. (above) Abstract shot of the pectoral fin of a parrotfish, featuring colourful patterns and textures

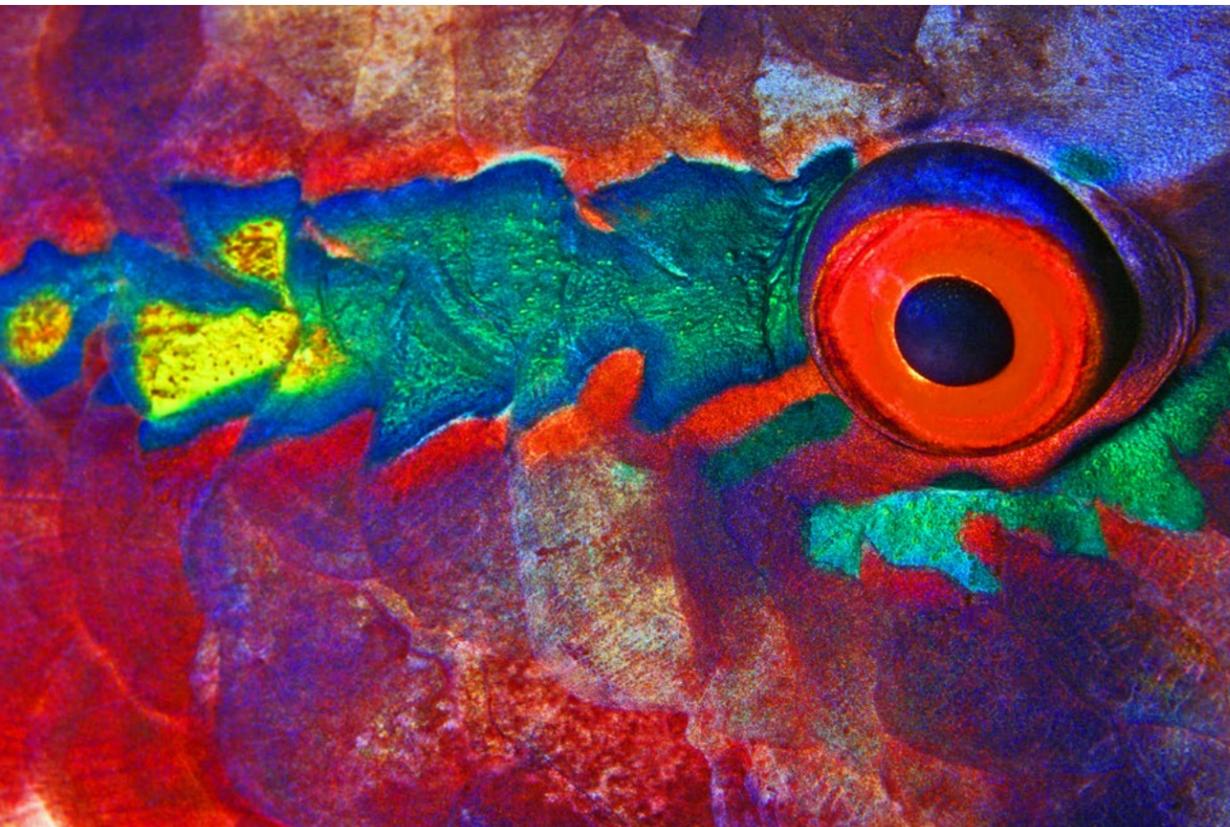
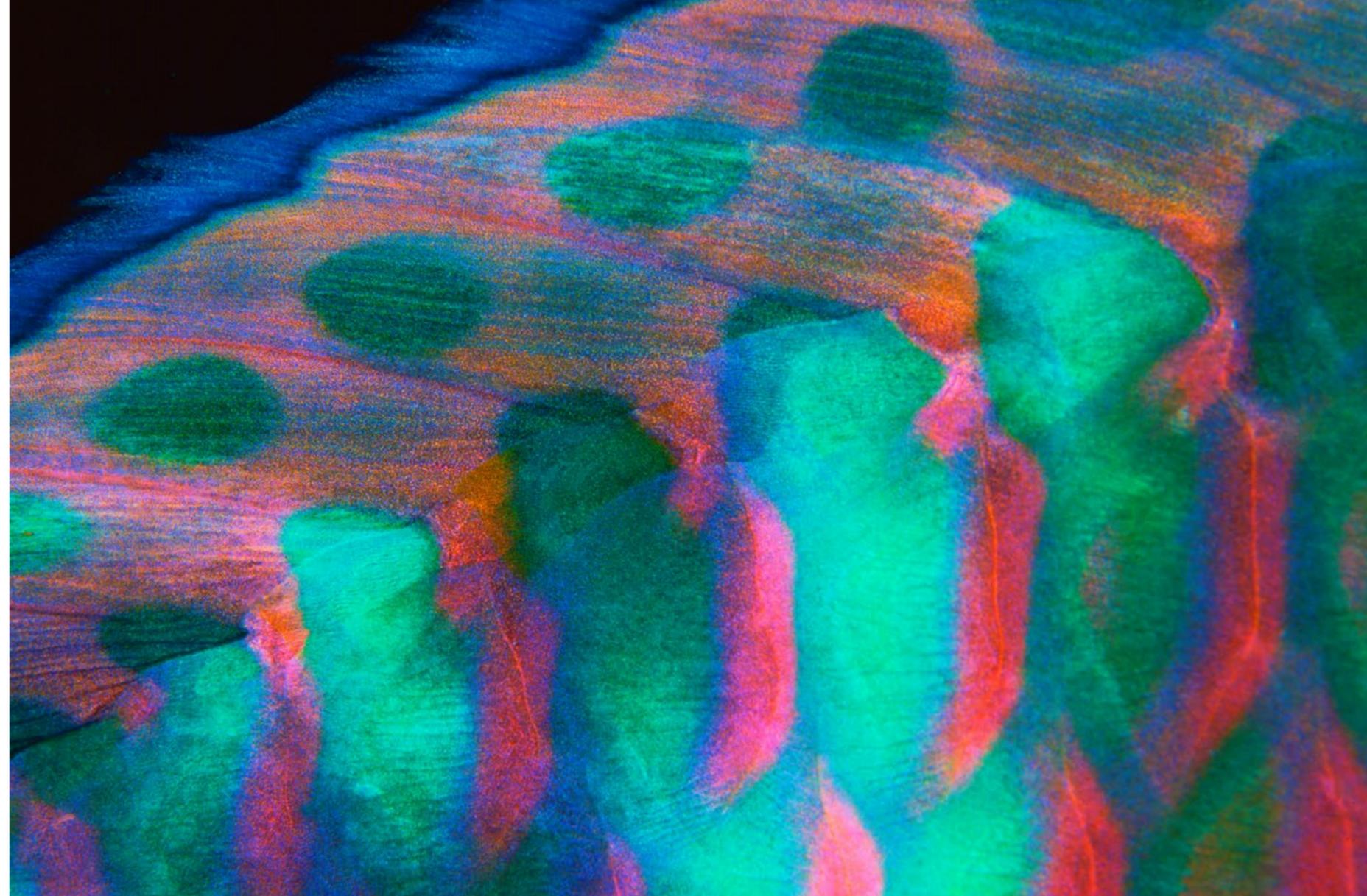
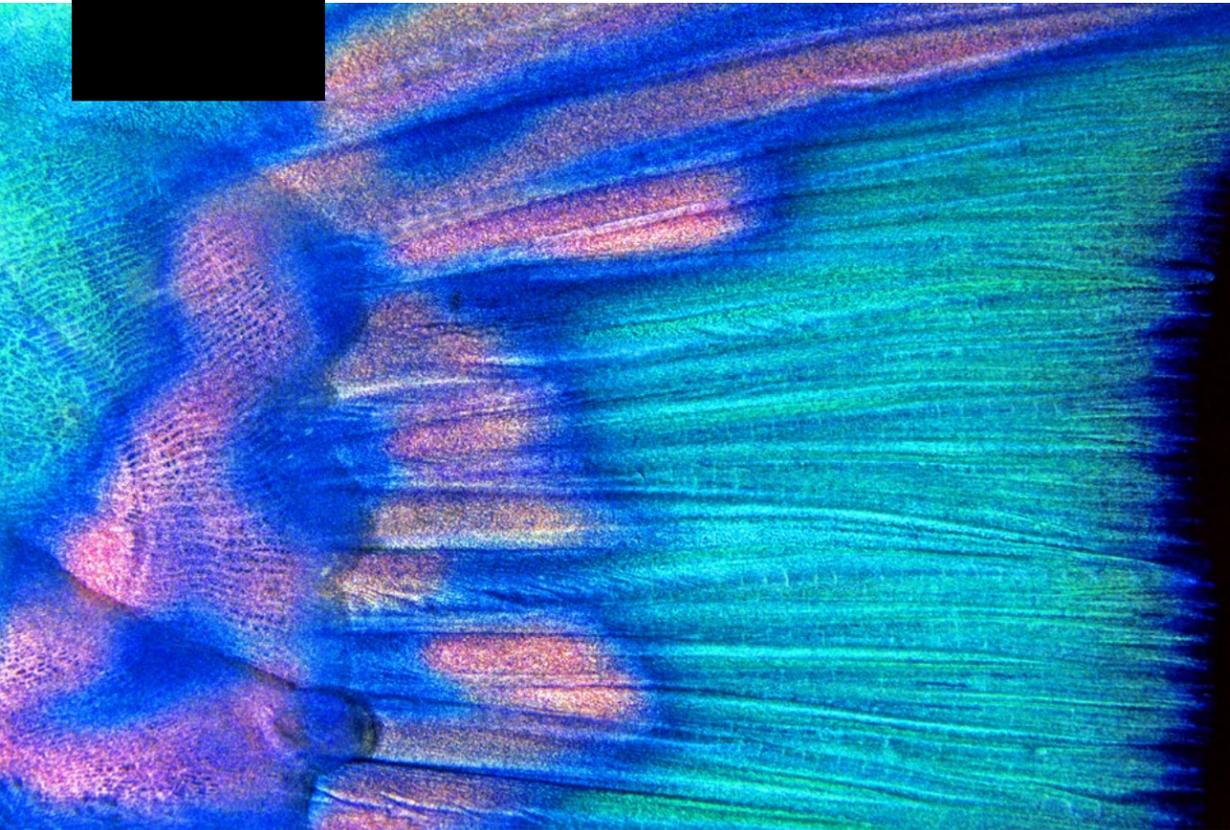


Photo 7. (top left) Close-up detail of the tail fin of a parrotfish, featuring graphic shapes, contrasting colours and textures; Photo 8. (above) Brilliantly coloured scales and dorsal fin of a parrotfish; Photo 9. (bottom left) Close-up of the eye of a parrotfish, featuring vibrant colours and contrasting shapes and patterns, photographed in the Maldives

Parrotfish

Parrotfish, given their habit of “sleeping with open eyes” on the reef and their infinite range of colours and patterns, are certainly among the most suitable subjects to begin with, in our experience as “artists of the sea.”

Photo 6 (previous page) shows a pectoral fin, against a background of the fish’s skin, where one can see the texture of its scales, punctuated by colour, culminating in a highly effective shot, rich in colour and graphic impact.

It is especially necessary to remember that parrotfish, if not completely

asleep, will wake up at the flash of strobes, which therefore should be used very sparingly. Powerful strobes are not needed to take close-up shots at night. Use somewhat “dimmed” light settings so as not to disturb the underwater fauna as much as possible.

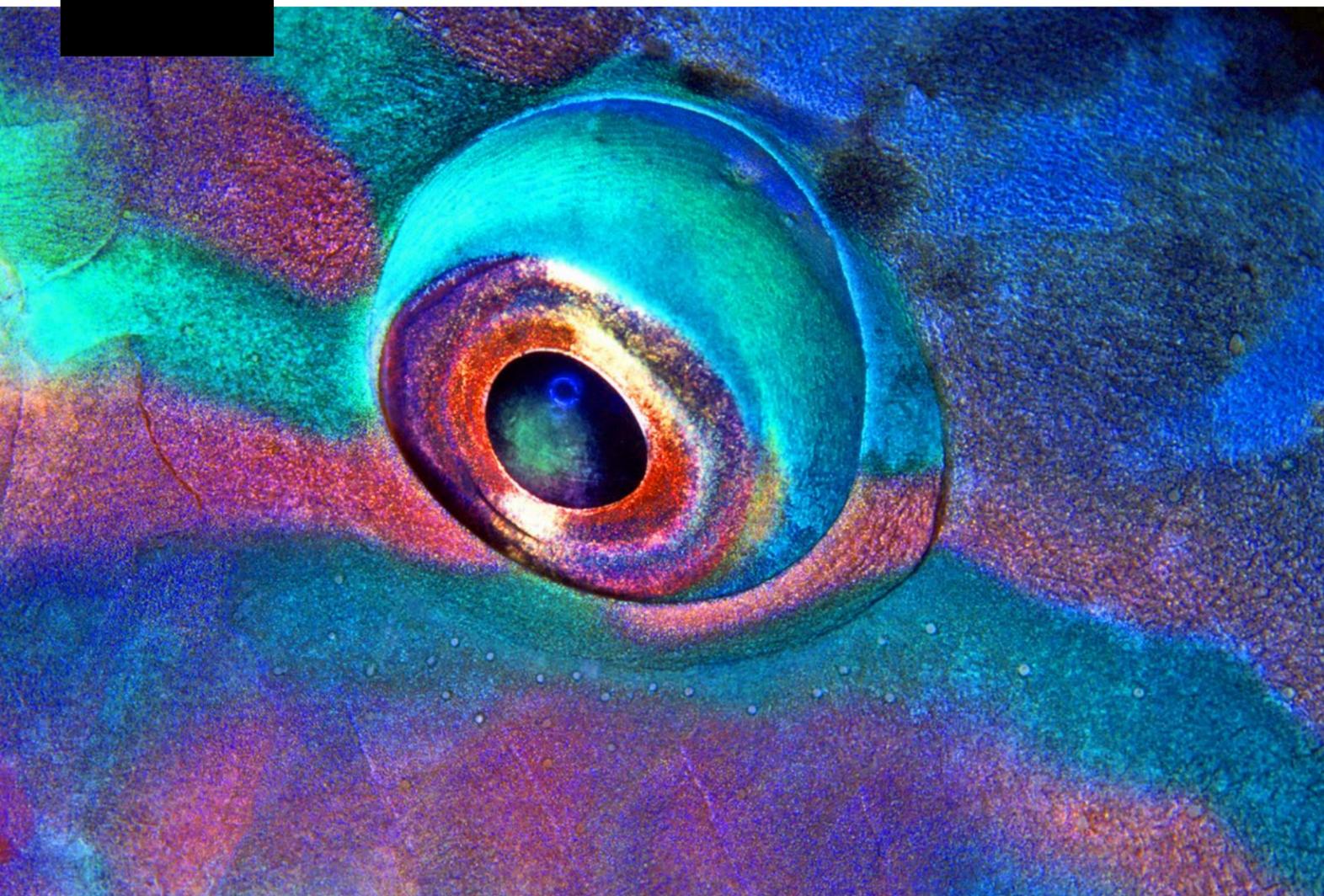
In Photos 7 and 8, the colours and patterns of a parrotfish’s tail and garish scales, with part of the dorsal fin showing, really leave one speechless. Although I have tried my hand at this type of shooting many times, I never cease to be amazed and fascinated by the magic that these images allow

to shine through. If we look at them carefully over time, they will give us a multitude of colourful details which, at first glance, might have escaped us.

True abstract images in underwater photography work when colour is the master and where “the artist” is the sea, while we can only be witnesses to its artistry... I really think it is a great privilege to behold.

To conclude this article (but certainly not this topic), here are two shots of parrotfish eyes, captured with a 60mm macro lens. In the first image (Photo 9), taken in the Maldives,

Photo 10. Close-up of the eye of a parrotfish, featuring more subtle hues. Photographed in Sudan.



colour has a great impact, with the vibrant colourful patterns of the surrounding fish skin further enhanced by the colourful shapes of the eye and additional vivid elements.

In the second, closer shot, taken in Sudan (Photo 10), we can observe the morphology of the outer visual apparatus of this scarid (parrotfish) and the fascinating mix of soft nuances surrounding it.

Trying your hand at this kind of photography can quickly

become a kind of "craze" or obsession, and there is really no limit to experimentation and imagination. ■

Claudio Ziraldo is an architect with a great passion for the sea and nature. He serves as president of the Bollate Sub Association, a sports club that promotes diving and the disciplines connected to it. He is a diving and marine biology instructor as well as a successful underwater photographer,

who has achieved prestigious international recognitions. In 1987, he won the "Nikon Photo Contest International Grand Prize" for an underwater shot, while in 1991, he obtained the "Prix Mondial du Livre d'Image Sous Marine" at the Antibes Underwater Image World Festival for the realisation of the depths in "Dreams of Light." In 2004, his book, Il Tempo della Luce, won awards in both Italy and Malaysia. Visit: ziraldo.net

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