



GLOBAL EDITION
October 2010
Number 38



Indonesia
North Sulawesi

Honduras
Utila Island

Sharks
Sandtigers

Amazon
**Pink
Dolphins**

Ecology
Cephalopods

INDONESIA
Lembah Strait

Portfolio
Caelum Mero

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by Eric Hanauer

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go quietly, amid the noise and haste...

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the rebreathers of choice from 6m to 160m



Image by Ray van Eeden of Prodivers, Kuredu, Maldives

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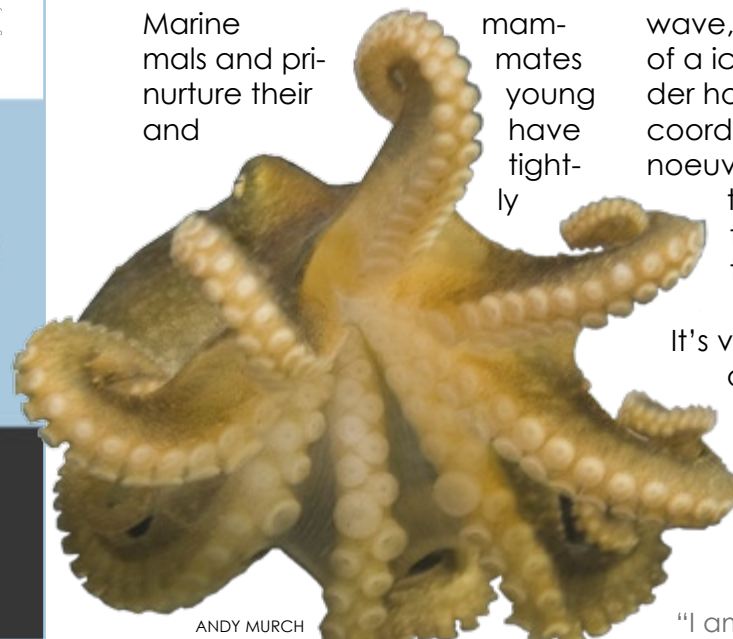
“Take me to your leader”

Cephalopods are such fascinating and seductive creatures, with a weird and alien anatomy. Octopuses are molluscs, a seemingly primitive animal group that includes clams and slugs. Yet, they are capable of some rather brainy feats such as observational learning and solving puzzles—skills supposedly seen only in higher vertebrates with sophisticated brains.

In recent years, we have come to understand how much we have in common with not only our closest relatives, the other primates but also the large marine mammals. While we can probably never know for sure what they feel, their physiological and behavioural responses are similar to ours. The same stress hormones get released when the animal gets spooked or is in pain.

Marine mammals and primate nurture their and

mammals young have tightly



ANDY MURCH

knit family structures with a social hierarchy and rules that serve to make the group stronger including using rewards and punishments to teach and discipline their young. And since acquired knowledge seems to be passed on from generation to generation, some researchers even talk about some species having culture.

In the Arctic, pods of orcas have been observed orchestrating and coordinating complex attacks whereby they in full synchronicity move to create a big wave, which washes a sea lion of a icefloat. One can only wonder how they communicate and coordinate such a complex manoeuvre requiring a very precise timing. How did they come to think of it and think it through?

It's very clear from observations of cephalopods that they are also extremely intelligent animals with an anatomically complex brain, but what goes on in an octopus' thoughts,

“I am one clever sucker”

ANDY MURCH



“Greetings biped”

will require a huge leap of the imagination. After all, the brains of animals like the octopus evolved entirely separately from the brains of the vertebrates, and they have an entirely different design—perhaps they also have a unique form of intelligence.

And here is a mindboggling thought: Since they are also very social creatures, does that imply that regardless of underlying construction that all creatures during their evolution converge towards the same sort of higher understanding of their environment and universe we live in? ■





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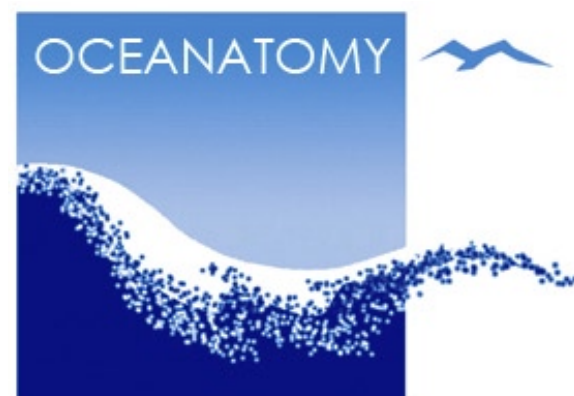
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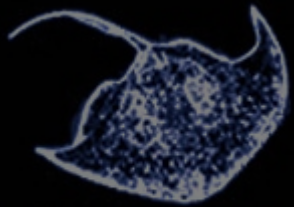


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X-ray mag

News edited
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It's all the rage

NEWS



CHRIS JEWELL

John Volanthen (filephoto)

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UEMIS

UK-led cave diving record in Spain

Explorers Jason Mallinson, Rick Stanton and John Volanthen, along with Dutch caver Rene Houben, charted new territory in a 50-hour voyage which saw them spend two nights camped deep underground.

By venturing 8.8km (5.5 miles) into the Pozo Azul cave system in Northern Spain, the British-led team beat the 7.8km (4.8 mile) world record for the longest cave dive penetration, set last year at Wakulla Springs in Florida.

Pozo Azul (Blue Pot) in Northern Spain is, as the name suggests, a deep blue

karst spring. The entrance is a welcoming clear blue basin, which is much visited by tourists. The cave behind the spring is filled with water and only accessible to cave divers. It is widely considered one of the best caves in which to train.

"It's an incredible buzz to explore further than anyone has been ever before," Jason Mallinson was quoted by Metro UK. "There was no wildlife down there, just a tunnel of crystal blue clear water stretching on and on. The adrenaline builds when you realise you are looking at

something nobody has ever seen before. It's that which drives you forward."

The team began their two-and-a-half day foray into the Pozo Azul caves in Covenera, northern Spain, on Saturday. They used underwater scooters to propel them through three sumps, or underwater passages.

After sump two, they emerged in a small dry cave area nicknamed Tipperary. It was there they spent two nights resting and replenishing their underwater breathing mixtures. ■

Fishing skews sex ratio in fish

Population collapses in many species of reef fish may be linked to an excess of males brought about by fishing — a situation that a quota system won't remedy. In many species, particularly those where individuals can change their sex, each fish produces fewer young as the population density drops.

To find out why this happens, Stefan Walker of James Cook University tagged 232 cylindrical sandperches (*Parapercis cylindrica*) in a Great Barrier Reef lagoon, and followed their movements and reproductive behaviour. Cylindrical sandperches are born female, but some later change into males, with harems of two to ten females.

Walker saw more sex changes in regions where fish populations were low. This led to more males holding court to fewer females and a drop in the number of eggs laid per square metre of lagoon.

"It's perplexing, because as population density drops, more resources should be available and populations should increase."

The finding is likely to apply to at least 70 other sex-changing reef fish, including many commonly caught species, said Walker, and suggested that marine protected areas are a better strategy for conserving populations than fishing quotas.

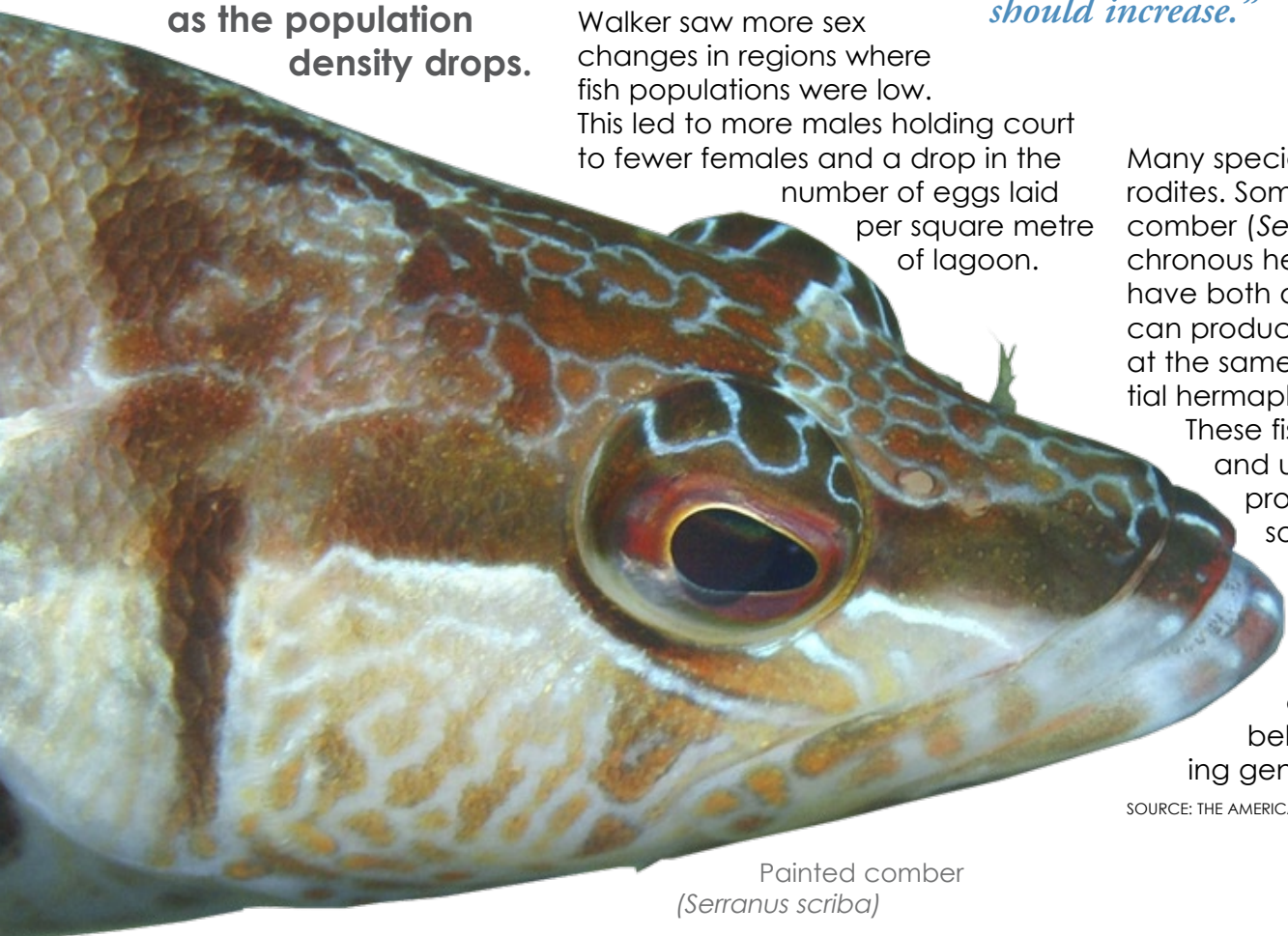
Protected areas maintain the density of populations whereas quotas may still allow populations to decline, increasing the rate of sex change.

Many species of fishes are hermaphrodites. Some, such as the painted comber (*Serranus scriba*), are synchronous hermaphrodites. These fish have both ovaries and testes and can produce both eggs and sperm at the same time. Others are sequential hermaphrodites.

These fishes start life as one sex and undergo a genetically programmed sex change at some point during development. Their gonads have both ovarian and testicular tissues, with one type of tissue predominant while the fish belongs to the corresponding gender. ■

SOURCE: THE AMERICAN NATURALIST, DOI: 10.1086/655219.

PETER SYMES



Painted comber (*Serranus scriba*)



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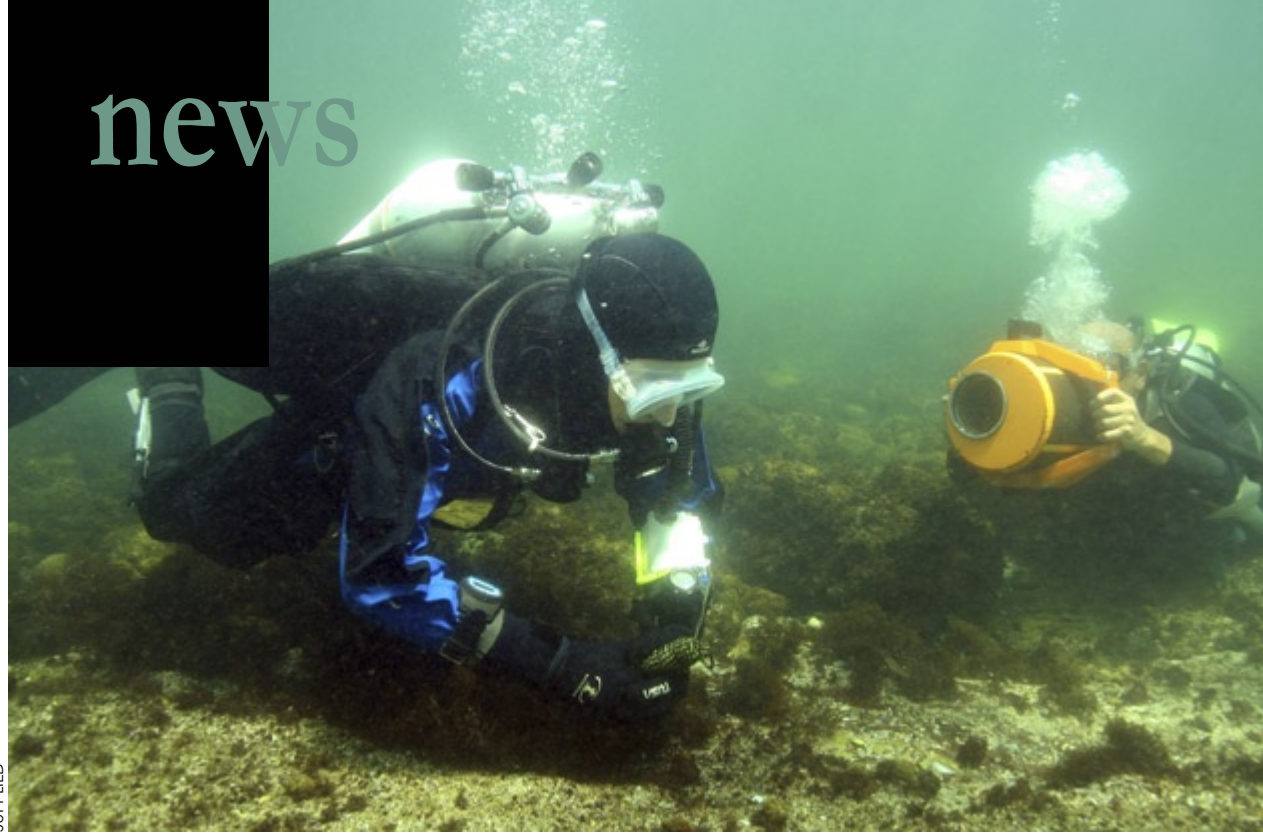
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During the attempt for a new world record, Ivan maintained constant depth of 7-8 meters

Bulgarian Ivan Zhelezarov sets a new world record for salt water dive

The 27-year-old NAUI instructor, spent 50 hours and two minutes under water, setting a new world record for the Longest Open Saltwater Scuba Dive.

The record is dedicated to the National Association of Underwater Instructors (NAUI), which celebrates its 50th anniversary this year. The previous record was set by Will Goodman from the United Kingdom, who managed 48 hours, 9 minutes and 17 seconds.

The attempt for setting a new world record began on 27 August 2010 at 1:46 pm, when Ivan Zhelezarov was submerged to a depth

of 8m in the sea near Kiten.

During the first 24 hours under water, Zhelezarov was accompanied by a support diver at all times, while later on, he was provided support by two divers and a doctor. Despite the difficulties, especially during the two nights when the conditions were the hardest, the enthusiast managed to hold on. Ivan returned to the surface at 3:48 pm today after spending 50 hours and two minutes under water. He is in good health, and after taking a necessary break, he will be back in shape and ready for new achievements.

Ivan had no physical contact with the surface at anytime during his time underwater, while his sup-

port crew replenished his air supply when necessary.

The support team for the dive included nine divers. By taking turns, each diver spent time under water with Ivan and supplied him with new air bottles at intervals of 90 minutes. Ivan's physical condition was constantly monitored by a team of physicians.

Ivan was equipped with a drysuit and nutrition was provided to him in liquid form. The dive was made using open circuit scuba. During the attempt for a new world record, Ivan maintained constant depth of 7-8 meters using a specially built underwater platform. The entire attempt was recorded on camera.

■

Florida Dive Instructor Allen Sherrod falls short on attempt at breaking the Guinness World Records mark for the longest scuba dive in open fresh water.

Sherrod was underwater for a total of 111 hours, just nine hours short of the world record mark set by Jerry Hall in 2004 in a Tennessee lake.

Sherrod dove into Lake David on Sept. 27 but said he had to resurface Friday because of hypothermia.

Sherrod via underwater speakers to help fight the boredom of the six day dive. The team was also delivering water and a small amount of food puree each day to keep his nutrition level up.

With this marathon dive, Sherrod wants to raise awareness of how important it is to maintain and improve the quality of Florida's fresh water local fresh water lakes. Full report by Wayne Fenior on xray-mag.com



WAYNE FENIOR

Allen Sherrod with NAUI National Territory Manager Chad Barbay

On this second attempt, a support team was assisting Sherrod with knowledge gained from the first dive which was aborted because Sherrod contracted the flu and surfaced for medical safety. Discomforts such as chapped and cracked hands because of constant water submersion are being averted via a full dry-suit now equipped with dry gloves. Music (classic rock mix), was being sent down to



WAYNE FENIOR

Allen Sherrod (left) with his Course Director NAUI National Territory Manager Chad Barbay



WWW.DDIVERS.ORG



PHOTO: DAVID PLOSOF



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PETER SYMES

Three Sisters Springs Manatees protected

Threatened by the prospect of development for years, Three Sisters Springs in Crystal River, Florida, recently became a protected, national wildlife refuge thanks to a multi-agency purchase deal, which puts the springs under the management of the U.S. Fish and Wildlife Service.

More than 150 manatees as-

semble within the warm springs of the area, known as Three Sisters Springs, for calving and feeding during the winter months and during critical cold weather periods.

The 57.8 acres of land were recently purchased for US\$10.5 million from Three Sisters Holdings, LLC. The acquisition more than doubles the size of

the refuge and stops the residential development planned on the property.

The protected area will be owned by the city of Crystal River and the Southwest Florida Water Management District. The U.S. Fish and Wildlife Service will manage the site as part of the Crystal River National Wildlife Refuge. ■

Mel Fischer's Maritime Museum's robbed of gold bar

For 25 years, visitors to the Mel Fisher Maritime Museum in Key West, Florida, had the opportunity to lift a US\$550,000 gold bar in a special display case. The bar was recovered in 1980 from the *Santa Margarita* shipwreck—a Spanish galleon off the Florida Keys, which Fisher discovered, according to the museum's website. The ship was one of eight to sink in a 1622 hurricane and was filled with gold bars, jewelry and silver coins. On August 18 around 5:15 p.m.

two bandits stole the 11-inch, 74.85-ounce gold bar. Security footage shows the suspects breaking into the case. No visitors or security guards were present. Detectives from Key West Police and the U.S. Federal Bureau of Investigation are trying to identify the two men who walked into the gallery room around 5:10 p.m. The police believe one of the men served as a lookout in the small gallery room. Investigators are also looking at fingerprints on the display

case, but they may be of visitors unconnected to the heist.

The museum's insurance company has offered a US\$10,000 reward for the return of the 16.5-karat gold bar. The uniqueness of the piece places the bar's value at \$550,000, Kendrick said. "Having the [insurance] money in its place would not be a winner for me," Kendrick told CNN.

So far, there has been no news on the recovery. ■



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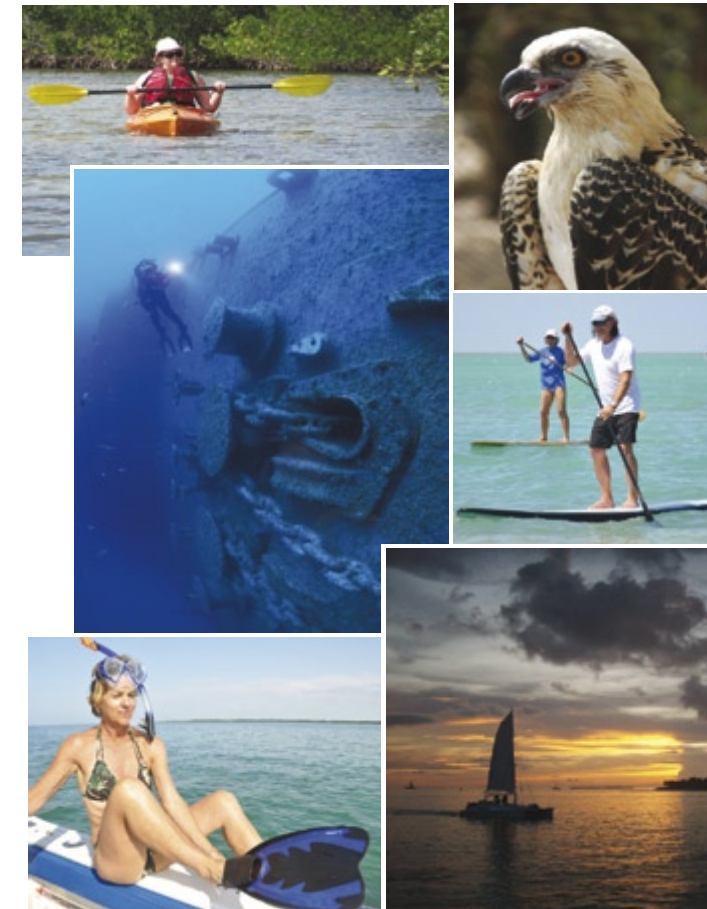
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- Underwater Scooter Races
- Organic Progressive Wine Dinner
- Environmental Comic Relief Swami
- Healthy Living Expo
- Environmental Summit
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- Blue/Green Expo
- Green Business Expo
- Recycled Art Show
- FIRM Bicycle Race



www.EcoWeekFloridaKeys.com



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New Submarine Runs Eternally on Thermal Power from Ocean Currents

Researchers have successfully demonstrated the first robotic underwater vehicle to be powered entirely by natural, renewable, ocean thermal energy. It traps thermal energy from the ocean each time it moves from deep cold water to waters on a warmer surface.

The *Sounding Oceanographic Lagrangian Observer Thermal RECharging (SOLO-TREC)* autonomous underwater vehicle uses a novel thermal recharging engine powered by the natural temperature differences found at different ocean depths. Scalable for use on most robotic oceanographic vehicles, this technology breakthrough could usher in a new generation of autonomous underwater vehicles capable of virtually indefinite ocean monitoring for climate and marine animal studies, exploration and surveillance.

Researchers at NASA's Jet Propulsion Laboratory, Pasadena, California; and the

"People have long dreamed of a machine that produces more energy than it consumes and runs indefinitely."

Scripps Institution of Oceanography, University of California, San Diego, completed the first three months of an ocean endurance test of the prototype vehicle off the coast of Hawaii in March.

"While not a true perpetual motion machine, since we actually consume some environmental energy, the prototype system demonstrated by JPL and its partners can continuously monitor the ocean without a limit on its lifetime imposed by energy supply," said Jack Jones, a JPL principal engineer and SOLO-TREC co-principal investigator. ■



The SOLO-TREC diver is the latest robot unveiled by NASA. The new ocean-going robot is the first of its kind to be fueled entirely by renewable energy

Ocean Conveyor Belt model needs a rethink

The accepted picture of how a massive oceanic conveyor belt of water turns has been complicated by findings published in *Nature Geoscience*. The results could help to boost the precision of climate-change models.

For decades, oceanographers have embraced the idea that Earth's ocean currents operate like a giant conveyor belt, overturning to continuously transport deep, cold polar waters toward the equator and warm equatorial surface waters back toward the poles along narrow boundary currents. The model held that the conveyor belt was driven by changes in the temperature and salinity of the surface waters at high latitudes.

As tropical water from the Equator flows north in the Atlantic Ocean, it becomes cooler and denser. Evaporation along the way makes it saltier and further increases its density. In the frigid Arctic, the water sinks into the depths and then moves southward, returning to the surface once it has warmed up again.

But this simplified picture of what is known as meridional overturning circulation (MOC) has been brought into question by a paper suggesting that, in the past 50 years, ocean circulation closer to the Equator has grown

weaker, whereas the northern waters have flowed more strongly.

"The more we look, the more complicated the ocean is," said Susan Lozier, professor of physical oceanography and chair of the Division of Earth and Ocean Sciences at Duke University's Nicholas School of the Environment, and lead author of the study.

conveyor belt for the overturning was developed decades ago, before oceanographers had measured the eddy field of the ocean and before they understood how energy from the wind impacts the overturning," said Lozier.

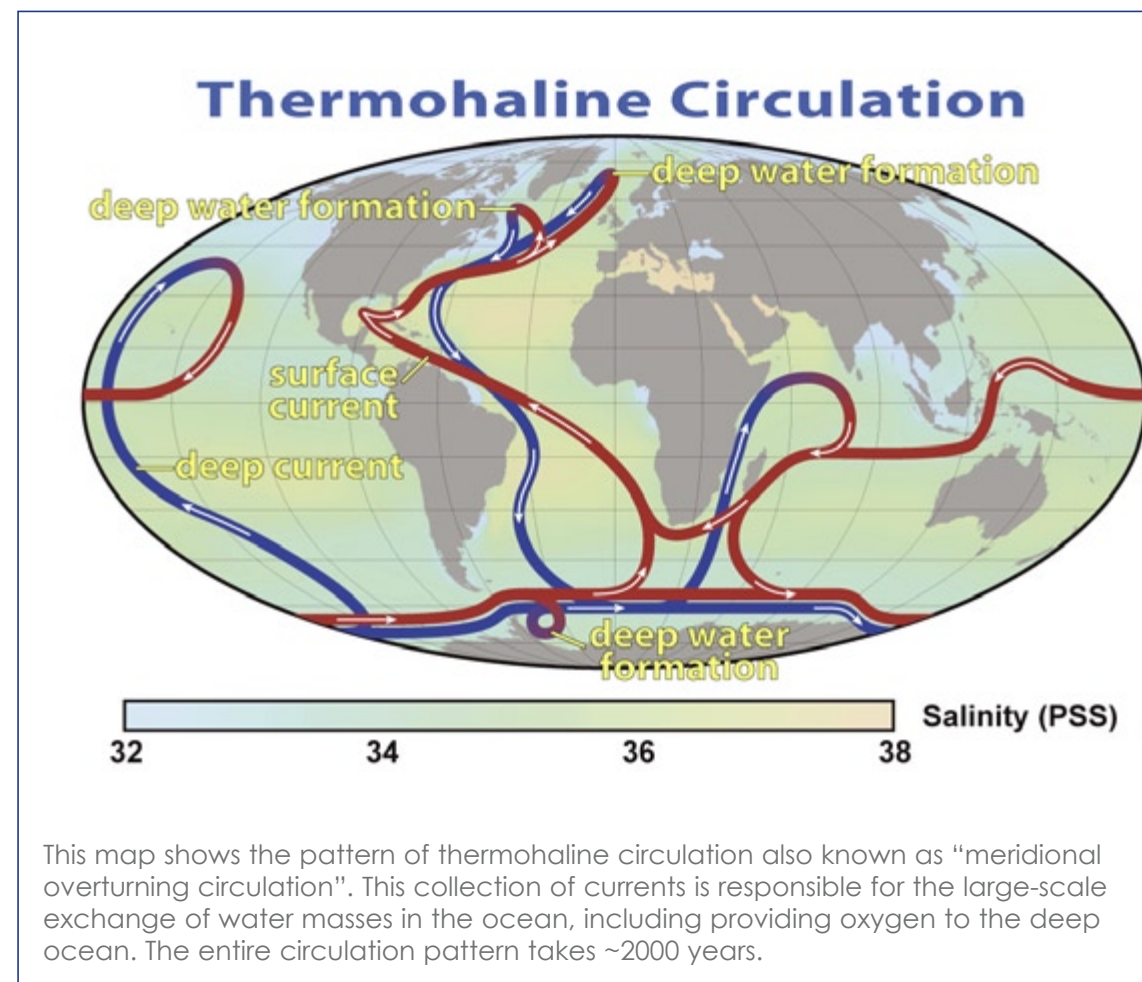
The idea of the seas moving as a smooth belt is being changed by the accessibility of satellite data, added

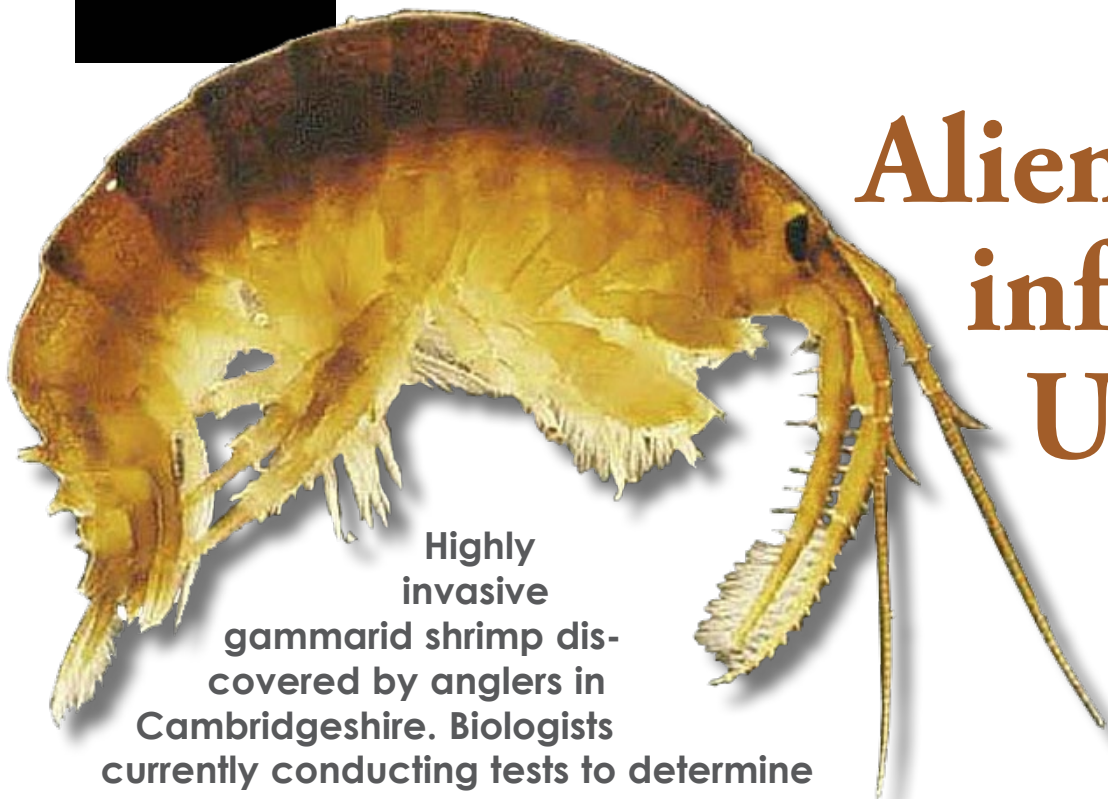
oceanographer Joël Hirschi, also at the National Oceanography Centre and a co-author of the earlier study. The essential outline remains, he said, "but on top of that conveyor picture, there is a lot of variability going on".

More details would help to produce better climate-change models, he said. Because heat released from the water moving towards the pole is part of what keeps Europe warm, filling in gaps in the data could provide a more complete picture of what might happen in particular locations.

Lozier agreed, adding that as surface waters turn over, they carry whatever gases are above them down to the deep ocean, locking them out of the atmosphere. Understanding the ocean flow could help to reveal carbon dioxide sinks, she said. ■

SOURCE: NATURE GEOSCIENCE





Alien shrimp infiltrate UK waters

Highly invasive gammarid shrimp discovered by anglers in Cambridgeshire. Biologists currently conducting tests to determine the severity of the problem.

The highly invasive gammarid shrimp, *Dikerogammarus villosus*, has been discovered by anglers at Grafham Water in Cambridgeshire. Boasting a fearsome set of jaws, the invasive gammarid shrimp originate in Eastern Europe and are far larger than United Kingdom's native species. The shrimps were confirmed as likely to be the killer species after samples were sent to the Environment Agency. An expert in Holland has now conclusively identified the species.

Aggressive hunters, they feed on native freshwater shrimp, damselflies, small fish and water boatmen—common sights on Britain's lakes and rivers—and could upset the delicate food chain. The shrimp often kill without feeding and can quickly dominate rivers and lakes.

Biologists are currently conducting tests to determine the severity of the problem and what measures need to be taken. Although the shrimp pose no risk to drinking water supplies, anglers using the reservoir are being urged to make sure the invasive species does not spread elsewhere.

"I am extremely concerned to hear that this highly invasive species has been found in Britain," stated Richard Benyon, the minister in charge of the natural environment. "Anglian Water has acted quickly to put biosecurity measures in place, and the

"I am extremely concerned to hear that this highly invasive species has been found in Britain."

Environment Agency is working hard to establish the extent of the problem and what action may need to be taken. We need to do everything we can to protect our native wildlife and young fish from the potential damage the killer shrimp can cause."

Paul Leinster, chief executive of the Environment Agency, said: "We are devastated that this shrimp has been found in Britain, and very grateful to the keen-eyed anglers who found it."

Posters have been put up warning boat users to check their equipment and vessels to stop the shrimp escaping to other reservoirs, lakes or rivers. Native to a region encompassing Romania, Moldova, Ukraine, Russia and Kazakhstan, the shrimp have already invaded Western Europe via the Danube. It is believed they have been spread via the ballast water in ships. ■

Dutch government funds coral nurseries in the Netherlands

The Dutch Ministry of Agriculture, Nature and Food Quality has recently selected the development of a coral nursery for financial endorsement from a short-list of innovative projects and technologies aimed at protecting biodiversity.

Soon, construction of a small-scale coral aquaculture facility will commence, after which the cost-effectiveness of the facility will be determined during an 18-month period. Two years from now, the first high-quality, sustainably cultured corals may find their way to wholesalers and retail stores around the globe.

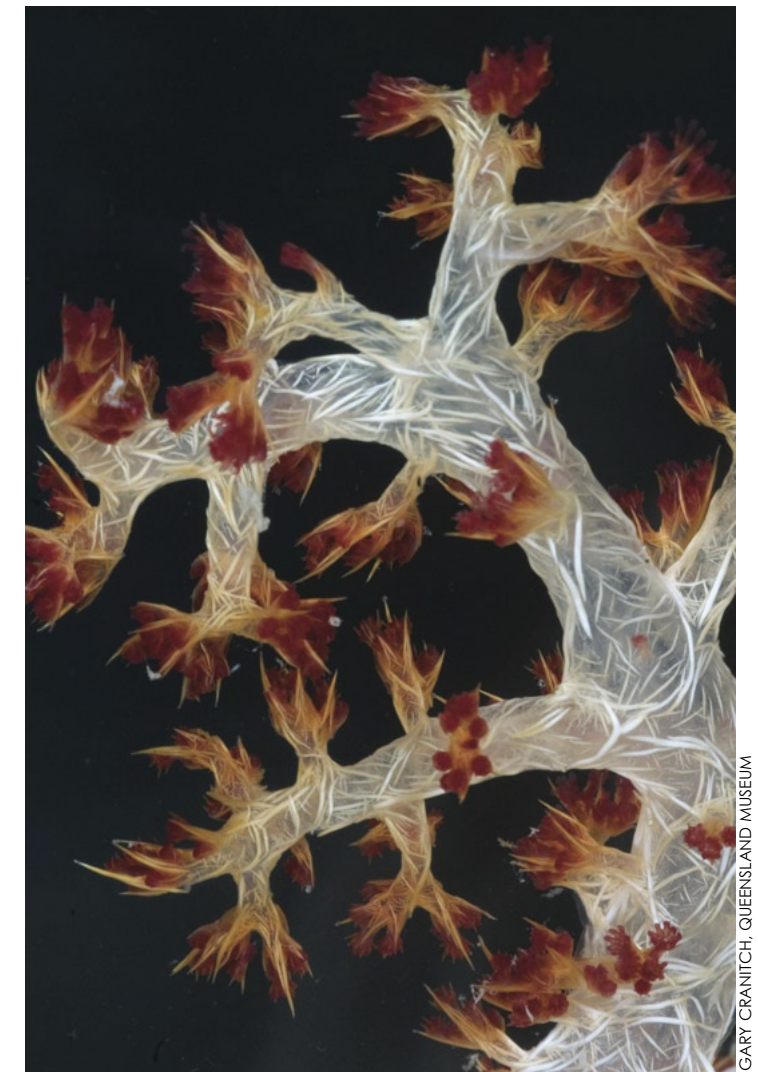
Coral reefs today are faced with unprecedented threats, including climate change, pollution, disease, overfishing and coastal development. The marine aquarium industry, which in great part relies on the collection of wild corals, fish and other reef organisms, has been under great pressure of late due to the decline of coral reefs worldwide. The sustainable aquaculture of corals and other reef organisms may be more important than ever, reducing pressure on wild populations and providing a "Noah's Ark" for endangered species.

Aquaculture

The establishment of a coral aquaculture facility is a welcome accomplishment in the International Year of Biodiversity. However, sustainable, aquaculture of corals has never been implemented on a large scale due to the high costs involved. As Peter Henkemans, CEO of EcoDeco a company which develops and builds biologi-

cal filtration systems for public aquaria, explains: "Growing corals is highly expensive, which is why most efforts have focused on mariculture. By letting nature do the work, costs can be greatly reduced. Mariculture however has several disadvantages. First, the ocean behaves in an unpredictable fashion. El Niño events for example may lead to coral bleaching and destructive tropical storms, which can decimate entire harvests. Second, anthropogenic disturbances such as pollution, including oil spills, may also disrupt the efforts of local Asian mariculture companies. EcoDeco's technology however, together with new scientific insights, offers new perspectives. In an ex situ aquaculture

facility, corals are able to grow under stable, controlled conditions. At the heart of the Coral Greenhouse project lies the unique combination of new aquarium technology with recent scientific advances in coral biology. ■



Octocorals are named for the eight tentacles that fringe each polyp. Shown is a soft coral, *Dendronephthya*, from coral gardens off Lizard Island

GARY CRANITCH, QUEENSLAND MUSEUM



Annapolis Reef Project Put on Hold

Text by Barb Roy

British Columbia, Canada — Due to unforeseen technicalities in the Provincial permit process for sinking a ship, Howe Sound will have to wait a while longer for their new wreck diving site, designated for Halkett Bay on Gambier Island. Representatives from the Artificial Reef Society of British Columbia (ARSBC) and the Dive Industry Association of British Columbia (DIABC) are currently meeting with government officials to work out the legalities and come to a

positive solution as soon as possible.

"The entire dive community is behind this project," comments Kal Helyar, President of the DIABC and owner of Porpoise Bay Charters in Egmont. "We have all wanted a ship in Howe Sound for years and the underwater terrain is similar to what we had in Sechart Inlet where the Chaudiere was put down — both were once log dumping grounds. The Chaudiere provided a stable platform for marine life to grow on. It's now a healthy underwater area,

which is what can happen in Halkett Bay too."

Background

In June of 2008 the ARSBC towed the *HMCS Annapolis* (271 feet in length) to Howe Sound where it began to undergo its transformation from a ship of war to an under-

water habitat for marine life. Since then the ARSBC has utilized volunteers from British Columbia, Alberta and Washington State to environmentally clean and prepare the ship for sinking.

What sets this ex-military ship apart from the other large ships in five destinations around coastal BC is the helicopter hanger. This steam-powered destroyer escort once carried anti-submarine Sea King helicopters, which were used to extend surveillance capabilities of a ship and find surface vessels in the dark during times of war.

Rockfish oasis

Although the northwest dive community is excited about getting a wreck so close to the Mainland, they are also thrilled with the idea of how this new reef of steel will aid in their efforts to restore endangered Howe Sound rockfish populations.

Previous observations by divers have suggested that other artificial reefs (ships) around Canada have provided a needed shelter and habitat in their individual areas, creating a noticeable

increase in marine residents. This is also true for other juvenile fish species like lingcod, cabezon and wolf-eels thus enhancing an overall replenishment of the aquatic realm.

"I have been in contact with many of the retailers and charter operators," adds Deirdre Forbes-McCracken, spokesperson for the ARSBC and co-owner of the retail dive centre Ocean Quest in Burnaby. "They have told me that over the years have seen the direct benefits these reefs bring to their businesses and communities as well the enjoyment they bring to the divers of British Columbia, the United States and abroad while being positive for the environment."

Ship prep

At this point, a sinking date is still undecided but the spring



of 2011 is a realistic possibility. Nonetheless, it is still business-as-usual on the *Annapolis* and the ARSBC is still in need of volunteers to continue preparing the ship. Work is conducted on the weekends with Deirdre Forbes-McCracken handling the schedules. Individuals and groups are encouraged to contact Deirdre

to schedule a volunteer workday or weekend. Volunteers meet at 8:00am in Horseshoe Bay, with free transportation to and from the ship. Contact Deirdre at: oq@diveoceanquest.com or dmc-cracken@artificialreef.bc.ca.

For more information, visit: www.artificialreefbc.ca www.diveindustrybc.com ■



For more info on diving in
British Columbia
 contact DIABC

www.diveindustrybc.com

THIS PAGE: Children participate in a Try Out Scuba session during the launch in August of Kids Scuba Denmark at the Naerum Sports Complex in Denmark

Kids Scuba Launched in Denmark

A group of children and teenagers ranging from eight to 12 years old, took part in the newly launched Kids Scuba Denmark Program by completing their Try Out Scuba Discovery dive at the Naerum (Rundforbi) Sports Complex in Denmark in August this year. The children did their Try Out Scuba sessions in teams of two under the direct supervision of the Scuba Rangers instructors. They dived underwater in a saltwater pool with full scuba gear for about 30 minutes.

"The kids are part of the Scuba Rangers Program, the First Scuba Rangers Club in Denmark, which is a children's education program of the Scuba School International (SSI) Scuba training program that specializes in teaching kids ages eight to 12 years old," said Nick J. Visser, director and Scuba Rangers instructor of Kids Scuba Denmark.

Kids Scuba Denmark is the only children's scuba school in the country. The Kids Scuba Discovery program brought together 16 children and teens in total.

Taking part in the launch of Kids Scuba Denmark was dive education professional, Syed Abd Rahman, the director of Kids Scuba Malaysia—the largest of its kind in the world with over 100 children as members. Rahman is a Scuba Rangers Instructor Trainer, who flew in specially from Malaysia to assist with the launch of the program.

"The Kids Scuba program is not only excellent for children and families, it is also a good form of family bonding. Families can look forward to enjoying a professionally organised program so that they can focus on participating in activities and much more," said Rahman during the launch.

The Kids Scuba program also educates the kids on marine awareness with marine environment education through a series of video presentations before the children get into the pool with the instructors. All children and teenagers are taught to respect marine life and as divers; they pledge to conserve the underwater world.

All 12 children participating in



Syed Abd Rahman with students in try dive

the session completed the Kids Scuba Discovery program with a smile on their faces after receiving their certificate of completion at the end of the program. The presentation of the certificate was witnessed by the SSI (Scuba Schools International) Nordic Regional Director, Ole Skjaerbaek, who came personally to oversee the launch of Kids Scuba Denmark. Skjaerbaek said that for the children, the achievement of scuba diving is the ultimate experience. "It is something that even adults might not be able to do, and it definitely gives the kids a great sense of achievement."

One of the biggest challenges of conducting a Kids Scuba program of this kind is bringing the families together. Visser said that it was an achievement to have parents and their children bonding, sharing their love of the sport, and enjoying a fantastic family day out without interruptions.

"And of course, the logistics is another





Quotes from the parents and kids:

"Thanks for a great Sunday. Felix was so worked up afterward—he simply just loved it. I would like Felix to join the sessions together with his friend Rasmus."

"Thanks a lot—Atash just couldn't stop talking about how great it was and wore his t-shirt all night yesterday. Your friend was truly a great teacher!"

"That was really great. Thanks. Sara really enjoyed it and Syed. Please sign Sara up for the Scuba Ranger Programme."

winning certified SSI (Scuba School International) Scuba Rangers Club dedicated to conducting SSI Scuba Rangers courses for children ages 8-12 in the Nordic region. The school was founded and organised in Denmark by Visser, a qualified SSI Scuba Rangers Instructor who did his training for three years as a Scuba Rangers Instructor in Malaysia.

Children are exposed to basic scuba education, snorkeling techniques and elementary scuba diving skills, graduating to beach and shallow dives during organized Kids Scuba Camps, which will be held in June and July 2011. Kids Scuba Denmark integrates care and conservation of marine life in all its materials imparted to all its students as part of

its programme.

Kids Scuba Denmark will organize a number of camps to the various dive destinations in the tropical climate and warm waters of Asia with the cooperation of Kids Scuba Malaysia, which



organizes camps four times per year at the beautiful marine park islands of Malaysia and Borneo.

Awards received by Kids Scuba Denmark include the Award for Success for the Scuba Rangers and Kids Scuba Camp at Mabul Sipadan Island in Sabah Malaysia in December of 2009 and the Award for Success for the first successful Kids Scuba Denmark program organized in the Nordic Region.

For more information on Kids Scuba Denmark and its courses at Naerum (Rundforbi) Sports Complex every second Sunday, log on to www.kidsscuba.dk or email Nick Visser at jv@kidsscuba.dk, telephone: (+45) 99 55 82 32 (Nick) or (+45) 50 62 21 41 (Mette). ■

At the Malaysia International Dive Expo 2010 in Kuala Lumpur, Syed Abd Rahman accepted an award from King Tuanku Mizan for Kids Scuba Malaysia for being the most successful Scuba Rangers program in the world, while show organizer, Thayalan Kennedy (far left) looks on. Two of the King's children are also Scuba Rangers



complicated story," he added with a laugh. "But what is important is that the children feel they have accomplished something wonderful with an experience that will take them a long way in life."

A Kids Scuba session with the Scuba Rangers program will be conducted every second Sunday on September 5, 19 and 26 in 2010. It will be held at the Naerum (Rundvorbi) Sports Complex. The Kids Scuba Denmark program was assisted by the SSI Nordic Region, Kids Scuba Malaysia, Hana Sea Sports and Oceanic Dive Consultant.

About the program

Kids Scuba Denmark is the first award-



Salps are the most efficient filter-feeder in the deep

Salps' role extends to removing carbon dioxide from upper ocean and atmosphere.

What if trains, planes and automobiles all were powered simply by the air through which they move? What if their exhaust and by-products helped the environment? Such an energy-efficient, self-propelling mechanism already exists in nature. The salp—a small, barrel-shaped organism that resembles a streamlined jellyfish—gets everything it needs from ocean waters to feed and propel itself. Scientists believe its waste material may help remove carbon dioxide (CO₂) from the upper ocean and the atmosphere.

Now researchers at the Woods Hole Oceanographic Institution (WHOI) and MIT have found that the half-inch to 5-inch-long creatures are even more efficient than had been believed.



"This innovative research is providing an understanding of how a key organism in marine food webs affects important biogeochemical processes," said David Garrison, director of the National Science Foundation (NSF)'s biological oceanography program, which funded the research.

Reporting this week in the journal *Proceedings of the National Academy of Sciences* (PNAS), the scientists have found that mid-ocean-dwelling salps are capable of capturing and eating extremely small organisms as well as larger ones, rendering them even

hardier—and perhaps more plentiful—than had been believed.

"We had long thought that salps were about the most efficient filter-feeders in the ocean," said Larry Madin, WHOI Director of Research and one of the paper's authors.

"But these results extend their impact down to the smallest available size fraction, showing they consume particles spanning four orders of magnitude in size. This

is like eating everything from a mouse to a horse."

Salp consumption

Salps capture food particles, mostly phytoplankton, with an internal mucus filter net. Until now, it was thought that included only particles larger than the 1.5-micron-wide holes in the mesh; smaller particles would slip through.

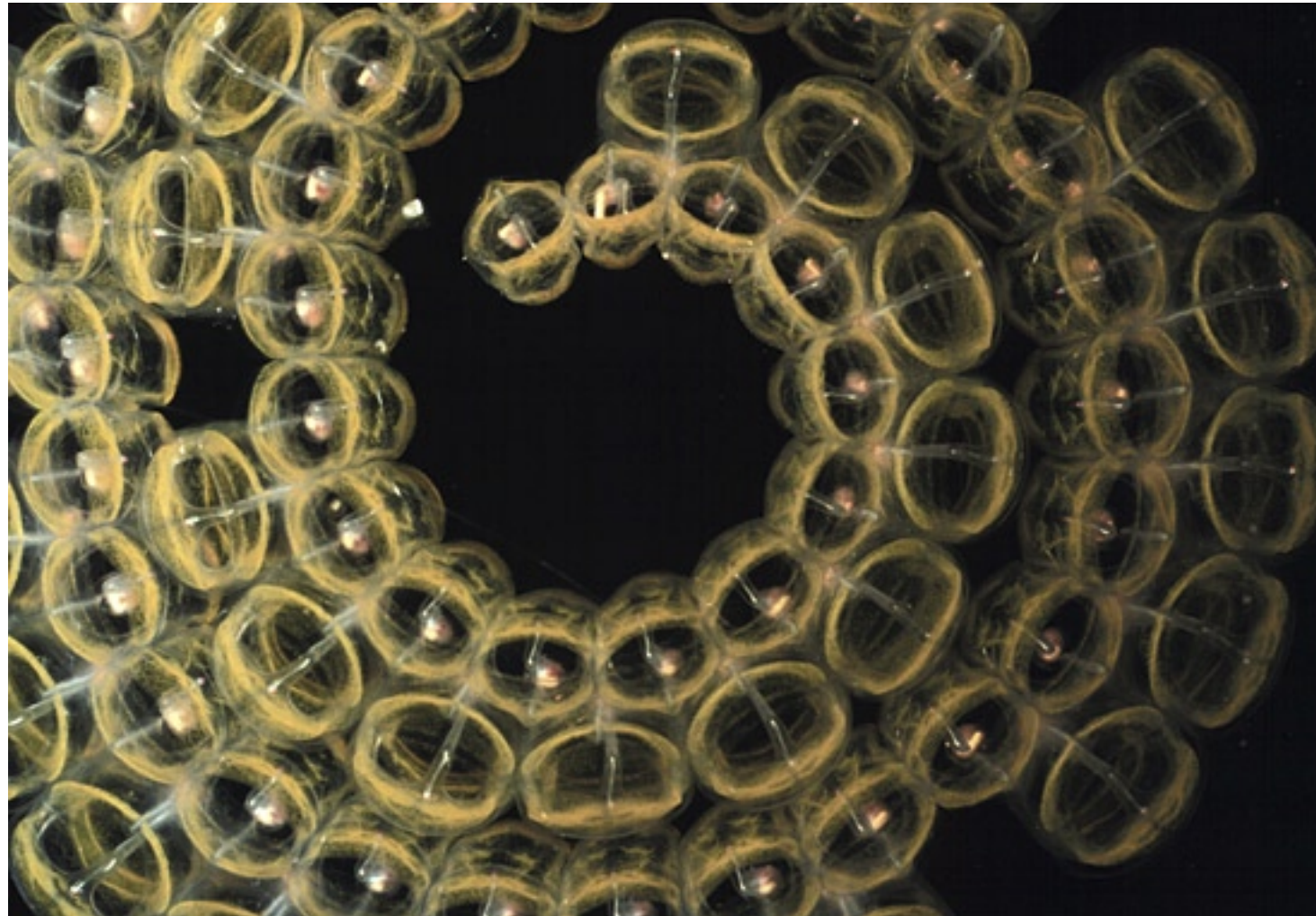
But a mathematical model suggested salps somehow might be capturing food particles smaller than that, said Kelly Sutherland, who co-authored the PNAS paper after her PhD research at MIT and

WHOI.

In the laboratory at WHOI, Sutherland and her colleagues offered salps food particles of three sizes: smaller, around the same size as, and larger than the mesh openings.

"We found that more small particles were captured than expected," said Sutherland, now a post-doctoral researcher at Caltech. "When exposed to ocean-like particle concentrations, 80 percent of the particles that were captured were the smallest particles offered in the experiment."

The finding helps explain how salps—which can exist either singly or in "chains" that may contain a hundred or more—are



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co-author Roman Stocker of MIT.

"The most important aspect of this work is the very effective shortcut that salps introduce in the process of particle aggregation," Stocker said. "Typically, aggregation of particles proceeds slowly, by

This process starts with the mesh made of fine mucus fibers inside the salp's hollow body.

Salps, which can live for weeks or months, swim and eat in rhythmic pulses, each of which draws seawater in through an opening at the front end of the animal. The mesh captures the food particles, then rolls into a strand and goes into the gut, where it is digested.

"It was assumed that very small cells or particles were eaten mainly by other microscopic consumers, like protozoans, or by a few specialized metazoan grazers like appendicularians," said Madin.

"This research indicates that salps can eat much smaller organisms, like bacteria and the smallest phytoplankton, organisms that are numerous and widely distributed in the ocean."

The work, also funded by the WHOI Ocean Life Institute, "implies that salps are more efficient vacuum cleaners than we thought," said Stocker.

"Their amazing performance relies on a feat of bioengineering—the production of a nanometer-scale mucus net—the biomechanics of which remain a mystery." ■

able to survive in the open ocean where the supply of larger food particles is low.

"Their ability to filter the smallest particles may allow them to survive where other grazers can't," said Madin.

Perhaps most significantly, the result enhances the importance of the salps' role in carbon cycling. As they eat small, as well as large, particles, "they consume the entire 'microbial loop' and pack it into large, dense fecal pellets," Madin said.

The larger and denser the carbon-containing pellets, the sooner they sink to the ocean bottom. "This removes carbon from the surface waters," said Sutherland, "and brings it to a depth where you won't see it again for years to centuries."

And the more carbon that sinks to the bottom, the more space there is for the upper ocean to accumulate carbon, hence limiting the amount that rises into the atmosphere as CO₂, said paper

steps, from tiny particles coagulating into slightly larger ones."

"Now, the efficient foraging of salps on particles as small as a fraction of a micrometer introduces a substantial shortcut in this process, since digestion and excretion package these tiny particles into much larger particles, which thus sink a lot faster."



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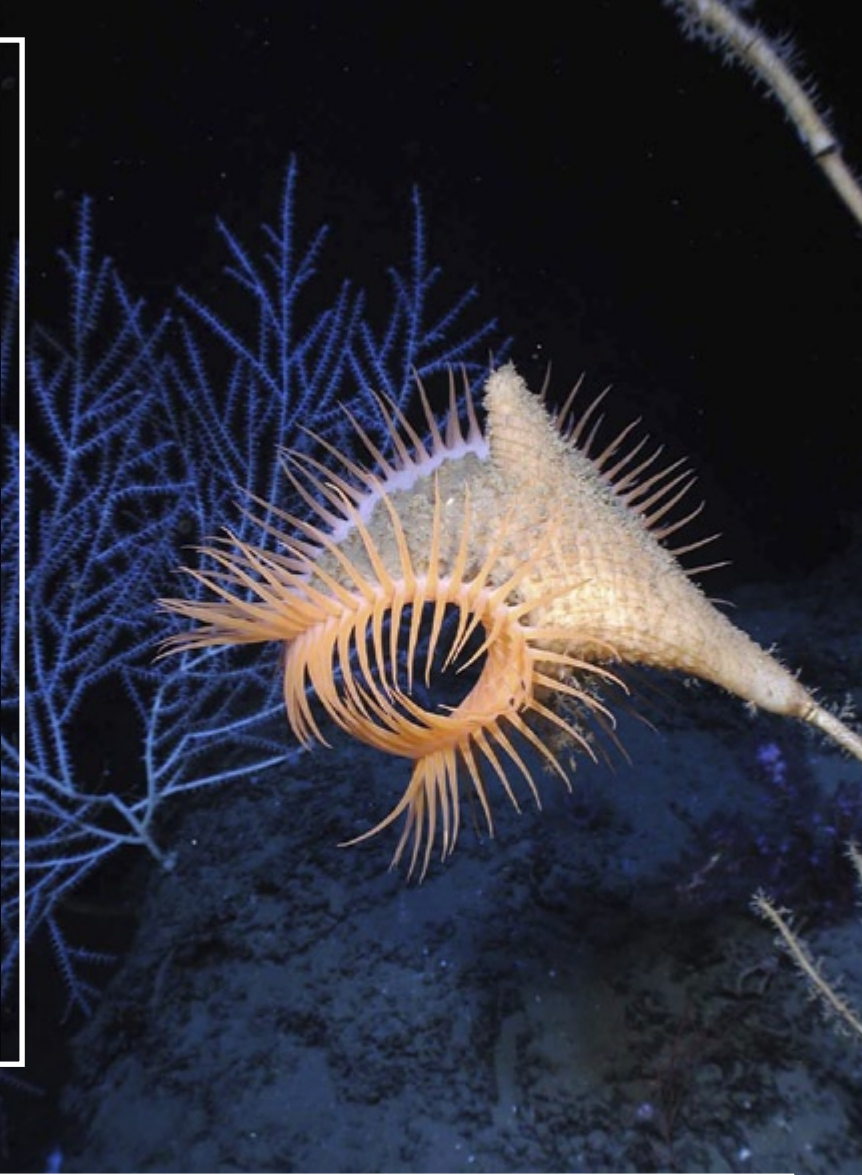
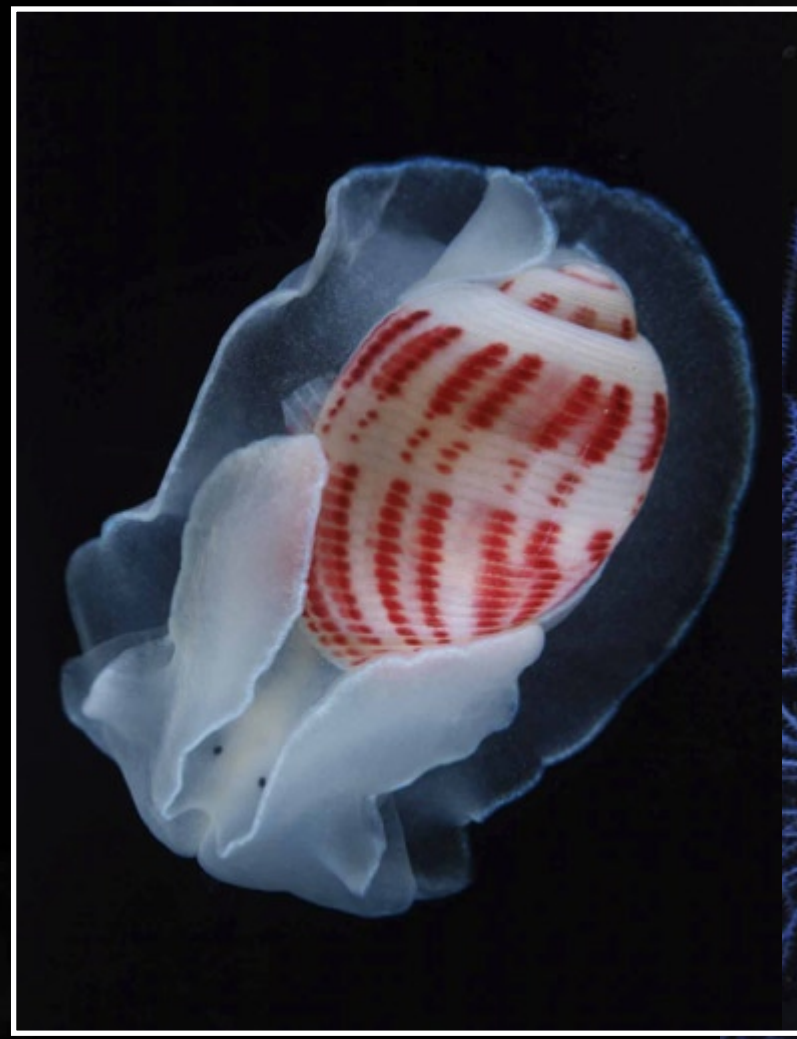
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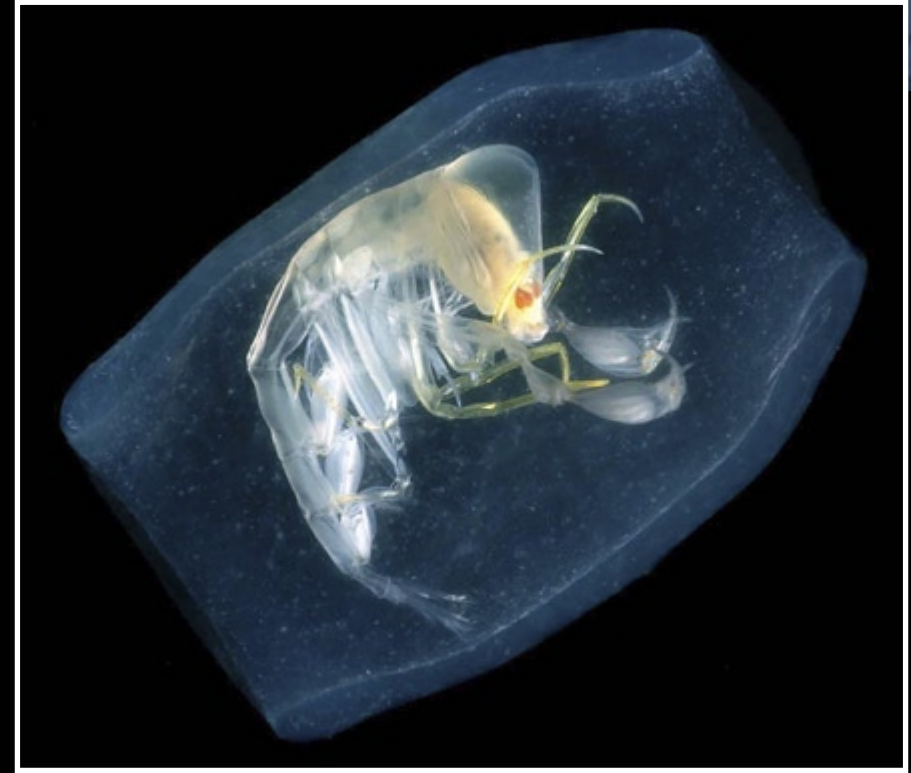
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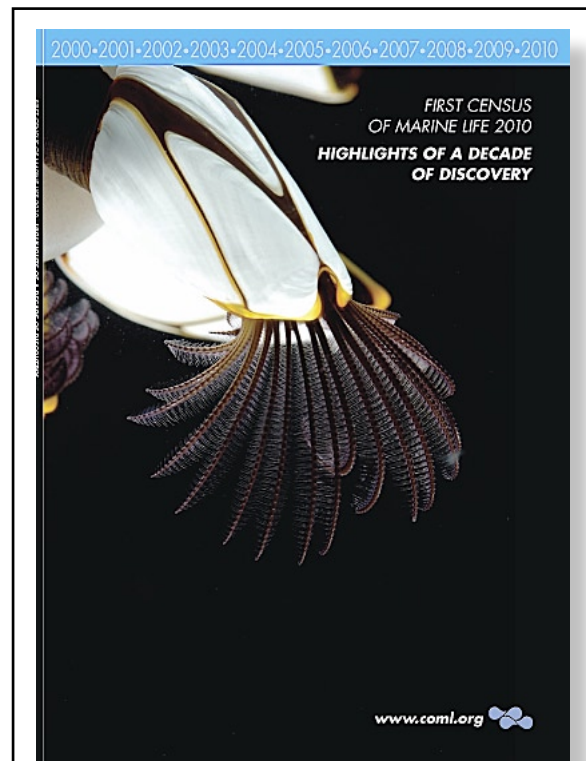


Planet Ocean is richer, more connected, more altered than expected.





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Just released —
First Census of Marine Life 2010: Highlights of a Decade of Discovery (CoML, 64 pages), edited by Jesse H. Ausubel, Darlene Trew Crist and Paul E. Waggoner.

Culminating a ten-year exploration, 2,700 scientists from 80 nations report the First Census of Marine Life.

In one of the largest scientific collaborations ever conducted, more than 2,700 Census scientists spent over 9,000 days at sea on more than 540 expeditions, plus countless days in labs and archives.

Released yesterday are maps, three landmark books and a highlights summary that crown a decade of discovery.

The now-completed documentation in books and journals, plus the accumulating databases

and established websites, videos and photo galleries report and conclude the first Census. Over the decade, more than 2,600 academic papers were published—one, on average, every 1.5 days.

Presented is an unprecedented picture of the diversity, distribution, and abundance of all kinds of marine life in Planet Ocean—from microbes to whales, from the icy poles to the warm tropics, from tidal near shores to the deepest dark depths.

Oceanic diversity is demonstrated by nearly 30 million observations of 120,000 species organized in the global marine life database of the Census, the Ocean Biogeographic Information System (OBIS). The

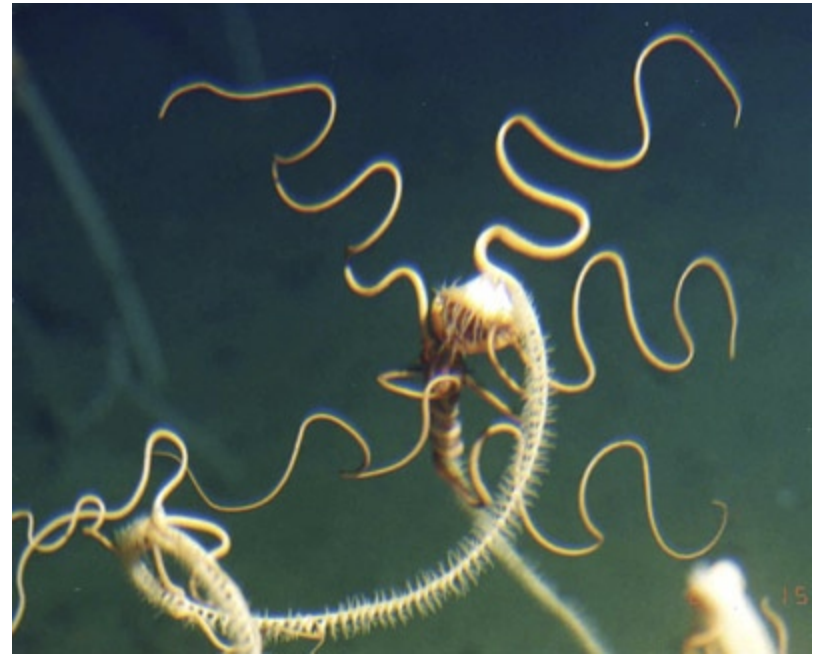
migrations tracked across seas and up and down in the water column, plus the revealed ubiquities of many species, demonstrate connections among oceans. Comparisons of the present ocean with the bountiful ocean life portrayed in old archives document changes. The Census established declines—and some recoveries—of marine abundance.

The OBIS directory of names and addresses of known ocean species establishes a reference against which humanity can monitor 21st century change. It also delineates the vast areas of ocean





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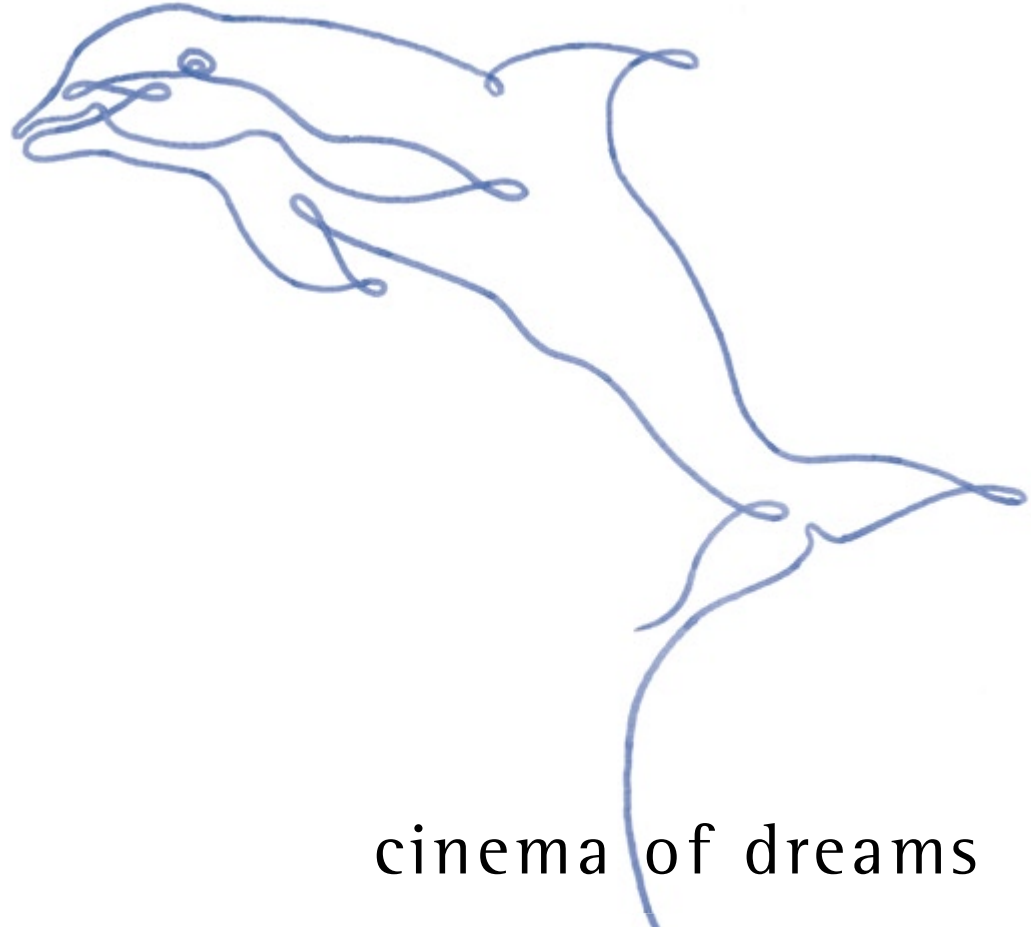


that have never been explored.
"We prevailed over early doubts that a Census was possible, as well as daunting extremes of nature," said Australian Ian Poiner, chair of the Census Steering Committee. "The Age of Discovery continues."
"This cooperative international 21st century voyage has



systematically defined for the first time both the known and the vast unknown, unexplored ocean."
According to Poiner, the beauty, wonder, and importance of marine life are hard to overstate.
"All surface life depends on life inside and beneath the oceans. Sea life provides half of our oxygen and a lot of our food and regulates climate. We are all citizens of the sea. And while much remains unknown, including at least 750,000 undiscovered species and their roles, we are better acquainted now with our fellow travelers and their vast habitat on this globe." ■

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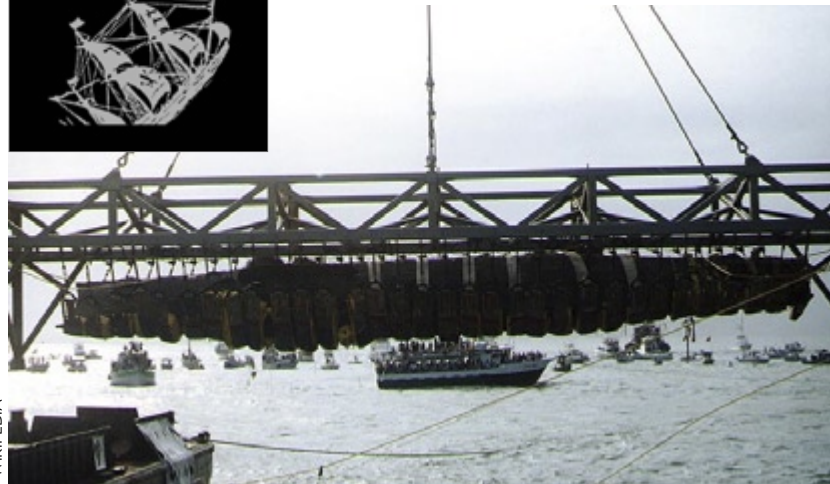


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wreck rap



Solution to the *Hunley* mystery inching closer



Confederate Submarine *H.L. Hunley*, suspended from a crane during her recovery from Charleston Harbor, 8 August 2000

Scientists studying the mystery of the shipwreck of the Confederate submarine *Hunley* are getting closer to understanding what happened to the hand-cranked sub and its eight-man crew. *Hunley* archaeologists now plan to delicately rotate the

submarine to an upright position, exposing sections of hull not examined in almost 150 years. Early next year the 23-ton sub will be delicately rotated to an upright position, exposing sections of hull not examined in almost 150 years.

When the *Hunley*

sank, it was buried in sand listing 45 degrees to starboard. It was kept that way as slings were put beneath it and it was raised and brought to a conservation lab in North Charleston a decade ago. ■

Historic British Submarine plundered



The *Holland 5*, which sank six miles off Eastbourne in East Sussex in 1912

English Heritage said divers stole the torpedo tube hatch of the *Holland 5*, the only surviving example on the seabed of this class of submarine in the world. The theft was discovered during a licensed dive by the

Nautical Archaeology Society in June and confirmed during a survey dive last month. Experts said a group of people would have been behind the theft but that the hatch carried very little monetary value.

The Holland class were the first submarines built for the Royal Navy ordered by the British Admiralty to evaluate the potential of the submarine with the Royal Navy. ■



One of the seven coins revealed during conservation—a choice Mexico City “piece of eight”

Encrusted conglomeration yields artifacts of wealth and war

Key West, Florida Keys -- The five pound encrusted conglomeration of Santa Margarita shipwreck artifacts discovered in the Florida Straits in May by W. Keith Webb's Blue Water Ventures, though still in conservation, has thus far yielded two prime examples of 17th century Spanish presence in

the America's—money and weaponry. The money appears in the form of seven silver “pieces of eight” treasure coins; the weaponry are ten “gunner's dice.” John Corcoran, chief conservator for Mel Fisher's Treasures—Blue



Four of ten “gunners dice” found in the conglomeration, still undergoing conservation

Water's joint venture partner—explained that gunner's dice are approximately 1”x1” bits of square-cut iron that were wrapped into a bundle—sometimes mixed with pieces of broken spike—and fired from cannon.

One never knows what might be discovered in a conglomeration of shipwreck material. Even though gold does not typically become encrusted in sea water, it can if it is near another metal such as iron, so a conglomeration can include a variety of artifacts, such as hull spikes,

weaponry, silver and gold coins, chains and jewelry.

The near-mint condition, Mexico City minted silver “piece of eight” coin in the accompanying photograph is from the conglomeration discovered in May by BWV diver Kris Goodner and represents one of about 80,000 coins still to be discovered on the sunken 1622 Tierra Firme Fleet galleon Santa Margarita. Mexico Mint coins are particularly rare on the Santa Margarita as they were actually part of the cargo of an altogether different fleet, the New Spain Fleet—whose admiral made the unfortunate decision to transfer valuable coin cargo from his fleet to the better-armed, but doomed, Tierra Firme fleet ships to carry.

For more information about Keith Webb's Blue Water Ventures and the Santa Margarita shipwreck, visit www.bwvkw.com. ■



Captain's Dan Porter and Mike Perna examine an E.O., and encrusted artifact, which conservation revealed to be a partial wooden sword handle





WWII Soviet Submarine located in the Black Sea

Text by Milen Milanov

27 August 2010, Bulgaria — Divers from the Varna Black Sea Diving Odesos club announced that they have found the Soviet submarine C-34, which sunk near the Bulgarian Black Sea coast in November 1941. They came across the remains during a dive east of Cape Galata, which is approximately 15 miles from the city of Varna.

Up to now, the team has carried out two dives on the spot with the support of the Black Sea Sunrise cooperation.

Orlin Canev from the team says that the submarine lies on its right board and that its hull is literally split in two. The periscope is out, which makes the divers believe that during the accident that caused the sinking of the Soviet submarine, it was at a periscope depth.

The news of the discovery caused quite a few debates. Many announcements in the Russian media challenged the authenticity of the statement that the object near Varna was indeed C-34.

In an August 28 article, Atanas Panayotov, Ph.D. in history, claims that it is impossible that the divers from the Black Sea Diving Odesos club have found C-34. To support his claim, the historian applies two

facts. First of all, the object is outside Position 22, where according to the military archive, the submarine was sent. And second, on 15 and 16 November 1941, the bodies of chief lieutenant Violet Dushin and boatswain Frol Terehov from the submarine's crew were found equipped with ЭПРОН diving gear on the Tsarski beach near the town of Sozopol, some 90 kilometers south of Varna.

On the other hand, in a subsequent article from September 1, Panayotov said that after examining the photo- and video-material, provided by the diving team after their second dive on the spot, he is convinced that the object found is C-34. Panayotov explained that the initial information that the submarine was on the territory of the Varna Bay was corrected with the addition that it was under the parallel of Cape Emine. That puts it in Position 22, where it was ordered to be. What is more, the discovery of the chief lieutenant and the boatswain's bodies that further south could be explained with the strong currents that are present in that part of the coast.

C-34 was the last of five submarines from the Soviet Black Sea fleet that were lost in



Bulgarian waters during the Second World War, with a location which remained unknown. The cause of the submarine's destruction is still unspecified. C-34 was located within the framework of a large Bulgarian mine barrier laid in the summer of 1941, said Panayotov. According to him, it is possible that the propeller tangled in a mine-rope. That would explain why Dushin and Terehov went out. After they failed with the task of untwining the rope, the commander of the vessel gave an order to move in a last attempt to free C-34, said the historian. As a result, the mine was pulled nearer the hull and exploded causing a secondary inner explosion, which caused the hull to split.

Some sources mention airbombs scattered on the bottom around the submarine. This fact leads to the conclusion that C-34 was also attacked from air.

Specialists hope that further investigation will shed more light on the fate of the Soviet submarine. The

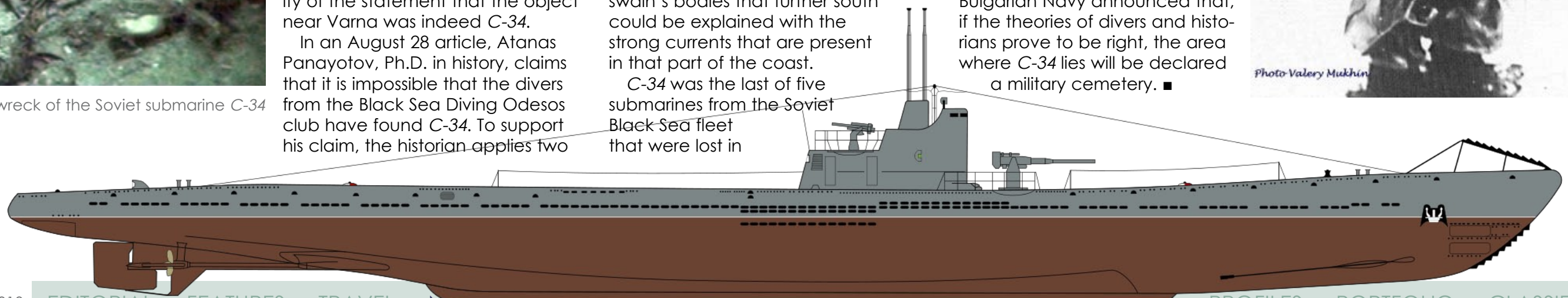
Bulgarian Navy announced that, if the theories of divers and historians prove to be right, the area where C-34 lies will be declared a military cemetery. ■



Photo: Valery Mukhin



Scenes from the wreck of the Soviet submarine C-34





Rare German wartime bomber found in the UK

A wreck of the German bomber Dornier 17 was discovered about two years ago, on a sandbank off Deal, Kent, in southeastern Great Britain. The plane, which landed on the sandbank in 1940 before it sank, is still in good condition, hence, there are plans to recover it.

Wessex Archeology has been working with the Royal Air Force (RAF) Museum and English Heritage on the twin-engined Dornier 17, a German bomber that was shot down in the Battle of Britain in 1940. The plane was found at a depth of 15 meters (50 feet).

“The flying pencil”

More than 1,500 examples of the Dornier 17 medium bomber were built. The twin engine, twin fin configuration together with the narrow fuselage and shoulder-mounted engines gave the aircraft a distinctive silhouette and earned it the nickname, The Flying Pencil.

Remarkable condition

According to the RAF Museum the plane was found in “remarkable” condition considering the years it has spent underwater, and is largely intact with its main undercarriage tires inflated and its propellers still showing the damage they suffered during its final landing. Plans to recover and preserve the plane and eventually put it up for exhibit are underway. The work to conserve

and prepare the Dornier for display will be undertaken at the RAF Museum’s award-winning conservation center at Cosford.

The discovery of the Dornier is of national and international importance. The aircraft is a unique and unprecedented survivor from The Battle of Britain. It is particularly significant because, as a bomber, it formed the heart of the Luftwaffe assault and the subsequent Blitz, said Air Vice-Marshal Peter Dye, Director General of the RAF Museum.

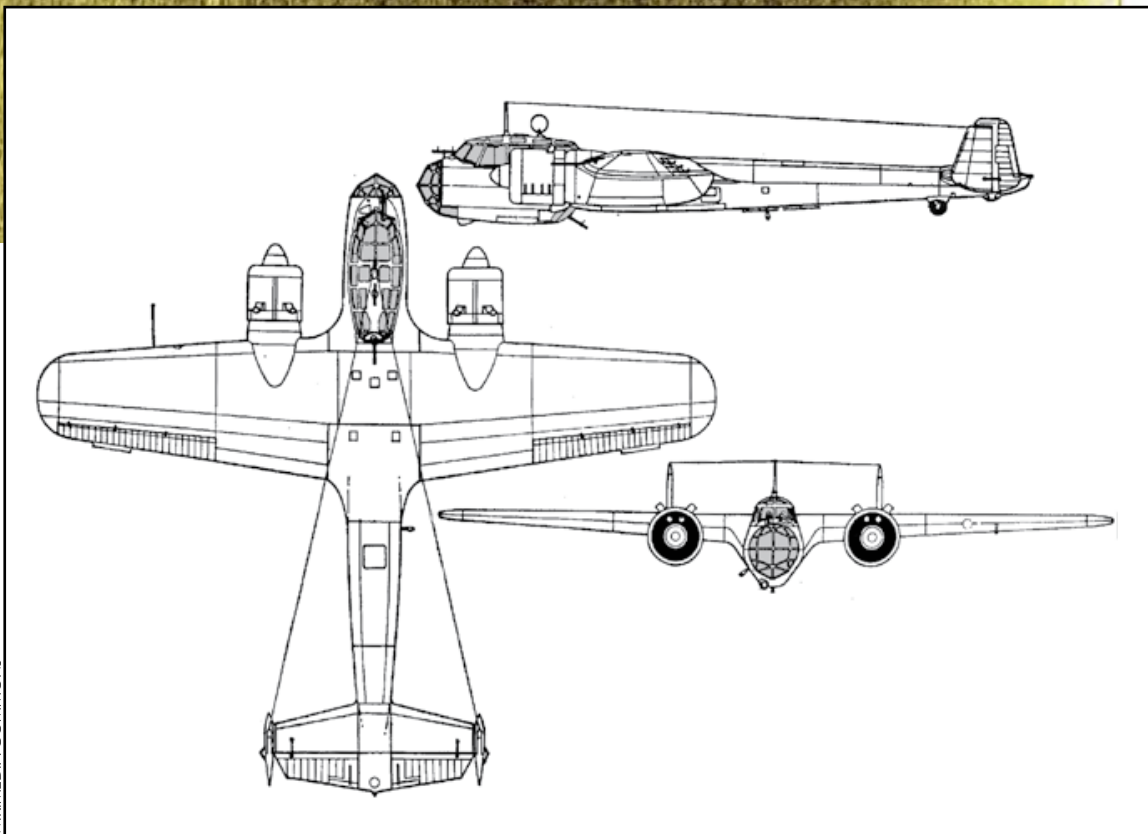
Controlled landing

With a crew of four and loaded with 900 kg / 2000 lb of bombs, the aircraft, a twin-engined Dornier 17 was part of a large enemy formation intercepted by RAF fighter aircraft at midday on 26 August 1940 as they attempted to attack airfields in Essex. The Dornier found on the coast of Kent was flown by Feldwebel (Flt Sgt) Willi Effmert who attempted a wheels-up landing on the Goodwin Sands (a 16 km /

10 mile long sandbank). He touched down safely and the aircraft sank inverted. Effmert and his observer were captured, but the other crewmen died, and their bodies were washed ashore later.

Only existing plane

The Dornier was used throughout the war and saw action in significant numbers in every major campaign theater as a front line aircraft until the end of 1941 when its effectiveness and usage was curtailed, as its bomb load and range were limited. Production of the Dornier ended in the summer of 1940. The Goodwin Sands wreck is the only known surviving example. ■



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Pieces of Eight



Silver Treasure Coins of the 1622 Shipwrecks
Nuestra Señera de Atucha
Santa Margarita
& the Portuguese Carrack *São José*

by Carol Tedesco

Fully illustrated with hundreds of finely detailed photographs, *Pieces of Eight* is more than just a reference book. Carol Tedesco not only explains the subtle nuances of the coins themselves, but places them in the context of their moment in history, explaining where they were coming from, where they were going and why.

To be released in 2010 by
SeaStory Press, Key West Florida.
To be on our availability e-mail alert list,
please inquire at lostgalleons@aol.com.

Wreck of *HMS Investigator* found in the high Arctic

Canadian archaeologists have found the *HMS Investigator*—a British ship abandoned in the Arctic while on a 19th century rescue mission.

HMS Investigator was a merchant ship purchased in 1848 to search for Sir John Franklin's lost expedition. She made two voyages to the Arctic and had to be abandoned in 1853 after becoming trapped in the ice. Now her wreckage was found on Banks Island, in the Beaufort Sea.

Canada's government says the discovery bolsters its claim to sovereignty over the Northwest Passage, which is feared threatened by increased shipping.

The *Investigator* was abandoned while searching for the Franklin expedition, itself lost with all its crew during a mission to discover the passage.

"It's an incredible site," Canadian Minister of the Environment Jim Prentice told the BBC by telephone from Mercy Bay. "You're looking at what people have not seen in 156 years, which is a remarkably intact British sailing vessel."

The *Investigator*, captained

by Robert McClure, left Britain in 1848, ultimately making two attempts to find the Franklin expedition.

The vessel was purchased by the Admiralty in February 1848 and was fitted for Arctic exploration at the Blackwall yard of Greens. The ship accompanied *HMS Enterprise* on James Clark Ross's expedition to find the missing Sir John Franklin. Also aboard *HMS Investigator* on this expedition was the naturalist Edward



HMS Enterprise (left) and *HMS Investigator* (right)

Adams.

Investigator was commanded for the return voyage by Robert

McClure, but became trapped in the ice, and was abandoned on 3 June 1853 in Mercy Bay on the

western side of the Canadian Arctic, where she had been held for nearly three years. The following year, she was inspected by crews of the *Resolute*, still frozen in, and reported to be in fair condition despite having taken on some water during the summer thaw.

Running low on supplies and food, Capt Robert McClure and his men were eventually rescued

by another party from the Royal Navy. Capt McClure is credited as the first European to discover the western entrance to the Northwest Passage.

'Largely intact'

Archaeologists discovered the ship under about 25ft of pristine, icy arctic water this week using sonar and metal detectors.

"You could make out all the planking on the deck, the details on the hull, all of the detail of the timber," Prentice told the BBC. "It's sitting perfectly upright on the floor of the ocean."

The Canadian researchers also found three graves of British sailors who died of scurvy on the 1853 expedition.

Parks Canada, a government agency, will inventory and study the ship and other artefacts but will not remove them. It has been in touch with the British government regarding the sailors' remains. ■

FOURTH ELEMENT TEAM DIVER, Pete Mesley
in Truk Lagoon, June 2010
Pete wears: PROTEUS wetsuit.

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wreck
rap

For the 11th consecutive year, the S.C. Army National Guard has partnered with the S.C. Department of Natural Resources (DNR) to donate surplus materials to the Marine Artificial Reef program, a collaborative project known as Reef-Ex. (File photo of an artificial reef deployment from 2005)



South Carolina extends its artificial reefs

The S.C. Department of Natural Resources and the S.C. Army National Guard teamed up once again and placed 20 stripped down armored personnel carriers (APC's) into the waters at the Beaufort 45 artificial reef.

The artificial reef in 45 feet of water was established about 15 years ago with concrete reef balls, retired Army tanks and even debris from the old Broad River Bridge. The APC's were distributed in a separate location, but are in the same permitted area for the Beaufort 45 Reef.

"I have fished at the Beaufort 45 and I have dived on it, and I can tell you first hand that this is a healthy reef. Besides seeing lots of fish around the artificial reef, I have seen sponges, soft corals and other fully developed invertebrates inhabiting the ecosystem," said Mel Bell, a fisheries biologist with the Department of Natural Resources,

Often divers and fishermen have

to share these reefs, and the APC section will provide them a new option."

Of course it will take several years for invertebrates to colonize the APC's. Over 33 permitted sites are active in S.C. waters, and the joint program has been placing structure in these locations for the past 15 years. Bell said, "This is a win-win situation for DNR, the S.C. Army National Guard, fishermen and our natural



resources. In terms of budgeting, DNR is only responsible to oversee the placement of the structure, while the NG cleans and prepares their retired vehicles and takes care of the logistics of barges, cranes and such. DNR is extremely grateful for the work that they do."

The state has one of the most prolific reef building programs with the National Guard along the Atlantic Coast. ■

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Edited by
Scott Bennett



ERIC CHENG

Solmar V liveaboard becomes green(er)

In 2011, *Solmar V* will partner with Carbonfund.org to establish carbon offsets for the boat's diesel emissions.

A part of revenues from every trip in 2011 will be earmarked for this program to help fight global warming—*Solmar V*'s contribution in making the transition to a clean energy future possible.

"When thinking about our business' environmental impact, we fol-

low simple principles: avoid-reduce-offset. Partnering with Carbonfund.org provides a great way to offset our impact. We want to encourage everyone to be good stewards of the oceans. If other operators are interested in learning how to do this, my staff would be happy to walk them through the process." said Jose Luis Sanchez, the operator.

In recognition of this move and to encourage divers who support this kind of action, *Solmar V* is offering the "Green Boat" special for all January 2011 trips to Socorro Islands. The Socorro Islands offer some truly pristine diving with exceptionally large animals: 18-plus foot mantas are common as well as numerous shark species, dolphins and even whales. ■

Scuba divers visiting the southern Thai provinces of Narathiwat and Pattani now have some unusual entries for their log books as 25 Chinese-made battle tanks (MBTs) have been dropped into the Gulf of Thailand.

The 36.7 ton (39.7 US ton) T69-2 tanks entered service with the Thai army in 1987 and were decommissioned in 2004 after the Chinese

army stopped manufacturing the tanks and parts became scarce.

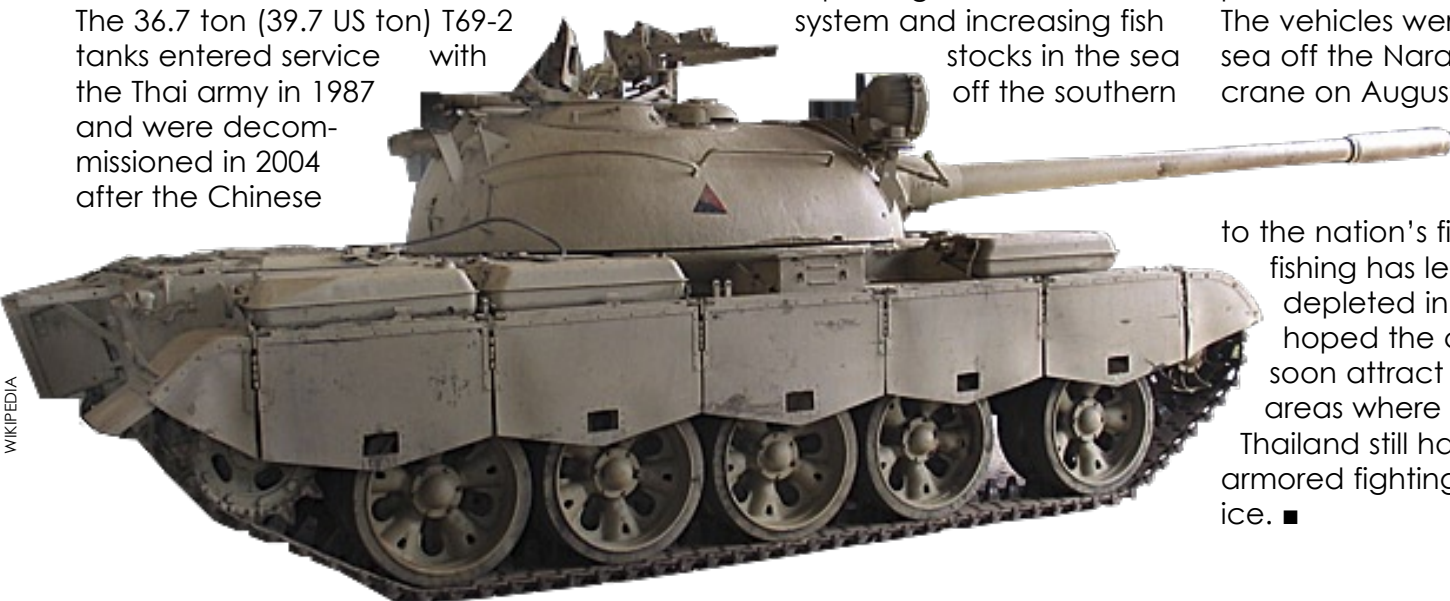
After slowly rusting away in a holding yard at a Thai army base in Nakhon Ratchasima, the tanks have become part of an artificial coral project initiated by Thailand's Queen Sirikit aimed at improving the marine eco-


system and increasing fish stocks in the sea off the southern

Chinese tanks to form new Thailand reefs

provinces of Narathiwat and Pattani. The vehicles were lowered into the sea off the Narathiwat coast by crane on August 10.

The fertile waters of the Gulf of Thailand are crucial to the nation's fishermen, but overfishing has left the ecosystem depleted in recent years. It is hoped the combat vehicles will soon attract coral and fish to the areas where they are laid to rest. Thailand still has 70 of the Chinese armored fighting vehicles still in service. ■







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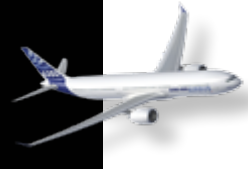


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Nautilus Explorer offers trip to remote Clipperton Atoll

The *Nautilus Explorer* is offering the very rare opportunity to combine the adventure of a voyage to a remote coral atoll with diving the Pacific mantas and dolphins of Socorro Island. Discovered by Ferdinand Magellan in 1521, Clipperton Island is a beautiful and very remote tropical coral atoll that has been visited by very, very few divers.

The *Nautilus Explorer* offers the only diving expeditions to have ever visited this place



EARTH SCIENCES AND IMAGE ANALYSIS LABORATORY, NASA JOHNSON SPACE CENTER



other than Jacques Cousteau, Scripps, the Smithsonian Institute, National Geographic and a French scientific party. The two-mile long atoll itself is jam-packed with life including five million land crabs and 500,000 boobies. It is surrounded by a shallow barrier that descends down to a white sand bottom at 175 feet. The amount

of fish life is prolific, ranging from the endemic Clipperton angel-fish to big schools of jacks and other panamic fish, nudibranchs and multitudes of free-swimming green moray eels. Sharks species include hammerhead, silky and tiger sharks as well as mantas and whale sharks.

Trips depart from Cabo San Lucas, which is easily accessible from anywhere in North America or connecting from Europe. It is a one-day ocean crossing out to Socorro and then an additional two days of voyaging to Clipperton. There is an overnight stay on the boat, with guests disembarking the next morning at 8:30 a.m. Trip length is 15 nights/16 days. ■ Nautilusexplorer.com

Galapagos Islands removed from the UNESCO World Heritage danger list

A U.N. panel has voted to withdraw the Galapagos Islands from the World Heritage in Danger list.

At the annual meeting of the UNESCO committee for World Heritage Sites, which was held this year in Brasilia, the capital of Brazil, it was decided that Ecuador has improved the situation in the

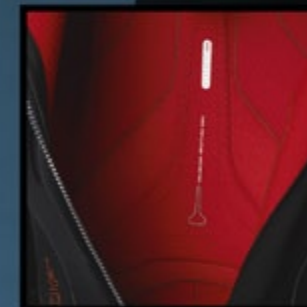
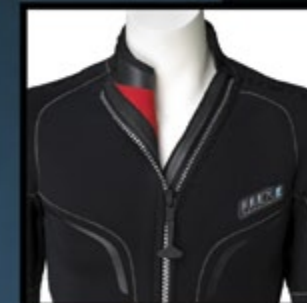
Galapagos Islands to such an extent that they need no longer be included on the List of World Heritage in Danger.

The archipelago of volcanic islands off the Pacific coast of Ecuador had been on the list of endangered world heritage sites since 2007. A growing local population, fishing, and tourism had put pressure on natural resources there.

But the committee voted 15 to 4 in favor of Brazil's recommendation to withdraw the islands from the list, saying Ecuador had made progress in recent years.

"It's important to recognize the effort made by the Ecuadorean government to preserve this heritage," said Luiz Fernando de Almeida, head of the Brazilian delegation. ■

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How to sleep on airplanes

For most travellers, the prospect of getting forty winks on a plane can be a nightmare. Sleeping bolt upright in a sardine can-sized compartment isn't particularly easy, and those long trans-oceanic flights are a virtual free ticket to stress-management therapy. Fortunately, catching a snooze at 35,000 feet is indeed possible.

For starters, skip the coffee. Dehydrating drinks such as coffee, tea, colas and alcohol coupled with tinder-dry cabin air can make sleep even more difficult. Instead, drink plenty of water, starting the day before you fly.

During takeoff, your body is subjected to increased G-forces, resulting in feelings of drowsiness due to the decreased oxygen in the cabin. If you're the sort of person who can fall asleep quickly, take advantage of this short time and try to get your body to

retire before you reach altitude. Music is a great way to relax. Before departure, create a playlist on your iPod with at least 20 songs that you find relaxing. Listening to music during sleep has been shown to help maintain normal blood pressure and good circulation throughout a long flight. Consider purchasing a set of sound isolating canal earphones (Etymotic Research ER-4P Earphones, US\$165, Amazon.com).

As the body expands at high altitude where cabin temperatures can be wildly inconsistent, layered, comfortable, loose-fitting clothing is best for sleeping. Take along a lightly stuffed full body pillow, preferably one made of memory foam because it can be packed into a small bag. Once you're in your seat, pull it out, fold it double and place it on your tray table

or somewhere you can reach it easily.

Try to get a window seat near the front, where it's quieter and not quite as bright. Choose a window seat for the wall, preferably in an exit row, so your neighbor won't disturb you if he or she gets up. An eye mask to block all light is also helpful.

Pressurized cabins can also

create havoc on one's gastro-intestinal system. Preflight, avoid gas-producing foods such as apples, apri-



cots, beans, broccoli, cabbage and cauliflower. Pack high-fiber snacks in your carry-on. Dried fruit, nuts and whole-grain granola bars are good choices. Containing melatonin and serotonin, bananas are a virtual sleeping pill in a peel. A handful of almonds can also be snooze-inducing as they contain tryptophan and a nice dose of muscle-relaxing magnesium. A pre-departure turkey dinner will also help! ■

Airline meals website

AirlineMeals.net is a website where users publish actual pictures of actual inflight meals. Since its inception in 2001, it has grown to more than 20,000 airline meal photos from approximately 600 airlines, searchable by airline, flight class, date and route, news and forums. ■

www.airlinemeals.net

List of international visa restrictions

The Henley Visa Restrictions Index is a global ranking of countries listed according to the extent of travel freedom their citizens enjoy. Henley & Partners has analyzed the visa regulations of all the countries and territories in the world. ■



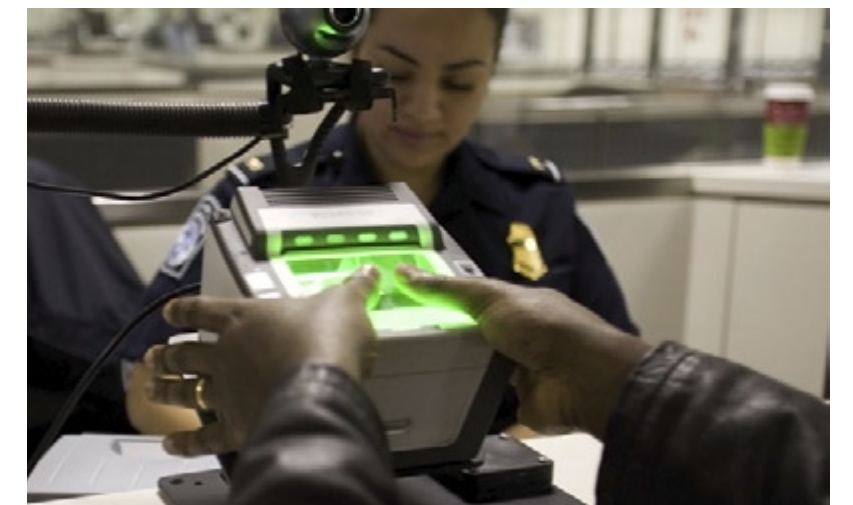
New clearance programs for international travellers going to or through the US

Global Entry is a U.S. Customs and Border Protection (CBP) program that allows expedited clearance for pre-approved, low-risk travelers upon arrival in the United States.

Though intended for frequent international travelers, there is no minimum number of trips necessary to qualify for the program. Participants may enter the United States by using automated kiosks located at select airports.

GOES—The Global On-

line Enrollment System—allows registered users to enter their own applications for U.S. Customs and Border Protection (CBP) Trusted Traveler Programs, and approved members to edit their information as needed. Once a completed application is certified by the applicant and the non-refundable payment is successfully processed, CBP will review it and determine whether or not to conditionally approve the application. ■



Non-US citizens still have to through the indignifying proces of having fingerprints taken upon arrival to the US as if they were criminals. Image from Washington Dulles International Airport



Text and photos by Scott Bennett

Utila Island

Jewel of Honduras





“If you’ve been to South East Asia, don’t bother with the Caribbean” is a phrase I’ve encountered many times over the last decade. Having done virtually all of my diving in Asia-Pacific, the region’s legendary diversity tends to leave one a tad spoilt. When you’ve dived exclusively in the world’s biodiversity hotspot, it’s all-too-easy to assume that other areas will suffer by comparison. However, when an opportunity arose to visit the island of Utila in Honduras, I was immediately intrigued.

As well as being a totally new part of the world (in my own hemisphere for a change), it was also reasonably close, with a mere two hours time difference. I decided to cast all preconceptions aside and enjoy the diving for what it was. I ended up being in for a pleasant surprise!

Getting there proved somewhat easier than anticipated. I discovered a non-stop service to Roatan from my

home in Toronto on Sunwing, a charter airline that just started flights this past winter. Better still was the fact I could avoid the long stopovers required by connecting flights travelling through the United States.

Four and a half hours after departing cold and drizzly Toronto, I landed at Roatan’s compact international airport. After breezing through customs, I gathered my gear and

I headed outside the terminal. A 20-minute taxi ride delivered me to the West End, one of the main tourist areas on the island. From here, I caught Captain Vern’s catamaran for the four-hour trip to Utila. I was somewhat surprised by the nationalities of the passengers—virtually all of them were fellow Canadians. Then Captain Vern uttered something rather ominous, “It’s going to be rough out there today, so

Detail of fan coral on the reef at Utila (left); School of Bermuda chub (above); Juvenile spotted drumfish hovers over coral (previous page)



CLOCKWISE FROM LEFT: Swimming pool at the Mango Inn; Utila ferry; Street scene in Utila; Pelican at the pier; ATV's and tourists populate downtown Utila

the north Honduras coast, the Bay Islands consist of eight islands and more than 60 cays. In contrast to the more rolling terrain of Roatan, Utila is quite flat, with the notable exception being the rounded summit of Pumpkin Hill.

eclectic assortment of electric golf carts, ATV's and most surprisingly, Thai-style tuk-tuks. It became immediately apparent that diving is prominently woven into the island cultural fabric, with more "diver

The island

Traditionally, Utila was largely a fishing community with the initial settlements to be found on the Utila Cayes, 11 palm-fringed islands off the southwest coast. Only 13km long and 5km wide with much of the coastline dominated by mangroves, the island is virtually uninhabited except for the small fishing village of East Harbour (Utila Town). Due to 300 years of British influence, the main language of the island's 6000 inhabitants is English, whereas mainland Honduras speaks Spanish.

In contrast to Roatan's more mainstream tourist scene, Utila is decidedly more charming, boasting a laid-back Caribbean vibe. Gingerbread houses awash in a range of pastel hues lined the main road, while traffic consisted of an



down" flags draped from buildings and flagpoles than actual Honduran flags! After checking in at the Utila Dive Centre (UDC), I was driven to my home for the week, the Mango Inn. Nestled amidst luxuriant tropical gardens buzzing with hummingbirds, the resort was situated in a quiet residential area of town, but only a 5-minute stroll from the all the amenities and restaurants on the main street.

Later in the evening, I met up with Andy Phillips, UDC's course director. Over a delicious pizza and a few Salva Vida beers at the Mango Inn, Andy gave me

I hope everybody has taken their sea-sick pills." Scanning the waters ahead, I could see a profusion of whitecaps. Yikes!

Within 15 minutes of departure, the vessel started heaving, and so did the passengers. (A word of warning: a lack of sleep, copious amounts of beer and rough seas do

NOT mix!) I speedily shifted to the non-vomiting side of the boat and tried to enjoy the rest of the trip. Fortunately, my stomach contents remained intact. When all was said and done, the trip took an hour longer than expected, and we finally arrived in Utila around 5:00PM. Situated approximately 65km off





a run-down on the island's diving.

Utila's waters are home to over 100 charted dive sites with a variety of environments. Suspended on the rim of the continental shelf, Utila's north side is flanked by submarine walls that plummet to over 1,000m. The drop offs are also home to the island's

most famous resident, the whale shark. The peak season for these gentle giants is between March-April and August-September. As my arrival had coincided with the former, my fingers were crossed!

I also asked Andy about the political events of 2009. While widely reported by the international media as a coup, the local version was somewhat different, with the removal of former president Zelaya being entirely within the rights of the constitution. As is typical in politics, some agreed and some didn't, and demonstrations did take place. As a result, the U.S. State Department slapped a travel advisory on the country and tourism virtually dried up overnight. Utila and Roatan were hit especially hard, as tourism is the foremost component of the local economy.

Despite a few incidents of unrest on the mainland, the Bay Islands remained trouble-free during the entire

Hummingbird build their snug nests out of local materials



CLOCKWISE FROM ABOVE: Vase sponge; Mango Inn bungalow; Cozy room at the Mango Inn



Utila

CLOCKWISE FROM LEFT: Pederson's cleaner shrimp (left); Utila Beach; Brown garden eel; Four-eye butterflyfish; Longspine squirrelfish

episode. After elections were held in November, a new president was instated and by December, the travel advisory was revoked. Happily for the locals, tourism has since bounded back.

The diving

The next morning, I arrived at the dive shop in plenty of time for the 8:00AM departure. It was a full boat, with 14 divers including guides Tyson (a fellow Torontonion) and Josiah. After a recent liveaboard trip in the Philippines where all you had to do was stick out your foot and someone would put a fin on it, I quickly realized

that the UDC was a do-it-yourself type of operation, with everyone responsible for setting up their own gear. It had been so long since I've done so that it was downright embarrassing!

Spotted Bay

Our destination was Spotted Bay, situated off the island's northwest coast. Just getting there proved to be an adventure, as the previous day's rollicking seas had not

yet subsided and the half-hour trip was decidedly rough.

After tying up at the mooring line, it was a real production to get everyone geared up and into the water. Tyson was assigned to be my dive buddy, and we opted to wait until everyone else was in first. After being helped to the rear of the wildly heaving boat, I did a giant stride and entered the water.

Despite the extreme surface chop, the visibility was surprisingly good. Descending to the sandy channel below, I got my first look at the reef and was immediately struck by how different it looked. While not boasting the sheer number of corals I'd seen in Asia, the growth was extraordinarily lush. A delirious array soft corals and sponges blanketed the reef, while fan corals were absolutely everywhere, their fronds undulating rhythmically in the strong surge.

Virtually everything in sight was totally new, especially the fish. Although I recognized angelfish, butterflyfish and squirrelfish, the species were unfamiliar. Squirrelfish looked virtually identical to their Pacific cousins, but boasted an impressive dorsal fin when the fish became agitated. Parrotfish were especially abundant and there appeared to be many different varieties (an incorrect assumption, but more on that later). I knew

I would be spending some serious time with the fish ID book back at the dive centre.

After an enjoyable 50 minutes, we surfaced to discover a steady rain had



fast enough! Moving back to the more protected waters of the island's south side, our next stop was Little Bight.

Little Bight

Here, a coral-shrouded wall descended 18m to a large expanse of white sand, which was home to large congregations of garden eels. Sitting in front of what appeared to be a small anemone was an exquisite shrimp. Sporting a pair of long white antennae, its transparent body was accented with an assembly of vibrant purple spots. I later discovered it to be a Pederson's cleaner shrimp, a commonly observed Caribbean species.

commenced. Getting on board proved to be a real challenge as the wooden ladder bobbed madly in the turbulent waters. Due to the surface conditions and strong surge, over half the group had opted to sit the next dive out.

As I sat cold and shivering in the rain, the surface interval couldn't end





A fan coral boasted a trio of small but conspicuous molluscs called flamingo tongues, their creamy shells garbed in a psychedelic wardrobe of orange spots encircled with black. Although the corals have developed toxins to deter predators, these molluscs

have developed a unique strategy to consume their favourite food. Over time, they have evolved a group of genes and proteins called a "defensome" that detoxifies coral compounds.

While scouring the white sandy bottom for additional macro subjects, I was

immediately assailed with a frenetic bout of tank banging. Whirling in all directions, I failed to see the cause of the commotion. That is, until I glanced above my right shoulder—hovering in the water column less than a metre away was a great barracuda! I quickly shifted my position and fired off a series of exposures. Best of all, I was able to capture a few images with a vibrant blue background.

Ted's Point

Still game for more, I headed out on in the afternoon with dive guide, Jeremy, to explore Ted's Point. The fish life was rife, attracted by a pair strong converging currents that sweep past.

At the eastern end, the wall drops sharply to below 40m, while to the west, a gentle slope lies at 18m. The sandy areas were dotted with coral bommies decorated with sea fans, soft corals and sponges. Feather duster worms were congregated in large clusters, unlike the solitary individuals I'd routinely encountered in Asia.

On the sandy bottom at 20m, a small wreck lay tilted on its side, soft corals

protruding from the underside of its bow like feathery goatee. At our safety stop, we came across a school of large silvery fish, which Jeremy couldn't identify. They weren't even in the reef guide; in fact no one seemed to know what they were. After doing some research back home, I discovered them to be Bermuda chub.

Topside

Just like its undersea environs, Utila's topside residents are a diverse lot. An eclectic mix of Spanish, African and English heritage, combined with an assortment of expats from around

some money exchanged, so I was steered me towards Archie Henderson's place on the main street near the crossroads. Surprisingly, Archie was no Brit, but thoroughly Spanish!

There was definitely no shortage of local characters. One afternoon, I saw

Utila

LEFT TO RIGHT: Fan corals at Ted's Point; Sunset in Utila; Young boy shows no fear handling a tarantuala local to the area; ATV serves as the family car in these parts



the world creates a rich cultural mosaic that is downright intoxicating. Interestingly, a number of people with English names are actually Spanish, a result of the island's 300 years of British control.

One night, I needed to get





one fellow speeding by the dive shop with a large scarlet macaw sitting on his shoulder. As a result of this extraordinary cultural mélange, Utila's residents boast a wealth of stories.

One evening, I ventured out to a Mexican restaurant called El Picante, which was situated adjacent to the crossroads on the main drag. The owner, Jean hailed from the Congo of all places. "How on earth did you end up in Honduras?" I queried. "A woman," he responded with a broad grin. His Honduran wife, Theresa, was also the cook, and she served up some of the best enchiladas that I've ever eaten. The drinks menu also offered a rather intriguing concoction called a "Chimpanzee". When Jean told me the contents included dark rum, coconut milk, bananas, cinnamon and crushed ice, I was sold on the spot. It did boast a kick, so I opted to stop at one. A few more and I'd probably be swinging from the treetops like its namesake!

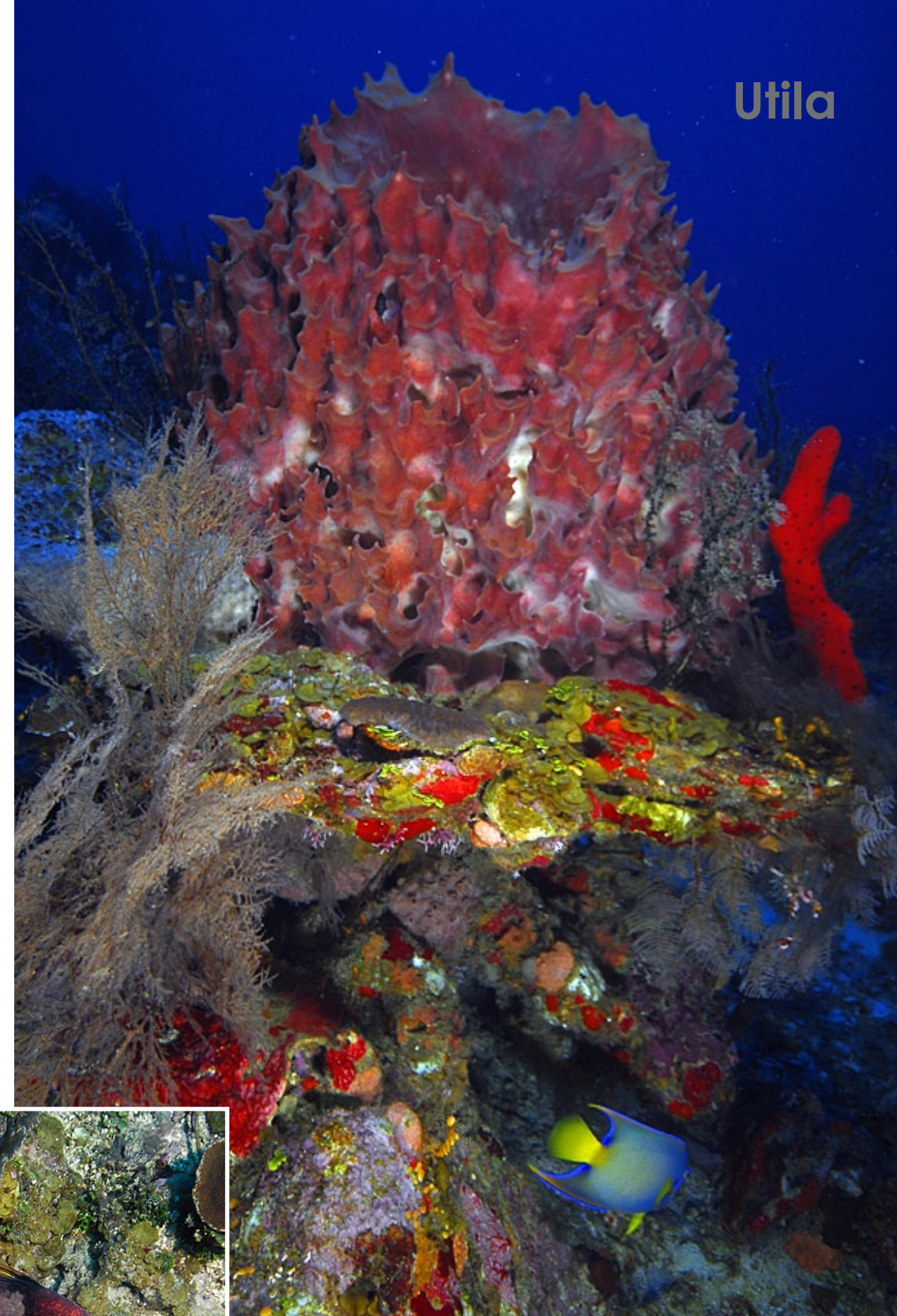
More diving

The remainder of the week followed a similar routine, with morning dives on the north shore followed by afternoons on the south.

CJ's Drop-Off

In contrast to the south side's gentler slopes, CJ's Drop-Off boasted dizzying walls plummeting to 1,000m. An assembly of triggerfish called black durgeons were on hand to greet us, as we descended 5m to the reef top. Hovering over the rim as it plunged into the abyssal depths below was truly exhilarating.

While descending the wall, frequent computer checks were absolutely essential, as the crystal clear visibility would make it all too easy to exceed recreational diving limits at the drop of a hat. Back on the boat, Ryan, my guide, reckoned it was the best visibility



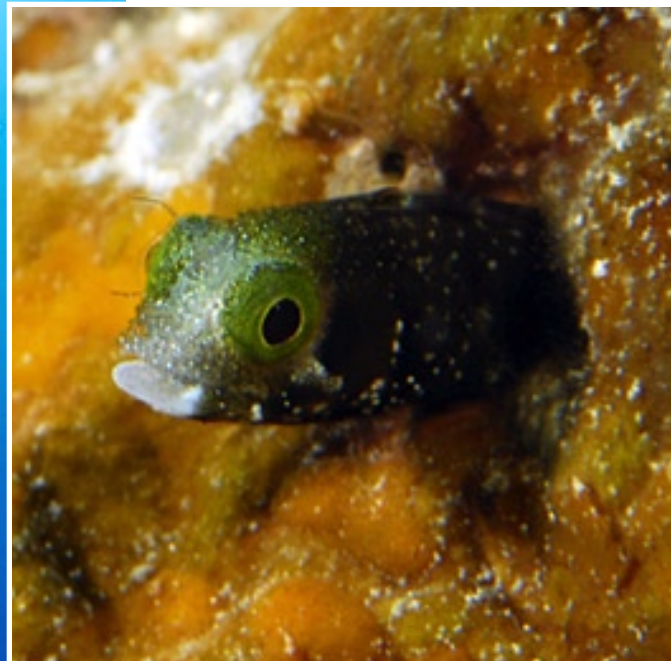
he'd seen on the island in weeks.

Big Rock

After the deeper dives of the morning, the day's final dive at Big Rock was kept decidedly shallower. Within moments, Ryan gestured to nearby coral,

CLOCKWISE FROM FAR LEFT: Barred hamlet; Diver at CJ's Drop-Off; Feather duster worms; Barrel sponge at Pumpkin Hill Banks; Hogfish (inset)





nose puffers and one seriously large dog snapper vying for my camera's attention.

UDC Jetty

For macro subjects, I discovered one needn't look any further than the Utila Dive Center jetty, whose wooden pilings are a favourite haunt of seahorses. One day, with a few hours to spare between dives, I grabbed my camera, donned some fins and snorkel and set out in search of them.

Although I did find a couple of banded coral shrimp and a school of grunts, my seahorse search came up empty-handed—that is, until I asked one of the dive instructors above, who informed me there was one attached to a rope right at the end of the jetty. Having a second look, I sheepishly realized it had been right in front of my nose during my initial forage. The experience ended up being a real first: underwater macro photography while snorkelling.

Black Hills

A firm favourite amongst many visitors, Black Hills is considered to be one of the Bay Islands' premier dive sites. An isolated seamount, its nutrient-rich waters attract fish like a magnet. It's summit, starting at a depth of 10m, was shrouded

with a patchwork of fan corals, sponges and hard corals. Swirling amongst them were successions of blue tang, French grunts, yellowtail snappers and the occasional grey angelfish. During the dive brief, we were told a large green moray could often be seen patrolling the reef top, and sure enough he (she?) appeared right on cue.

Above the reef, a shimmering school of horse-eye jacks glinted in the blue, joined by several Atlantic spadefish and a school of southern sennet, a species of barracuda. The duration of the dive was spent encircling the seamount's perimeter, and every pass revealed something new. While photographing a fan coral, a large hogfish appeared from beneath one of the fronds. A large wrasse named after the shape of the male's head, they are also highly valued for their meat (which does not taste like pork).

Duppy Waters

For our next dive, we headed over to the north

where I barely discerned a diminutive head poking out of a hole. Barely the size of a pencil eraser, its owner was a secretary blenny. Photographing the tiny creature proved especially challenging, as it was difficult enough just SEEING it through my camera's viewfinder!

While a compliant subject, the difficulty of focusing on such a small fish coupled with the incessant surge present made for moments of extreme frustration. Photo subjects abounded for the remainder of the dive, with Pederson's shrimp, arrow crabs neon gobies, sharp-

CLOCKWISE FROM FAR LEFT: Dive boat hovers over reef at Duppy Waters; Secretary blenny; Seahorse; Decorated nudibranch (sea slug); Dog snapper



where these corals can be observed at such shallow depths. Descending the wall, I came across one of Utila's smaller but most spectacular residents. Flitting above a rich tableau of table corals was a juvenile spotted drum. Attired in

plenty of other fish on view including schoolmasters, honeycomb cowfish, blueheads, Creole wrasse, porkfish and groupers.

During our surface interval, we had lunch at a charming seaside restaurant called The Purple Pelican. Sitting astride a white palm fringed beach offering expansive views to

side to Duppy Waters. 'Duppy' translates to 'ghost' in the local dialect, and the site receives its name from the light shimmering over the reef. Legend has it that if anyone sees a flash of light, his or her days are numbered. While no ghosts made an appearance, the reef was wondrous to behold, with exuberant coral growth at each and every turn.

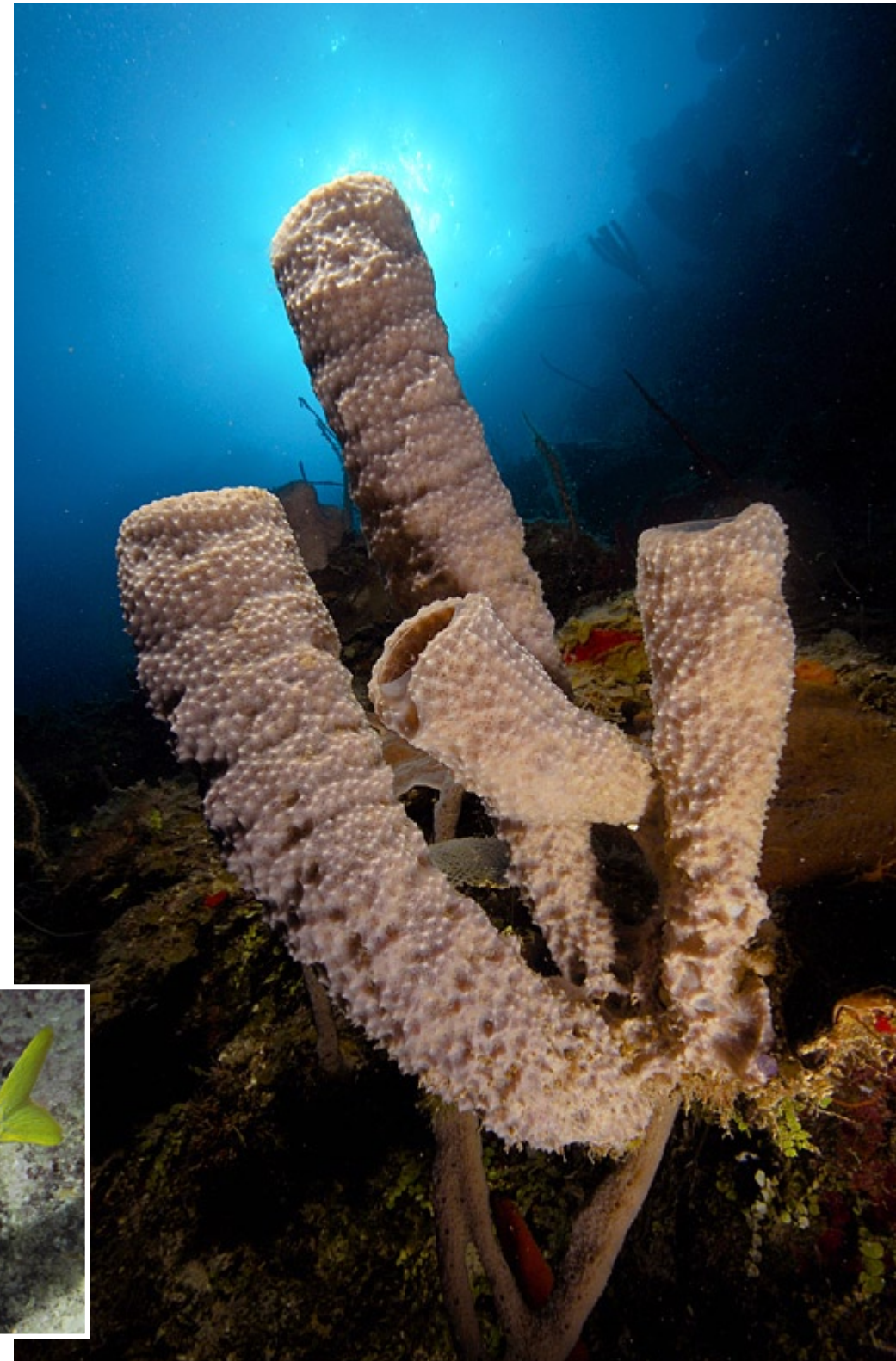
the nearby Cays, it even had a pelican (albeit not purple) perched out front on a wooden pylon

Afterwards, we paid a visit to Black Coral Wall.

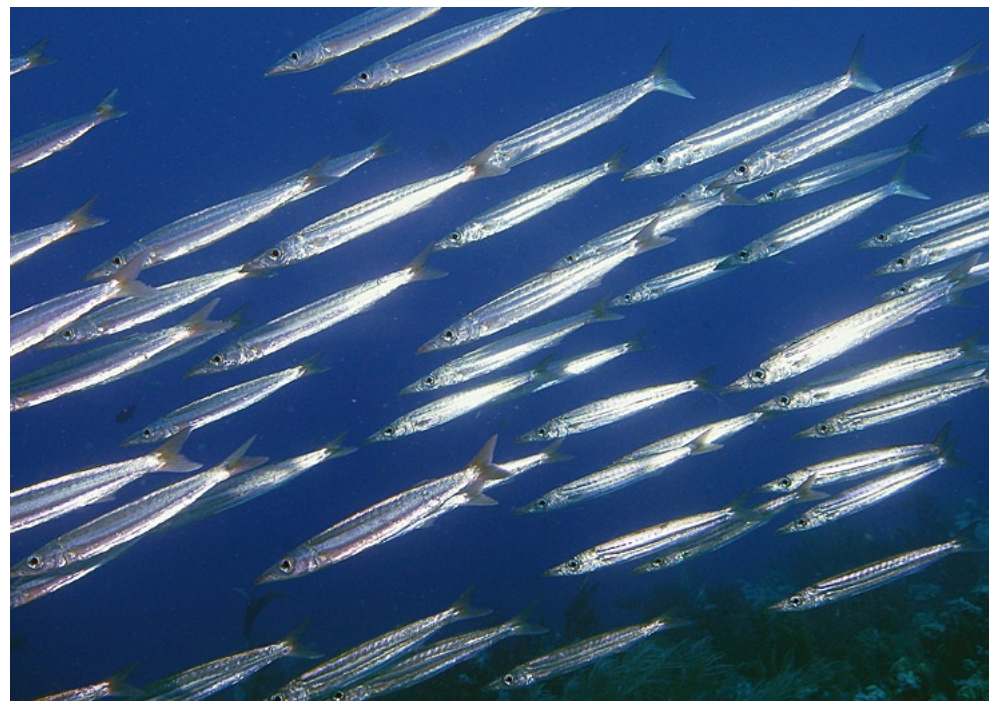
Black Coral Wall

The site was aptly named, as the walls were home to a profusion of young black coral trees. In fact, it is reputed to be one of the few places in the world

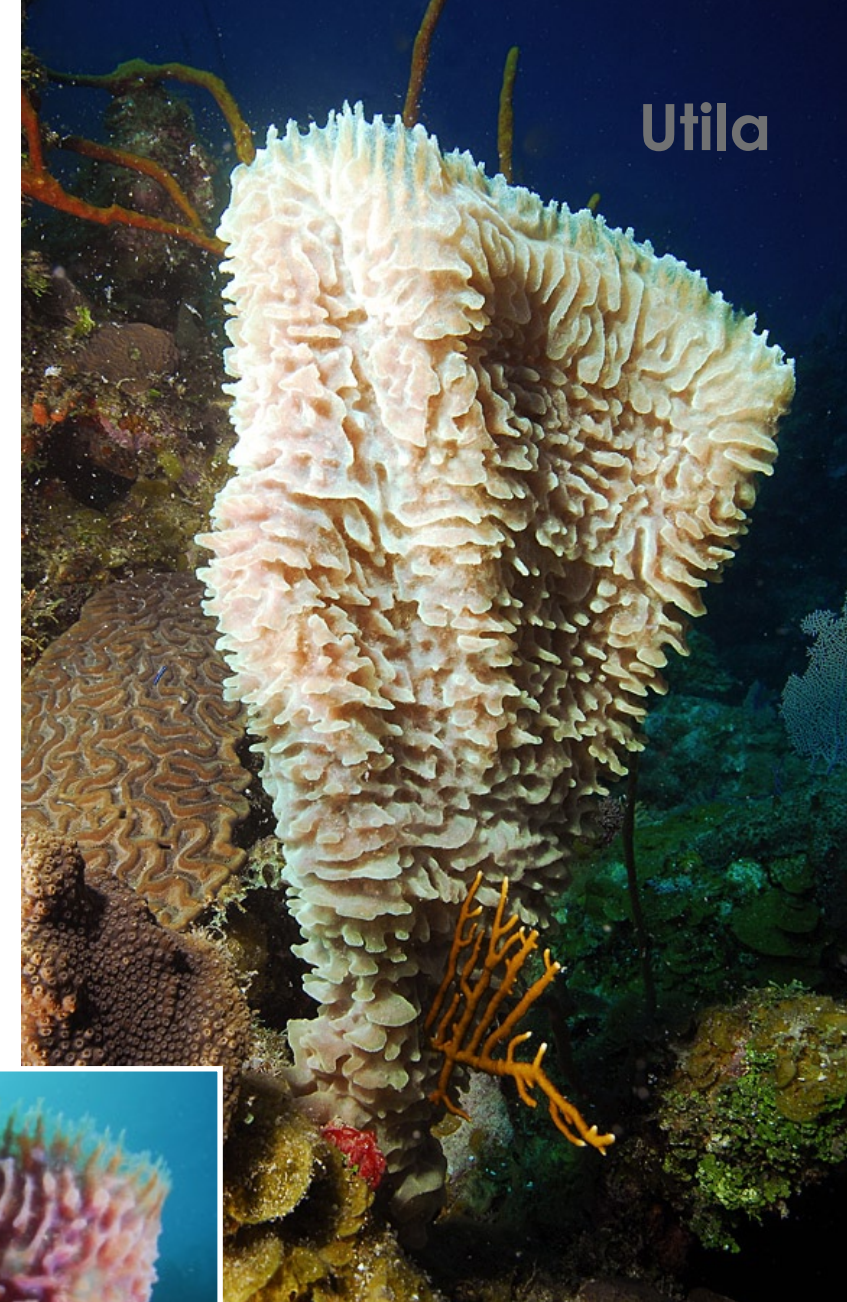
After swimming through a meandering canyon hewn into the reef top, we emerged at a precipitous wall. The waters beyond were hued in the most incredible shade of blue I've ever seen, with visibility easily surpassing 30m. While no whale sharks made an appearance, there were



CLOCKWISE FROM ABOVE: Reef scene from Duppy Waters; Lizardfish; Nassau Grouper; Branching vase sponge at Black Coral Wall; French grunt; Tobaccofish



CLOCKWISE FROM LEFT: Pillar corals at Black Coral Wall; School of sennet, a species of barracuda; White vase coral and pink vase coral at Black Coral Wall



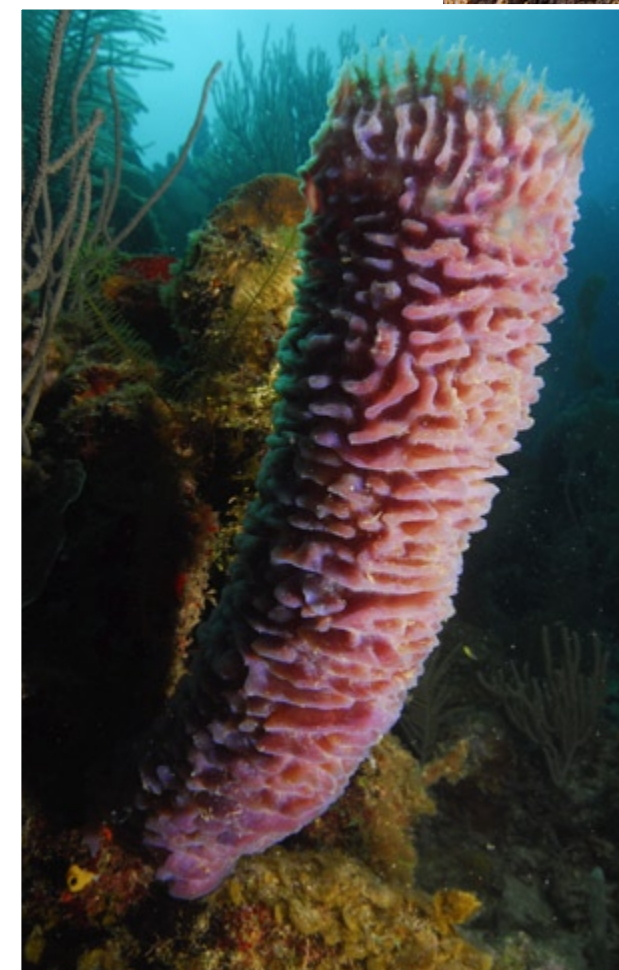
a striking wardrobe of black and white accented by an elegant sinuous dorsal fin, it flitted incessantly above the corals, seemingly oblivious to my presence.

Especially captivating were the myriad of sponges on display. Boasting a wild array of shapes, sizes and colours, they soon became one of my favourite photo subjects. One species, however, was like nothing I've seen before. Standing erect like inverted bugles, vase sponges were garbed in a rich palette ranging from cream to vivid fuchsia. Dominating the reef top was an immense pillar coral. Resembling the ramparts of a submarine medieval castle, the towering spires attracted swarms of Bermuda chub, Atlantic spadefish and a couple of hefty drum fish. I ended up doing this dive several times during my stay. Each visit revealed new surprises, with the undisputed highlight being a pair of spotted eagle rays gracefully swimming side by side.

Iguana excursion

One afternoon, I took a break from diving and hopped on a tuk-tuk for a visit to the Iguana Research and Breeding Station (IRBS) on the outskirts of town. Under the guidance of biologist Helder Perez, the project is part of

The Bay Islands Foundation, a private non-profit organization committed to the protection of the country's endangered flora and



fauna through a series of conservation projects.

The IRBS was born in 1997 with the main purpose of protecting and preserving the spiny-tailed iguana, a species endemic to Utila. Known locally as swampers, the iguanas are threatened with extinction due to illegal hunting, uncontrolled development and destruction of their mangrove forest habitat.

The foundation receives volunteers interested in doing scientific research of the island's biology and ecology as well as in participating in the conservation projects for iguanas. Helder then took me on a tour of the centre, which featured a number of informative displays



CLOCKWISE FROM LEFT: Iguana at mealtime; Stoplight parrotfish; Red shrimp; Banded coral shrimp; Juvenile swamper

on the island's ecology. Despite its compact size, Utila is home to a remarkable number of species, with new discoveries being made all the time. One room housed a large cabinet containing a series of incubators, where the iguana eggs are kept prior to hatching. To date, 750 hatchlings have been released in the wild.

Afterwards, we went outside to a series of enclosures, where



termites with wild abandon. Nearby, another enclosure contained a pair of fully-grown breeding adults as well as a large green iguana that was missing its left forelimb.

It was also feeding time for a highland iguana, the third of the island's iguana species. The meal consisted of an odd pairing of fiddler crabs and hibiscus flowers, which the hungry lizard greedily gulped down with gusto.

Perched beside the enclosure door was another island resident, a formidable looking Honduran tarantula. The centre's volunteers wouldn't touch it with a ten-foot pole, but a small boy gleefully plucked the large arachnid from its perch!

Night dive

After rushing back to the dive centre, I was fortunate to join a group of dive-masters for a night dive. Our destination was Silver Gardens, a short boat away. I couldn't wait to see what macro treasures Utila's waters would reveal at night. Frank, my dive guide, soon proved adept at finding critters and my camera's shutter clicked away happily for the ensuing 50 minutes.

Shrimp were everywhere, their beady eyes glowing red in my strobes'





Parrotfish at night (left)
Red nudibranch (bottom left)
Spotted scorpionfish at night (below)

Utila

a noise that I first took to be our boatman revving the engine in a series uniform of bursts. Confusingly, it seemed to grow louder and then softer again for no apparent reason. Then, at one point it got REALLY loud. In fact, the sound became so intense I could feel the vibration right down to my very bones! Nearby, I could see Frank diligently searching for something underneath a rocky overhang.

Then, I remembered a conversation from the previous day, and a light went off in my head. It had to be a toadfish! With their broad and flat heads sporting barbels, spiny cheek protrusions and enormous mouths brimming with scores of sharp teeth, these sluggish bottom dwelling fish are more often heard than seen. It certainly was the

case that evening, as the elusive creature retreated into to a dark recess before I was able to catch a glimpse of it.

Still, the dive had one more surprise in store. Just as we were approaching the ladder, a Caribbean reef octopus regarded us suspiciously from the reef top before vanishing under some corals.

While consulting the reef guide back at the resort, I made a surprising discovery. It seems that two of the parrotfish species I had been observing all week was, in fact, one. The stoplight parrotfish undergoes a dramatic colour metamorphosis as it reaches adulthood. Juveniles are light grey in colour with a lattice pattern of chocolate brown punctuated

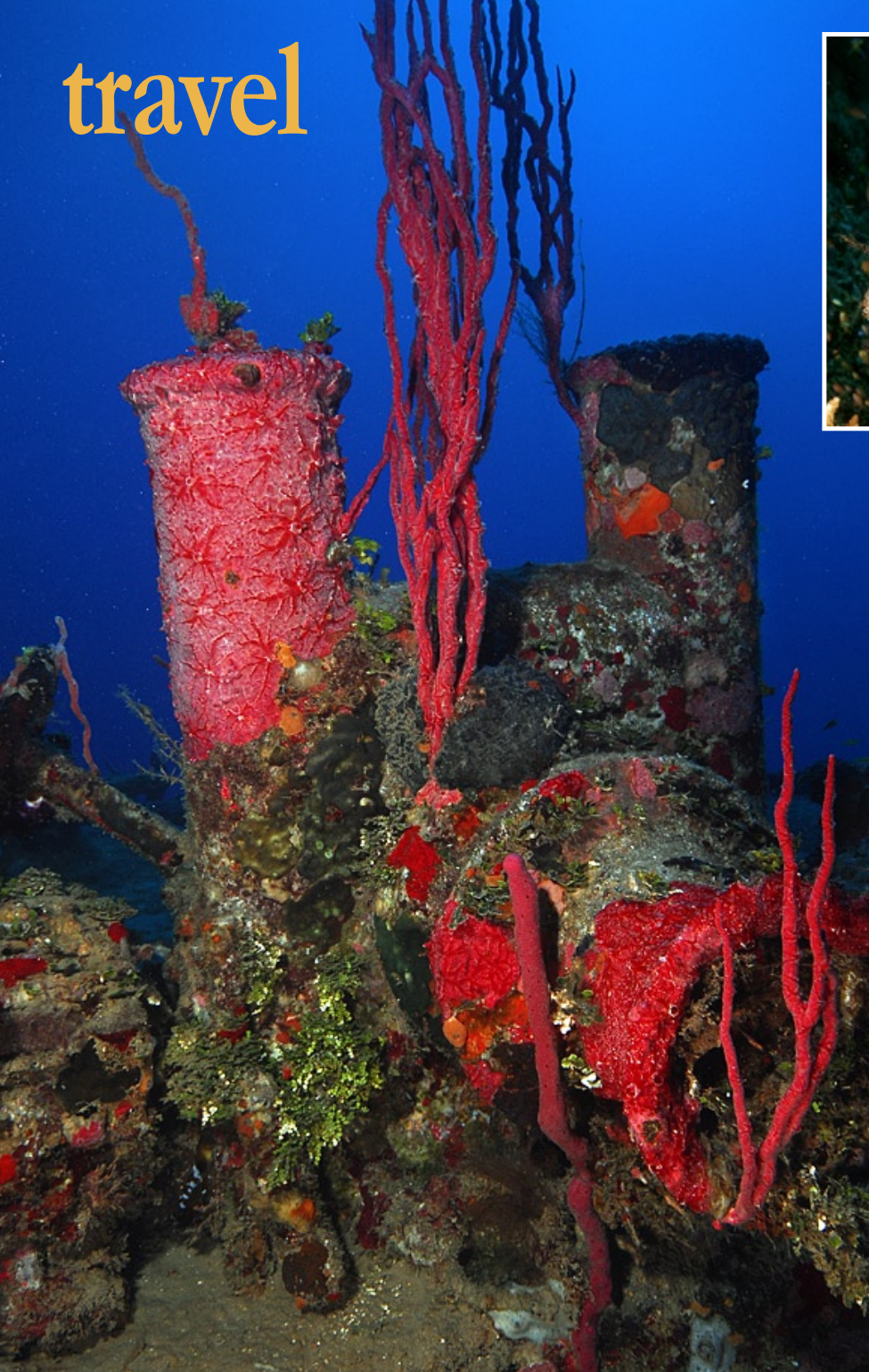


spotting lights. A couple of familiar faces even showed up: a pair of banded coral shrimp. I even spotted a large bright-red nudibranch, a rarity in Caribbean waters. Although resembling a Spanish dancer, Frank said it was another species entirely.

The sandy area between bommies was crawling with spotted goatfish, while a foraging blue conger eel was an unexpected surprise. In some plac-

es there was almost a bit TOO much life, as the water was literally seething with masses of wriggling red worms. For some reason, they seemed to be utterly entranced by the spotting lights of my underwater strobes, more so than everyone else's torches.

I also had a close encounter with one of the Caribbean's most unusual residents, not visually but audibly. Early into the dive, I kept hearing faint

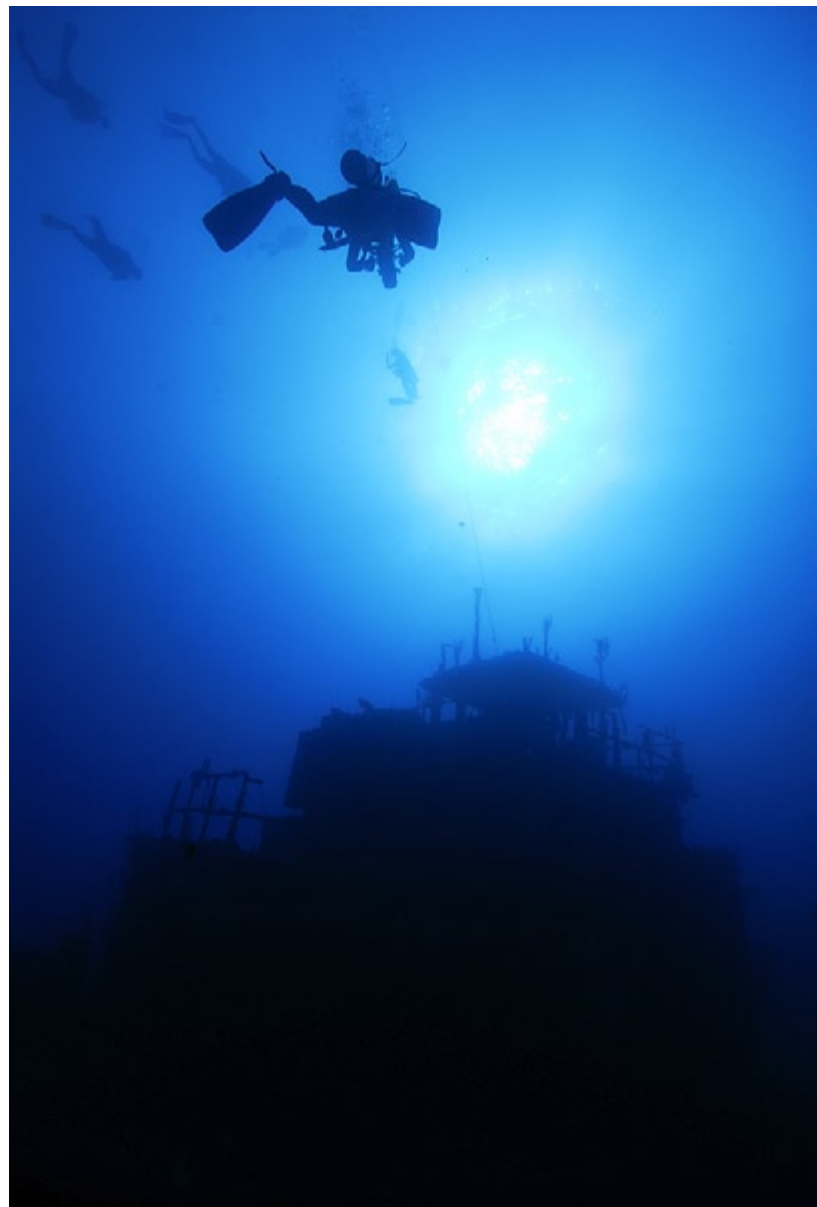
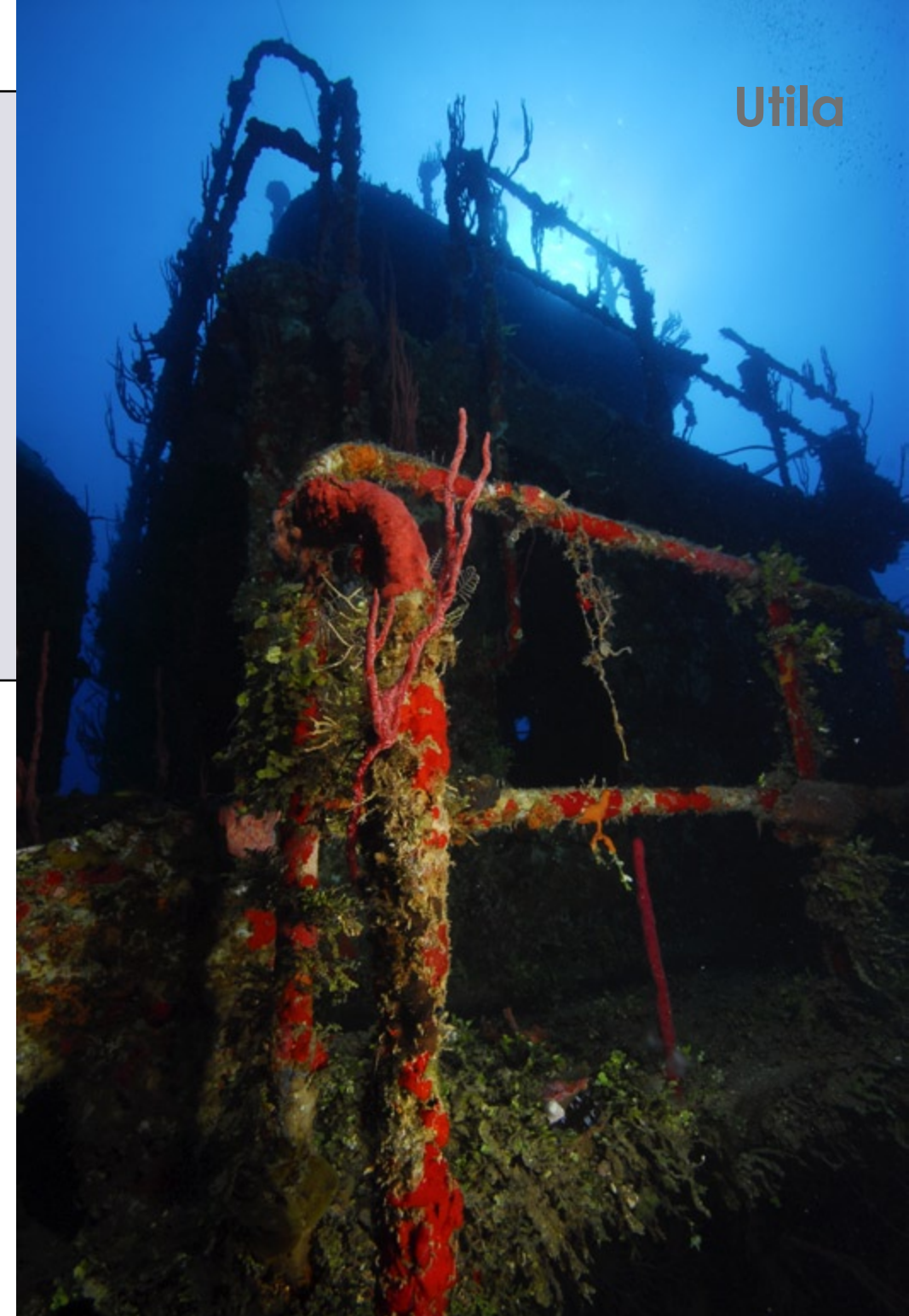


Lionfish

The poster said it all, "Wanted: Dead or alive." Emblazoned underneath the bold type was

a large image of a lionfish, Utila's newest and most unwelcome arrival. Since its first appearance in Utila's waters in the middle of 2009, the local community has declared all-out war on this destructive interloper. Just how they arrived is open to a good deal

of debate. One version theorizes that several escaped from an overturned aquarium when Hurricane Andrew slammed into Florida in the 1990s. Others put the blame on Hurricane Katrina. Whatever the reason, lionfish are now firmly entrenched in Caribbean waters with the potential of wreaking environmental havoc on local ecosystems. In their natural home in the Pacific, lionfish breed only once a year, but in the Caribbean, it has been discovered that they breed five times a year. To combat this potentially catastrophic problem, a vigorous eradication programme has been implemented to rid Utila's waters of this uninvited menace. ■



vessel sits upright on a flat, sandy bottom at a depth of 30m. An inter-island supply vessel, it was deliberately sunk in 1998 by the Utila Dive Operators Association to create an artificial reef.

Descending the mooring line into the blue, the ghostly outline of the ship soon became visible. This was one seriously big wreck! Stretching 30m from bow to stern, I could already see the dive time wasn't going to be nearly long enough. Although it's possible to penetrate the cargo hold, I decided to concentrate on the exterior. On the sand below was a decidedly unusual sight: the skeleton of a pilot whale. Nearby, a corroded bicycle tire played home to a lizardfish and arrow crab while a large spiny lobster peered out from an opening at the vessel's base.

Near the bow, an H-bitt for securing mooring lines was enveloped with red star encrusting sponges and capped with a pore rope sponge, looking like an oversize stick of dynamite. As fairy basslets and queen angelfish flitted past, a peculiar jumble of objects caught my attention. On the vessel's uppermost section,

a number of items had been adhered to the railing ranging from a mannequin's head with mask to a PADI card. I later discovered that some divers like to leave personal mementos behind. While everyone doesn't approve of this practice, it has nevertheless become something of a tradition. On a decidedly smaller

by a vivid crimson belly. Adult males are blue-green accented with pink. In most parrotfish, individuals start out as females and change to males. Adding to the confusion is that some spotlight parrotfish develop directly to males from the get go. These individuals often resemble the initial phase, and often display a different

mating strategy than the terminal phase males of the same species. The verdict? Mass confusion all around!

The Haliburton Wreck

One of the week's highlights was a dive on Utila's biggest and most famous wreck, the *Haliburton*. Situated off the island's south coast less than ten minutes from town, the



scale, Ron's Wreck is also a lot shallower, lying at a depth of 14m. Since it sank in 1991, the vessel has been colonized

by a veritable tangle of sponges and corals and is home to Christmas tree worms, shrimp and lobsters. The



abundant fish life included blue chromis, Spanish hogfish, four-eye butterflyfish, tobaccofish, barred hamlets and a school of blue tang.

Venturing along the wall towards Ted's Point yielded a few more surprises. Hovering beside a fan coral was a massive yet tolerant Nassau grouper. Unfortunately, I was equipped for macro, so I had to content myself with some facial portraits. A small canyon jutting off the main wall proved to be a real bonanza. After firing off a few images of an arrow crab, I practically bumped into a spiny lobster. A scant metre from that was a massive red crab followed by an adult spotted drum. At nearby Moon Hole, I spotted a gorgeous flatworm flecked with orange spots, something I hadn't encountered during my entire visit.

Jade Seahorse

Before I knew it, the week was rapidly drawing to a close. However, there was one more land-based attraction that I was told I simply couldn't miss. All week I'd been hearing about a place called the Jade Seahorse, which was barely a minute's walk from my hotel. Comprised of a restaurant, cabins and bar, the somewhat unassuming exterior bore no portent as to the marvels that lay inside. As I entered through the main gate to the garden, I literally stopped dead in my tracks. Before me lay a whimsical setting straight out of Alice's Wonderland.

Over a number of years, the owner has lovingly crafted his verdant property into marine-themed fantasyland of glazed tile, bottles and glass. An unbridled assortment of platforms, gazebos, bridges and pathways were swathed with incredible mosaics jam-packed

THIS PAGE: Scenes from the Jade Seahorse garden created by the owner out of glass, bottles, tiles, ceramic plates and other found objects

with detail. Overlooking the proceedings was the Treetanic Bar, a ship wrecked in the branches of a trio of mango trees towering over the front yard. There was even a hotel called Nightland, consisting of several private cabins. The detail was astonishing, and the hour I spent wandering the grounds was not nearly long enough. Definitely worth a return visit.

Pumpkin Hill

On my last diving day, Andy had a very special dive in mind. Like an undersea version of Pumpkin Hill, the Pumpkin Hill Banks is a large and round-topped seamount situated off the island's southeast coast. It was also deep, with the top lying



Utila Centre for Marine Ecology

Established in 2006, The Utila Centre for Marine Ecology's aim is to improve the welfare and economic growth of Utila by supporting the management and sustainable use of its marine biodiversity. With its unique location and variety of marine habitats, Utila is an ideal centre for ecological research. In addition, the island provides an interesting development model as the community shifts from strong historical links with fishing to its current reliance on reef based tourism.

Currently, Utila's dive industry supports up to 85 percent of the island economy. While global coral reefs face increasing threats, major bleaching events in recent years have hit Caribbean reefs especially hard. The project's goal is to identify and reduce local stressors to coral reefs, to make them more resilient to global environmental changes and will achieve this by integrating targeted research, with ongoing monitoring and community management.

The UCME has grown rapidly to become a focal point for the investigation of tropical marine and island

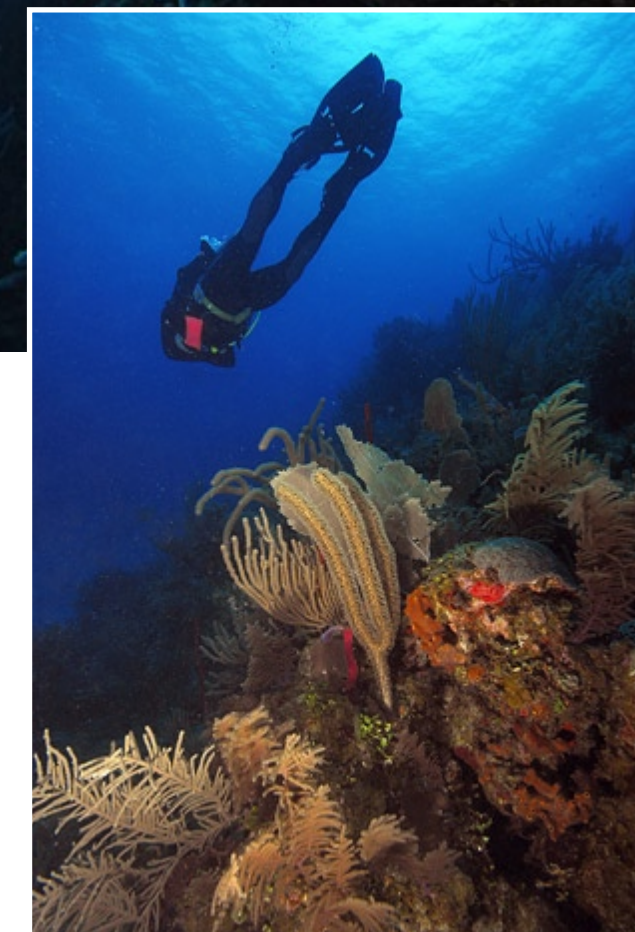
biodiversity and now provides technical capacity in marine research to the Honduran government. Research focuses on identifying and studying factors that create, maintain and influence the islands biodiversity, providing information, which can guide management decisions and underpin effective conservation. Combining cutting edge marine science with volunteer programmes and educational courses, divers and non-divers alike can assist national and international researchers as they study the island's wealth of biodiversity.

A variety of projects are currently underway, including the establishment of a locally managed conch farm, studies on assessing the extent and health of the mangrove systems, lionfish eradication and studies monitoring local fish populations. The local community is highly supportive of the centre's efforts and is actively integrated into the various research studies, working side by side with marine biologists and conservation specialists to better understand and conserve Utila's threatened marine environment. ■

at a depth of 32m. Swept by strong currents that bring in the nutrients, local fishermen have long known the spot to be a prime fishing ground.

Our group was small, with only myself, two ladies from New York, Andy and Frank. With two of the island's most experienced diversmasters on hand, I knew we were in good hands. I asked Andy if Captain Anthony

needed GPS to pinpoint the exact location. "Not necessary," he responded. "He can find it by sight." Using the outline of Pumpkin Hill and a few distant trees as landmarks, Anthony was able to find the spot with minimal difficulty. To help maximize bottom time (which admittedly wouldn't be long) we went down on Nitrox. Surface currents here can sometimes be strong,



CLOCKWISE FROM ABOVE: Diver in the sun; Fan coral at Black Hills; Diver and reef at Ted's Point

but we lucked out and were able to descend quickly. As it was a blue water descent, Frank took along a second tank as a safety precaution.

Moments after descending, the seamount's dim silhouette loomed into view. Glancing at the depth on my computer, I saw my bottom time steadily click down into single digit numbers. Due to the incessant battering by strong currents, the summit was covered with short

knobby corals and a plethora of squat barrel sponges. I just got myself in position to take a photo and realized my depth was 42.6m. My remaining bottom time was all of three minutes! Not wanting to go into deco, I reluctantly started to ascend with the others. Final dive time: 20 minutes. Short but sweet.

That sentiment also summed up my weeklong visit. Utila took me completely and happily by surprise. Did it have the

Pacific's biodiversity? Of course not. Instead, I embraced the differences rather than bemoan them and experienced its wonderful dive sites and array of brand-new species. Alas, the whale sharks failed to make an appearance, but the diversity of undersea life, combined with wonderful people and an easygoing island ambiance makes Utila a must for all divers. I guess I'll just have to come back for the whale sharks. ■

fact file

Honduras



SOURCE: CIA.GOV WORLD FACTBOOK

History In 1821, Honduras became independent of Spain. Military rule followed for two and a half decades until 1982, when a freely elected civilian government came to power. The country proved a haven during the 1980s for anti-Sandinista contras fighting the Marxist Nicaraguan Government. Honduras was also an ally to Salvadoran Government forces, which were fighting leftist guerrillas. In 1998, the country was devastated by Hurricane Mitch, which killed around 5,600 people and caused about US\$2 billion in damage. The economy has slowly rebounded since then. Government: Democratic constitutional republic. Capital: Tegucigalpa

Geography Honduras is located in Central America and borders the Caribbean Sea, between Guatemala and Nicaragua. It also borders the Gulf of Fonseca (North Pacific Ocean), between El Salvador and Nicaragua. Coastline: 820km. Terrain is mostly mountainous in the interior with narrow coastal plains. Lowest point: Caribbean Sea 0m. Highest point: Cerro Las Minas 2,870m. Note: While the country has a short Pacific coast, it has a long Caribbean shoreline, including the mostly uninhabited eastern Mosquito Coast.

Climate Lowlands are subtropical; Mountainous regions are temperate. Natural hazards include common but mild earthquakes as well as frequent damaging hurricanes and floods along the Caribbean coast.

Environmental issues

include expanding urban population; deforestation due to logging and clearing of land for agriculture; soil erosion and further land degradation accelerated by uncontrolled development and farming of marginal lands; heavy metal contamination of freshwater sources by mining activities. Honduras is party to the following agreements: Biodiversity, Climate Change, Climate Change-Kyoto Protocol, Desertification, Endangered Species, Hazardous Wastes, Law of the Sea, Marine Dumping, Ozone Layer Protection, Ship Pollution, Tropical Timber 83, Tropical Timber 94, Wetlands.

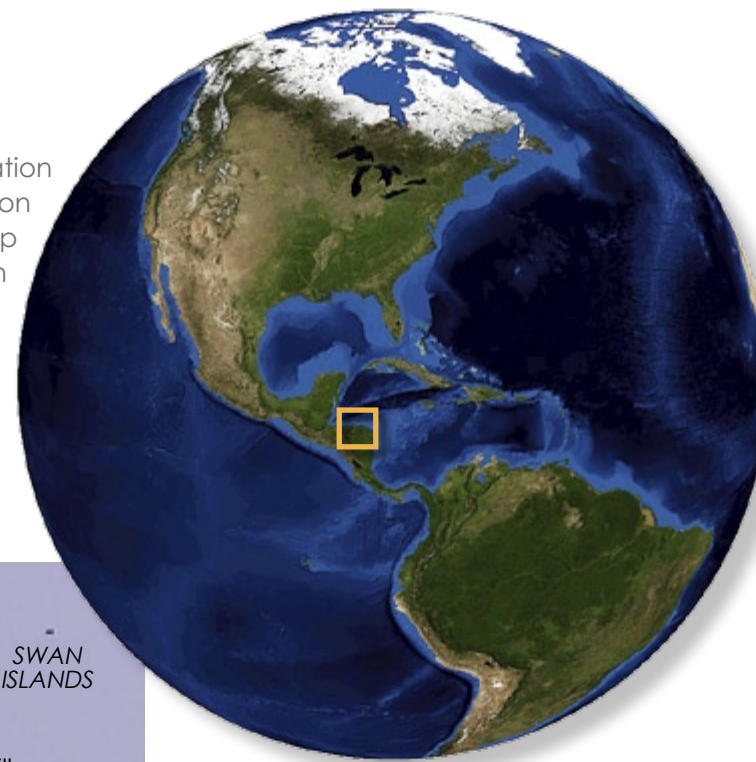
Economy Honduras is the second poorest country in Central America. It suffers from extremely unequal distribution of income, as well as high unemployment and underemployment. Heavily reliant on a narrow range of exports such as apparel, bananas, and coffee, the nation's economy is vulnerable to changes in commodity prices and natural disasters; but, investments in the maquila and non-traditional export sectors are contributing to a gradual diversification of the economy. Almost half of the country's economic activity is directly tied to the United States. In 2006, the U.S. Central America Free Trade Agreement (CAFTA) came into force. It has helped increase investment,

however security and political issues may be deterring potential investors. Marginal economic growth in 2010 will not improve living standards for those in poverty, which is almost 60 percent of the population. The fiscal deficit is growing, despite improvements in tax collections because of increases in current expenditures to cover increasing public wages. Natural resources: timber, gold, silver, copper, lead, zinc, iron ore, antimony, coal, fish, hydropower. Agriculture: bananas, coffee, citrus, corn, African palm; beef; timber; shrimp, tilapia, lobster. Industry: sugar, coffee, textiles, clothing, wood products, cigars.

Currency Lempiras (HNL) Exchange



RIGHT: Location of Honduras on global map
BELOW: Location of Utila Island on map of Honduras
FAR RIGHT: Detail from the Jade Seahorse garden



rates: 1EUR= 24.84HNL; 1USD= 18.92HNL; 1GBP= 29.42HNL; 1AUD= 17.94HNL; 1SGD= 14.21HNL

Population 7,989,415; Below poverty: 59% (2008). Ethnic groups: mestizo (mixed Amerindian and European) 90%, Amerindian 7%, black 2%, white 1%. Religions: Roman Catholic 97%, Protestant 3%. Internet users: 658,500 (2008).

Language Spanish, Amerindian dialects

Health There is a high degree of risk for food or waterborne diseases such as bacterial diarrhea, hepatitis A and typhoid fever as well as vectorborne diseases such as dengue fever and malaria and water contact disease such as leptospirosis (2009)

Hyperbaric Chambers
Utila Hyperbaric Chamber
Bay Islands College of Diving
Utila, Bay Islands of Honduras
www.dive-util.com

Websites
Let's Go Honduras
www.letsgehonduras.com



Indonesia's Sulawesi

Muck diving & diversity

Text and photos by Eric Hanauer





Text and photos by Eric Hanauer
www.ehanauer.com

Sulawesi is one of those places on nearly every diver's bucket list. If not, it ought to be. A dozen years ago, people would have thought you daft to go diving there, much less build a dive resort in an area dominated by dark volcanic sand. Yet in Sulawesi there are nearly two dozen resorts vying for divers' dollars, yen and euros.

Sulawesi came on my radar when I first set eyes on Roger Steene's book, *Coral Seas*, published in 1998. At the time, the last thing on my wish list was another coffee table book. I had been diving nearly 40 years and thought I'd seen just about everything I wanted to see underwater. But when I spotted the weird, exotic animals in that book, I realized what I'd been missing. An inordinate number of them were photographed in Sulawesi.

My first trip to Sulawesi was in 2005 on the liveaboard *Aqua One*, motor-ing through Bunaken and Lembeh Strait. When I returned home and matched all the critters still miss-

ing against Steene's book, I vowed to return. I've never been a fan of checklist diving, but after seeing shots of mimic octopuses, rhinopiases, bob-bit worms and stargazers, I realized that I'd missed the boat. So, when the opportunity finally arose, nobody had to twist my arm.

This time, it would be a slow and leisurely two weeks, split between two land based resorts: Cocotinos in the Bunaken area, and Kasawari in Lembeh Strait. Bunaken Island features the dropoffs, walls and colorful invertebrate life we all associate with the tropical Indo-Pacific. Yet, there's also excellent muck diving offshore. Lembeh Strait has a few coral reefs to

Flamboyant cuttlefish (above); Banggai cardinalfish school (left); Wonderpus in water column (previous page)



Sulawesi

He seemed to know where every frogfish of every color was hanging out, as well as every boxfish and pipefish. The best spot was a rubble pile with three sea horses and two kinds of scorpionfish. Despite the walls, I spent most of my dives at Cocotinos shooting macro.

Kasawari

At Kasawari Lembah Resort, I renewed acquaintances with two Indonesian divers who had pioneered the art of muck diving: Nuswanto Lobbu and Ali Umasangadji. Nus is now the manager of Kasawari, complaining that his office duties preclude very much diving. Although he is a

go along with all the bottom dwelling critters. The good news is that both are within a two-hour drive from Manado's airport, Bunaken on the western side of the peninsula and Lembeh to the east.

Muck diving

First, let's define Sulawesi's brand of muck diving. The substrate isn't really muck, but dark brown to black volcanic sand. That's important for several reasons. First, the big grains settle quickly instead of remaining in suspension and destroying visibility. Second, it's okay for a diver to lie down on the bottom, allowing for eye level shots. No delicate corals will be smushed, but watch out for urchins and stargazers and the like. Finally, the dark colors won't be blown out by the lights of strobes, providing an excellent background for underwater photographs and videos.

Bunaken

Bunaken Island is about a 45-minute boat ride from Cocotinos Boutique Beach Resort. It's a series of classic

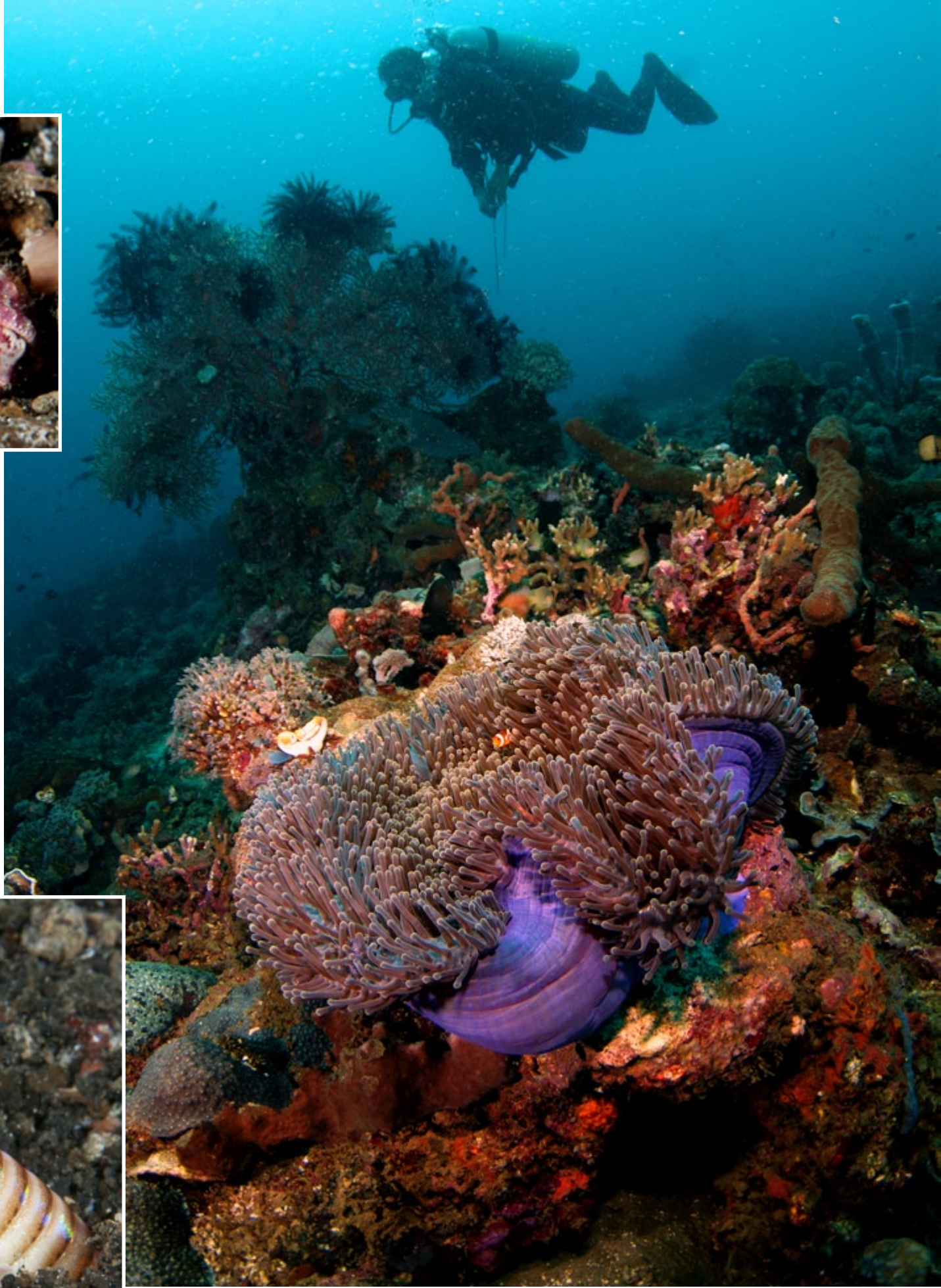
wall dives with virtually every inch covered by sponges, tunicates and hard corals. Clouds of anthias flutter about the reef, joined by fusiliers in the blue. What's missing is big critters; a shark sighting was a big deal. But to me the big deals were mating nudibranchs, ribbon eels, a juvenile lionfish and an extremely cooperative jawfish. I kept peering down the wall, but the computer and Nitrox nixed those thoughts.

The first thing my guide, Tono, promised was to find me a pygmy seahorse. The first thing I replied was that everybody had pygmy seahorse photos, I'm not into super macro, so let's find other things. Tono seemed relieved.

relative newcomer to underwater photography, Nus' uncanny ability to find critters has resulted in images that make the pros jealous. Ali, despite many years of guiding, still radiates joy when finding rare and exotic marine



LEFT TO RIGHT: Carrier crab with fire urchin; Amicus scorpionfish; Hairy frogfish



their nuptials. My problem was that three layers of red plastic made the light too dim to focus by.

On the following night, I used only one layer, which was like no red light at all. But I aimed it downward, until the mandarins began their upward sprint into ecstasy. Then, I was able to get the beam on them, autofocus and shoot. That technique resulted in about five times the keepers of the previous night. Mandarins are the most beautiful fishes on the reef, and they know it.

Bobbit worm

Another night critter on my wish list was a bobbit worm. A meter or more

the bottom. After a few strobe flashes, he seemed to resent this invasion of privacy and buried the female in the sand, leaving only her eyes protruding.

Mandarinfish

Mating mandarin fishes at dusk presented a different challenge. For those who haven't tried shooting them, the exercise consists of

50 minutes of boredom followed by five minutes of chaotic action. That's when the male and female suddenly spurt out of the coral maze into the water column, release their eggs and sperm, and dash back under cover. Common practice is to use a red modeling light to avoid inhibiting



life. In Sulawesi's muck, a shooter is almost totally dependent upon the guides. Occasionally, I was able to locate my own subjects, but for at least 80 percent of the images in this spread, credit must be shared with Tono, Ali, Robin, Hanni and Indra.

Critters

On the first night dive in Lembeh, I made a find of my own: a pair of mating crabs. The male was on top of the female, and slowly dragged her along



CLOCKWISE FROM TOP LEFT: Mandarinfish pair; Box crab; Diver hovers over lush reef; Bobbit worm; Mating crabs



Sulawesi

Rhinopias is an exotic variety of scorpionfish, another ambush predator that crawls along the bottom on prehensile "feet." It took nearly all of the two weeks to find one. Then Indra and I were grubbing around the bottom when we ran into some other divers and guides. He inquired via signs and a slate, and they took us to the rhinopias. At first glance, it was disappointing: a tiny brown fish about the size of a child's fist. But strobe shots showed it to be a brilliant orange. My final shot was the keeper: mouth open, lit from underneath for a touch of menace. There are six species of rhinopias; this one was an Eschmeyer's.

Mimic octopus

The mimic octopus is the star of the show in Lembeh. This unusual

cephalopod gets its name from the incredible shape, texture and color shifting it goes through to escape from predatory photographers. These shapes may include a ray, a sea star, a lionfish,



CLOCKWISE FROM ABOVE: Stargazer; Rhinopias; Mimic octopus

long, it stays mostly buried in the sand, but will dart up when a piece of bait is dangled out there. It won't stay for long, just grabbing for the bait and retreating again. Depending on your frame of reference, it resembles a sandworm from the *Dune* books by Frank Herbert, or a big penis.

The animal was named after Lorena Bobbit, who chopped off her husband's organ after he had been unfaithful. Carrying the parallel a step further, a popular folk myth states that the female worm bites off the male's penis after copulation and feeds it to her young. Not true. Bobbit worms are broadcast spawners, releasing sperm and eggs into the water column. Mama will never see her ugly babies.

Stargazers

One basic rule I followed in Lembeh was to never miss a night dive. I had botched my stargazer shots on the previous trip, so I asked Ali to find me one. It was like ordering food off a menu. He found not

one, but several.

A little fish swam close by, and the stargazer erupted out of the sand and inhaled it. I was too slow on the trigger to catch the action.

Stargazers are so ugly they are cute. Their perpetual toothy frown is reminiscent of a stonefish, as is their Jabba the Hutt shape and venomous spines. Like frogfish, they have a fleshy lure that attracts victims for ambush predation.

Rhinopias

A rhinopias was at the top of my wish list.



or even a crab. Whether these shapes are random or intentional is open to conjecture, but either way it's quite a performance. The wonderpus is a close relative, with shape-shifting

talents of its own, but not to the extent of the mimic. How can a diver tell them apart? The mimic octopus has a white stripe running down the underside of each tentacle. Both species were discovered only within the past 15 years.

Lasting Impressions

After a while I started looking for more on my own. Fire urchins often hide tiny zebra crabs in their spines. They in turn are often carried along the bottom on the backs of carrier crabs. Delicate porcelain crabs may be found in the same anemones as clownfishes. Slipper lobsters roam the sand at night on long, spindly legs. The giant among Lembeh nudibranchs is the solar power nudie, nearly a foot long, with fleshy lobes all along its body.

One of my favorite sites from the earlier trip was the police pier. Among the rubble, there were hundreds of the beautiful Banggai cardinalfishes, hanging out among sea urchins, anemones and old tires. Unfortunately, the pier is now actively used by big boats, so diving underneath and around it is forbidden.

However, we did make a dive about 50 yards away, where we encountered a white mantis shrimp. I'd seen all sorts of colorful mantis shrimps but this was the first white one. I suspect it's a regular stop on the police pier tour.

By the end of two weeks, the only critter missing on my to-do list was the blue ringed octopus. But that's a good thing, because it's a strong incentive to return—as if I needed an excuse. ■



CLOCKWISE FROM LEFT: Squat lobster on nudibranch; Juvenile banggai cardinalfish in pink anemone; Close-up portrait of a pipefish

FACT FILE

GETTING THERE From Singapore, Silk Air, a subsidiary of Singapore Airlines, has regular flights to Manado. Most resorts will pick you up at the airport by van. Rides to the resort range from one to two hours.

PASSPORT A current passport with 6 months remaining is required. A 30 day visa is \$US25, payable at the immigration counter in US dollars or rupiah. Airport departure tax is 100,000 rupiah, payable in rupiah. (Don't panic, see next paragraph.)

CURRENCY One euro is equivalent to 11,811 Indonesian Rupiah Credit cards are accepted in almost all tourist facilities. ATMs are located in most towns.

LANGUAGE Bahasa Indonesian. English and Japanese is widely spoken in tourist facilities.

ELECTRICITY 230 volts, European and/or British plugs

CLIMATE Tropical humid. December through April is the rainy season, but diving is good all year round. Water temperatures range from 26 to 28 degrees Celsius (78 to 82 degrees Fahrenheit). A 3mm wet suit will be sufficient for most divers.

TOURIST FACILITIES Those catering to American/European clientele offer a wide range of amenities including Nitrox, wifi, satellite television, spa and massages, and land excursions.

WEBSITES

Cocotinos Cocotinos-manado.com
Kasawari Kasawari-lembeh.com

Thanks to Cocotinos and Kasawari resorts for their help in preparing this article.

Indonesia North Sulawesi

Text by Don Silcock
Photos by Eric Hanauer and Don Silcock

The island of Sulawesi lies like a large broken star in the middle of the vast archipelago that forms the country of Indonesia. It's remote location, roughly a third of the way between the huge islands of Borneo to the west, and New Guinea to the east, places Sulawesi right in amongst what is generally considered to be the richest marine environment in the world — the Coral Triangle.





Sulawesi

ERIC HANAUER



ERIC HANAUER

CLOCKWISE FROM ABOVE: Zebra crab on fire urchin; Nudibranch; Pipefish. PREVIOUS PAGE: Shrimp on sea cucumber

Defined by the Nature Conservancy as the global epicenter of marine biodiversity, the Coral Triangle is characterized by more than 600 species of coral and 3,000 species of reef fish.

To put those numbers into perspective, the Red Sea has around 200 coral species and 1,000 fish species, and the Caribbean, 50 and 900 respectively.

Geographically, the Coral Triangle covers six countries—from

the Philippines in the north to the Malaysian state of Sabah on the tip of the island of Borneo in the west and the Solomon Islands to the east. In between lies Indonesia, East Timor and Papua New Guinea.

The scientific reasons for this tremendous biodiversity are complex and relate to a combination of factors including such technical issues as water salinity, temperature and speciation rates. However, there is little doubt that the phenomenal flow

of water that marine scientists refer to as the Indonesian Throughflow plays a significant role (see sidebar on next page).

Diving North Sulawesi

Divers are basically spoiled for choice when it comes to exploring this part of Indonesia. The area has its own international airport at Manado, serviced by direct flights from Singapore with Silk Air four times a week. Plus it's easily accessed from

both Jakarta and Bali, although that usually involves a short stop at Makassar (Udjung Pandang) in South Sulawesi.

At the tip of North Sulawesi are the Bangka and Gangga Islands, which receive the full force of the Indonesian Throughflow as it first touches land, and offer some exceptional diving if you are an experienced diver and know how to handle strong currents.

On the east coast, there is the critter mecca in the sheltered Lembeh





ERIC HANAUER



DON SILCOCK

area of almost 90 hectares and 97 percent of it is water with the five islands in the park—Bunaken, Manado Tua, Mantehage, Siladen and Nain—occupying the other three percent.

Each of the five islands has its own flavor but the dormant volcano, Manado Tua, with its classic cone shape and sheer size, simply dominates the park. While Siladen Island, with its white sandy beaches and densely wooded interior, has a real desert island look about it. Bunaken Island, in the shadow of Manado Tua, is the most populated island and supports a population of around 4,000 people as well as the majority of the dive resorts that operate in the Marine Park.

The area is renowned for its blue waters, wall diving and pelagic encounters. It's easy to see why, when you look at



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CLOCKWISE FROM TOP LEFT: Wolf lionfish; Lembeh Strait with the volcanic mountain looming on the horizon; Angelfish and trupetfish; Nudibranch



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Straits and some of the most unusual things you will ever see underwater, while on the west coast there is the magnificent Bunaken Marine Park with its steep walls and blue water diving.

The whole area of North Sulawesi is very well served by an assortment of dive resorts plus a number of resident and visiting liveaboards and is

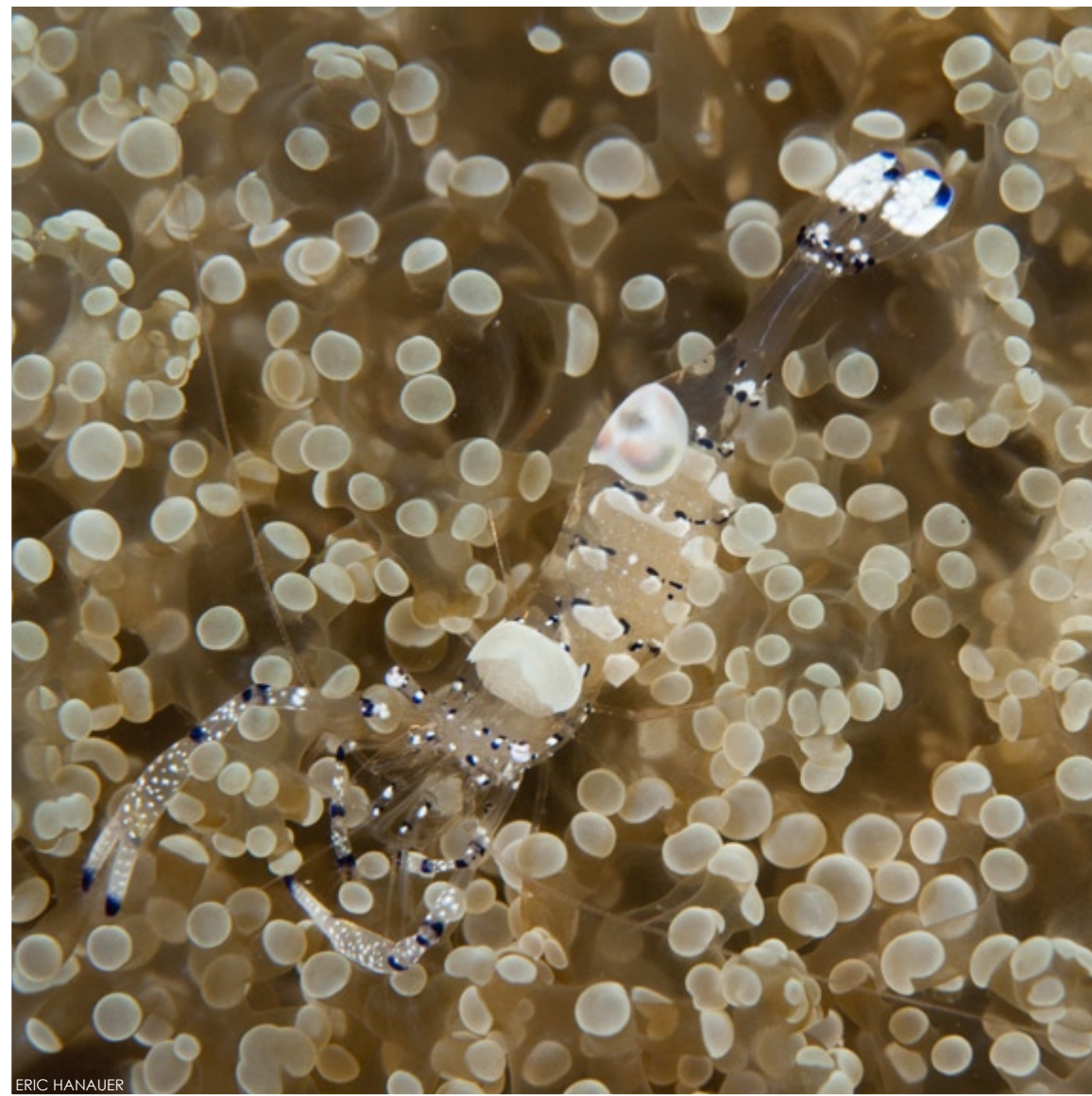
without a doubt a world class destination that justifies an extended stay to make the most of the tremendous diving available.

Bunaken National Marine Park

One of the first parks to be established in Indonesia, the Bunaken Marine Park was created in 1991. It covers an



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White mantis shrimp; Transparent shrimp; Nudibranch; Leaf fish

the sea charts and have a basic understanding of the Indonesian Throughflow. The deep basins to the north and west of Bunaken and to the south in Manado Bay are the source of the blue water. As

the nutrient rich Throughflow surges past the five islands of Bunaken Park, it creates numerous counter currents around them.

The underwater topography and lunar cycles are just some of

it's strongest on the eastern and western sides of the islands and the sites there, such as Timur One and Two are rich in hard and soft corals, sponges and schooling fish,

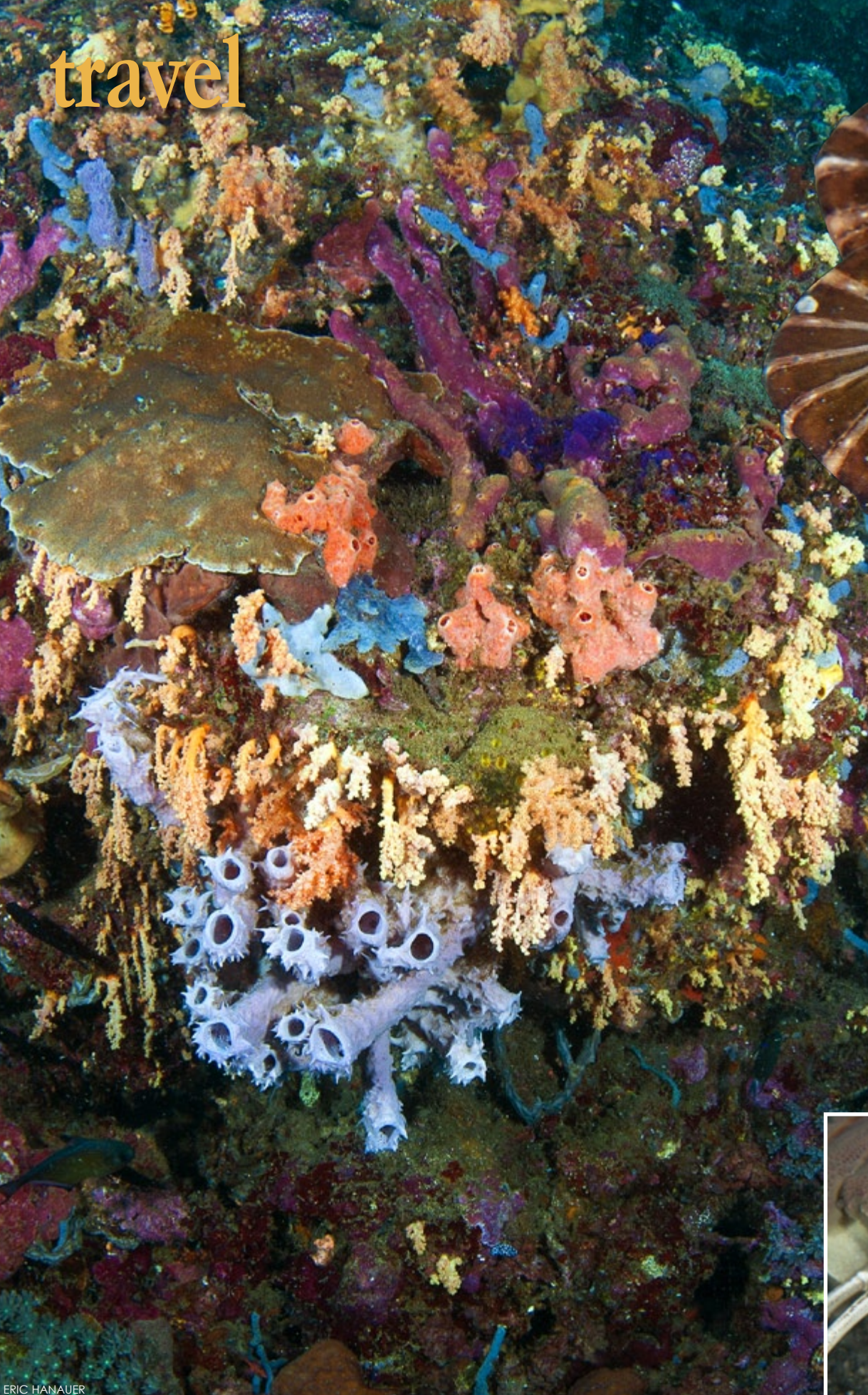
the variables at work, but the end results are biodiversity hot spots that produce some wonderful dive sites. The sites around the crescent shaped Bunaken Island best illustrate these mechanisms, because the island—lying as it does in the middle of the park—faces into the predominant northeast current.

The current is at

nourished by the nutrients from the deep water basins to the north. But the underwater topography between the islands, and the 1,500m deep Manado Bay to the south, creates the swirling counter currents that feed the multiple dive sites on the southern side of Bunaken—such as Lekuan One, Two and Three on the southwest side and the really excellent Fukui on the southwest side.

Diving these sites is a heady experience—particularly on the vertical walls, which drop down into the abyss and create a feeling akin to vertigo on a clear day if you look down!

A mid-morning dive at Timur One and Two on the east coast of Bunaken is simply superb, and



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Sulawesi

probably my favorite dive of all, because the sun is perfectly positioned to illuminate the sloping wall and profusion of corals that provide the perfect backdrop to the clear blue waters.

Fukui was also a memorable dive with giant clams, schooling batfish and sweetlips. My encounter with the huge, ancient and completely indifferent green turtle at Lekuan One was something I will always remember.

So many sites, so much to see, so little time....

Bunaken Critters

The number of critters I encountered while diving Bunaken pleasantly surprised me



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ever tried to get a really good image of just one of these tiny but incredibly photogenic creatures actually looking at the camera will know why I was so excited about two of them both posing for me and for long enough for me to actually press the shutter.

There are some very basic rules for photographing critters. First, you obviously have to be at a site where they can be found. Then, you need the right camera and lens combination to fill the frame, and finally, you need to be able to spot them, and this is where the dive guides come in. There really is no substitute for a good guide, and I was constantly amazed at the critters Fendi could find and direct me to.

brought Andrew Lok's face.

Andrew, the general manager of Cocotinos where I based myself for this trip, had assured me that there were some excellent critter diving sites less than ten minutes from the resort, but having dived the Lembeh Strait the year before, I have to say that I was not really convinced.

So, when I came back on just the second day of the trip with excellent photographs of two pygmy seahorses and a new Bahasa phrase learned from Fendi, my excellent Indonesian guide—*dua pygmy, empat mata* (two pygmies, four eyes)—I knew it was my turn to buy the beers for Andrew!

Anybody who has



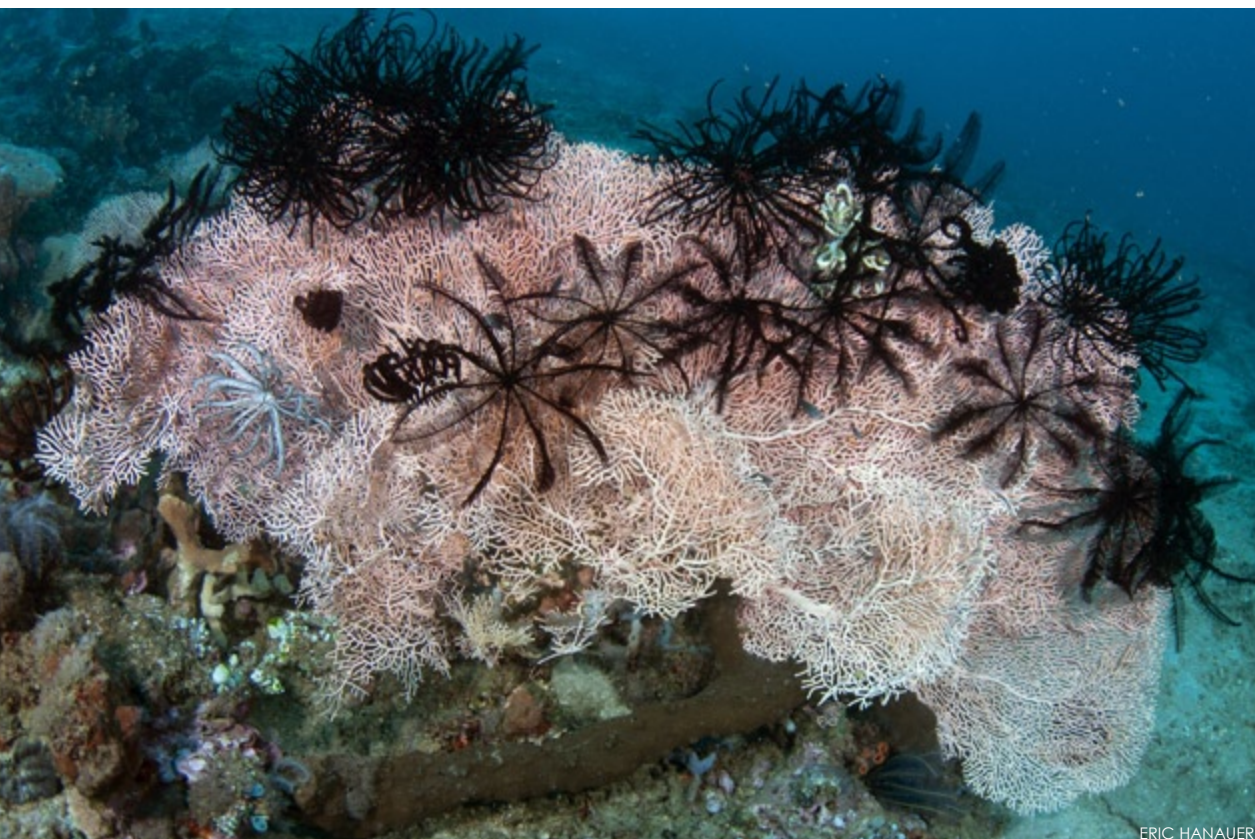
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CLOCKWISE FROM ABOVE: Colorful invertebrates; Wonderpus; Hermit crab with anemones; Nudibranch; Slipper lobster





DON SILCOCK



ERIC HANAUER

Sulawesi



DON SILCOCK

CLOCKWISE FROM FAR LEFT: Local transport through the jungle; A busy day at the pier; Crinoids on sea fan

Cocotinos Resort is located right in the fishing village of Kima Bajo in Wori Bay, north of Manado, and there are some great critter sites to the north of the bay at Aba Point and Odyssey Point and to the south at Gabet and Posi Posi.

Aba Point is a classic critter site, located in a small bay that provides protection from rough weather with a small river providing a constant source of organic nutrients and nearby deepwater for the essential cold water upwellings critters seem to thrive on. It was there that I was able to capture the two pygmies on a small gorgonian fan at 30m, but spent so long with them my beeping computer limited further exploration to an extended 5m deco stop.

The pygmy seahorse is in my opinion the single most

dangerous creature in the sea for underwater photographers!

Posi Posi to the south of Wori Bay is the place to be as the sun goes down because of its resident colony of mandarin fish and their nightly mating ritual—but make sure you get there early and get a good spot, as it can get crowded with boats from other resorts.

Being so close to the world's critter mecca of the Lembeh Strait is obviously challenging, and you won't find the really exotic critters, such as hairy frogfish and Ambon scorpion fish in Bunaken, but there is no doubt that there is a lot of small stuff to see on the western side of North Sulawesi.

Lembeh

There really is no other place quite like the Lembeh Strait—it's simply unique!

Located as it is between the eastern side of the tip of North Sulawesi and the island of Lembeh, the strait benefits from the rich flow of deep sea nutrients of the Indonesian Throughflow, and its cold waters plus sheltered bays on both the mainland and Lembeh side provide the protected areas for the critters to thrive.

And thrive they certainly do—attracting divers and underwater photographers from all over the world to witness the incredible selection of the weird, wonderful and downright strange creatures the sea can offer.

For underwater photographers, it's a "must do", and many divers will enjoy it, too. But it has to be said that it's not everybody's cup of tea. The water can be

quite cool, and the visibility, challenging at times. Plus, if you are not taking photographs, critters that can disguise themselves to look just like a rock or a crinoid look like rocks and crinoids and may not hold your attention like a stunning coral reef can.

I chose to stay at Cocotinos because its location at Kima Bajo meant that I could get to all the main dive sites around Bunaken. Plus, it's a relatively easy 90-minute drive over to Lembeh, which means that you can have the best of both worlds—diving the walls and reefs of Bunaken plus some of the famous sites in Lembeh like Hairball and Nudi Falls.

Having spent a week at Lembeh last year dedicated to critter diving, this balance of a couple of days there in between the rest at Bunaken proved to be a perfect way to spend ten days in North Sulawesi.

For more information, visit: www.indopacificimages.com ■

fact file

Indonesia



SOURCES: CIA.GOV WORLD FACTBOOK, STARFISH.CH

History In the early 17th century, the Dutch began to colonize Indonesia. From 1942 to 1945, Japan occupied the islands. After Japan's surrender in WWII, Indonesia declared its independence, however, it took four years of negotiations, recurring hostilities and mediation by the United Nations for the Netherlands to finally agree to transfer sovereignty in 1949. 1999 marked the year of Indonesia's first free parliamentary election after decades of repressive rule. The world's third-largest democracy, Indonesia is the world's largest archipelagic state. It is also home to the world's largest Muslim population. Current challenges include: improving education, alleviating poverty, curbing terrorism, initiating economic and financial reforms, controlling corruption, holding the military and police accountable for human rights violations in the past, addressing global warming, and controlling bird flu. An historic peace agreement with armed separatists in Aceh was reached in 2005, which led to democratic elections in Aceh in 2006. However, the government still faces sporadic armed resistance by the separatist Free Papua Movement. Government: republic. Capital: Jakarta

Geography Indonesia is an archipelago of islands located in Southeastern Asia, between

the Indian Ocean and the Pacific Ocean. Coastline: 54,716 km. The terrain is mostly coastal lowlands with interior mountains on the larger islands. Lowest point: Indian Ocean 0m. Highest point: Puncak Jaya 5,030m. Note: Indonesia is made up of 17,508 islands of which 6,000 are inhabited. It straddles the equator in a strategic location adjacent to major sea lanes from Indian Ocean to Pacific Ocean. Piracy and armed robbery has been known to occur against ships in the territorial and offshore waters in the Strait of Malacca and South China Sea.

Climate Indonesia has a tropical, hot, humid climate with more moderate temperatures in the highlands. Natural hazards include severe droughts, occasional floods, earthquakes, tsunamis, volcanic activity and forest fires.

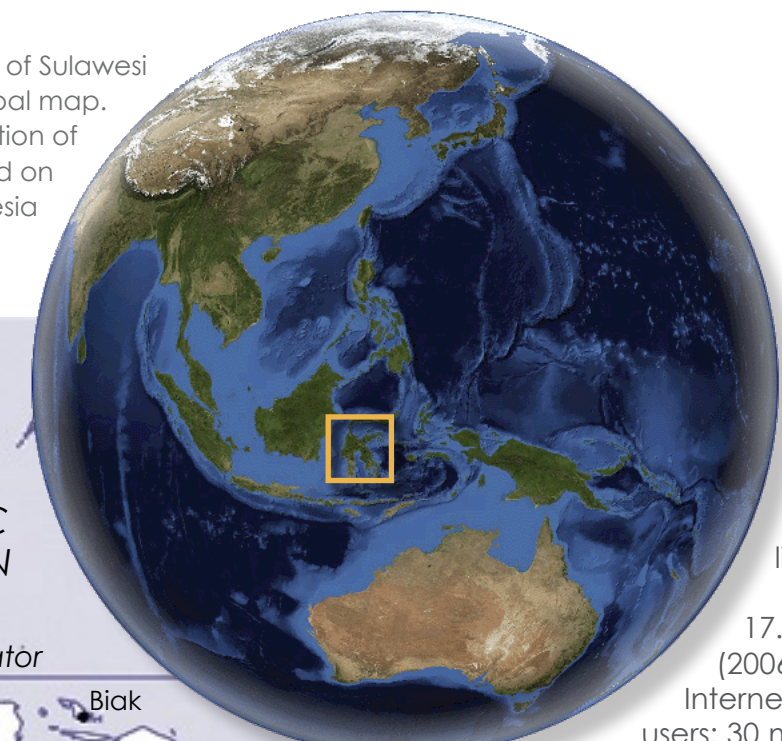
Environment Deforestation; water pollution from industrial wastes, sewage; air pollution in urban areas; smoke and haze from forest fires. Indonesia is party to agreements including: Biodiversity, Climate Change, Climate Change-Kyoto Protocol,

Desertification, Endangered Species, Hazardous Wastes, Law of the Sea, Ozone Layer Protection, Ship Pollution, Tropical Timber 83, Tropical Timber 94, Wetlands. The country has signed, but not ratified Marine Life Conservation.

Economy As a vast polyglot nation, Indonesia has been able to weather the global financial crisis relatively smoothly due to its heavy reliance on domestic consumption as the impetus for economic growth. To counter the effects of the crisis, the government used fiscal stimulus measures and monetary policy and offered cash transfers to poor families. Consumption was partially buoyed by campaign spending in advance of legisla-

tive and presidential elections in 2010. Economic advances and significant reforms in the financial sector, including tax and customs reforms, the use of Treasury bills, and capital market development and supervision, were made under President Yudhoyono. Increasingly robust GDP growth and sound fiscal stewardship has steadily reduced Indonesia's debt-to-GDP ratio in recent years. Persistent challenges include poverty and unemployment, inadequate infrastructure, corruption, a complex regulatory environment, and unequal resource distribution among regions. Natural resources: petroleum, tin, natural gas, nickel, timber, bauxite, copper, fertile soils, coal, gold, silver. Agriculture: rice, cassava, peanuts, rubber, cocoa, coffee, palm

RIGHT: Location of Sulawesi Island on global map.
BELOW: Location of Sulawesi Island on map of Indonesia



line:
17.8%
(2006).
Internet
users: 30 mil-
lion (2008)

Language Bahasa Indonesia (which is the official, modified form of Malay), English, Dutch, local dialects (Javanese is the most widely spoken)

Health There is a high degree of risk for food or waterborne diseases such as bacterial diarrhea, hepatitis A and E, and typhoid fever, as well as vectorborne diseases such as chikungunya, dengue fever and malaria. Note: There have been cases in Indonesia of the highly pathogenic H5N1 avian influenza. However, it poses a negligible risk to visitors.

Hyperbaric Chambers
Manado (Sulawesi): Malalayang Hospital, tel: 0812-4302970; and Professor Dr Kan-dou Hospital, tel: (+62) 8134-0000840

Makassar (Sulawesi): Rumah Sakit Umum Wahidin Sudirohusodo
Tel: (+62) 0411-584677

Websites
Tourism Indonesia
www.indonesia.travel
North Sulawesi Promotion Board
www.north-sulawesi.org ■

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POINT & CLICK
ON BOLD LINKS

Equipment

Let it roll



Watershot Video Lights

The latest in the STRYKER series of underwater lights is the addition of a video light to its round up. The lights can be set up in tandem for use with video set ups or configured as a single dive light. The light head can be set to high lumen output or adjusted to three different levels, or strobe mode. www.sitech.se

Atomic Aquatics Cobalt

The engineers of Atomic Aquatics have created an OLED (organic light emitting diode) faced dive computer that sets the stage for the next generation of dive computers. Aside from its beautiful display (think iPhone), the computer packs advanced features that will appeal to recreational divers and technical divers alike. Running algorithms from the RGBM (reduced gradient bubble model), the computer can handle three gas mixes (up to 99 percent O₂), and user configurable conservatism. Topped out with digital compass, air integration, rechargeable battery (AC or USB from a laptop), and 40 to 60 hours of dive time. The test unit we were able to dive with this summer performed flawlessly, and the user interface and menu design were quickly and easily mastered without a manual. www.atomicaquatics.com



Icaro Tech

A BCD designed with needs of a tech diver, but equally useful for the recreational diver or underwater photographer. The

Icaro Tech offers complete independence from the harness to the air-cell. Extremely light weight 3,050 grams (less than seven pounds), easily adjustable, and fully accessorized with six 55mm D rings. The outer material is polyurethane coated 1000 denier Cordura and finished with three convenient dump valves. www.seacsub.com

Titan

Into its third generation and boasting ten years of experience is the newly designed Titan regulator. This balanced diaphragm T-shaped design is made from stamped brass with multi-plated chrome finish. With the option to use either the right or left hand, the second stage has a quick disconnect and does not need tools. With its single hp port and four mp ports and a second model for cold water (the Titan Supreme) this regulator should fit the need for most divers. Complete specifications at: www.aqualung.com



ABC Safari bag

The iQ-ABC-Bag comes with two shoulder straps, so that it can be carried

as a backpack. With netting, so that the bag is well ventilated. Made from 100% Polyester, robust 600 Denier fabric
IQ-Company





equipment

The Equipment News is brought to you in part by Gear Check, compiled by Robert Sterner of Sterner Editorial Services. Suggest products to review and read earlier Gear Check items by product categories at www.sternereditorial.com

Nautilus Lifeline

This new radio and GPS for divers is designed to work with any marine radio and comes with Digital Selective Calling (DSC) capability to transmit GPS position or distress calls. DSC radio is the latest in marine radio technology. Digital Selective Calling is part of a global upgrade in maritime distress communications. Intuitive and easy to use. Use the button on the right to talk to every boat around you on CH16—the worldwide marine hailing frequency. Use the button on the left to chat with your dive boat or other divers. Advanced software prevents you from accidentally jamming the frequency and even automatically adjusts your squelch. Press the DSC button, and your GPS position will be transmitted to every boat and marine VHF DSC radio within 6km. Their radios will switch to CH16, alarms will sound, red lights will flash and your position will be shown on each radio display. nautiluslifeline.com



Scuba Pro Black Tech Regulators

Paired with either exclusive high flow piston MK25 or high-performing diaphragm MK17 first stage, the A700 systems are phenomenal in beauty and in breathing performance. The Black Tech incorporates a PVD (Physical Vapor Deposition) finishing process, which increases ruggedness, scratch resistance and surface hardness. PVD finishes are already found on military equipment, watches and tools. It is applied using titanium nitride and boasts a hardness of 2500 HV (chrome is 900 HV; stainless steel is 190 HV). The second stage has precision handcrafted all metal construction for a lifetime of diving. The regulator has unparalleled breathing performance regardless of depth, temperature or breathing position—now with a newly aligned co-axial VIVA (Venturi Initiated Vacuum Assist) system for more precise breathing assistance, control and comfort. Finished with two HP ports, five LP ports and swiveling turret. Available in chrome or Black Tech, and DIN or yoke. www.scubapro.com



Kata handy dive gear tote

Kata bags weren't designed for divers but they should have been. The sturdy

but very light-weight bags found in photo some designed to models of cameras

are stores with snuggle specific brands and and others as general gadget bags. Bags are made with water-resistant fabric and zippers. Some even have cushions that can be inflated after gear is inserted, providing the ultimate in protection from jarring and making the bag buoyant should it fall overboard. Bags typically have dividers that are handy for organizing gear and a pillow to protect lenses from jostling. Toblerones are built into the bottom and edges to absorb shocks and to keep the bag above standing water. Click handles provide an ergonomic grip at different angles and dual-purpose buckles optimize carrying in various angles. The multi-sided shoulder strap fits left or right shoulders, slung either straight down or across the chest, and it's slotted to let air circulate under the strap. The optional trolley eases lugging the heavier bags and is sturdy enough to pile on another bag or two of luggage, too. www.kata-bags.com



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- Hydrogom
- Jetsam Technologies
- Kent Tooling Diving Products
- Liquivision
- Midlands & London Diving Chambers
- Meridian Chartware
- Miflex
- MR Diving
- Narked @ 90
- Oceanic
- OMS UK
- O'Three
- Otter
- Papua Diving
- Phil Grigg Technical Diving
- Red Sea Diving College
- rEvo Rebreathers
- Santi
- Scuba Industries Trade Association
- Shearwater Research
- Silent Planet
- Stansted Fluid Power
- Submerge Productions
- Suex Scooters
- Suunto Diving UK
- Tech Thailand
- The Rebreather Site
- TillyTec
- VR Technology
- Waterproof
- Wreck Diving Magazine
- XRay Magazine

- Agencies
- GUE UK
 - IANTD UK
 - PADI TecRec
 - TDI

Speakers and Topics

Antti Apunen & Janne Suhonen

- The Molnar Janos Cave System beneath the City of Budapest
- Diving Finnish Mines



Leigh Bishop

- Britannic 2009; When deep wreck diving goes fatally wrong

Mark Caney

- Closed Circuit Rebreathers; Tec or Rec

Craig Challen

- Cocklebidly; Extreme Cave Diving in the Australian Desert

Carl Douglas

- Shipwreck Discoveries in the Baltic Sea
- Filming Deep Wrecks in the Baltic

Note: the awesome photography that complements these talks is by Jonas Dahm

Martyn Farr

- Classic Dark Site Diving; Cave Diving around Europe
- Cave Diving in the UK; a look at traditional British Cave Diving



Kevin Gurr

- Rebreathers; Fact, Fiction or Voodoo



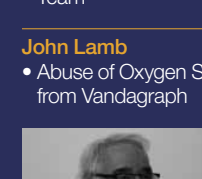
Jill Heinerth

- Extreme Cave Diving in Bahamian Blue Holes complimented by the Wes Skiles beautiful photography
- Digital Photography Still Imaging Clinic
- Diving the Ice Caves of the Antarctic



Evan Kovacs

- 3D Deep Ocean Imaging; A look at producing 3D films underwater
- Awesome 3D films from the Woods Hole Team



John Lamb

- Abuse of Oxygen Sensors with the expert from Vandagraph



José Santaria Marques & Armando Riberio

- Deep Portuguese Wreck Diving; a look at some stunning wrecks off the coast of Portugal

Gareth Lock

- Risk Management In Diving



José Santaria Marques & Armando Riberio

- 'Erich Glese'; Deep Wreck Diving on a Nazi Destroyer off Narvik

Barry McGill & Ian Lawler

- Deep Wrecks of Ireland – a look at the Carinthia, HMS Curaco and others



Agnes Milowka

- Cave Diving Down Under
- Caves of Florida; new discoveries and classic dives. (The stunning images are by the late Wes Skiles)

Dr Simon Mitchell

- Physiology of Divers
- Inwater decompression; current issues that have been topics of several forum debates
- CO₂ Issues with Rebreather Diving

Tom Mount

- The Evolution of Technical Diving; how technical diving came about
- Survival Dynamics; A look into the philosophy of diver survival

Martin Parker

- Staying In The Loop; Accident Analysis

Eduardo Pavia

- The Viminali – Deep Italian Wreck diving on this awesome Ocean Liner lying off Sicily

Mark Powell

- Decompression Planning; Translating decompression theory practically with PC Planning Tools
- Deep Stops and Bubble Models in Deco Theory

Daniel Rice

- Freebreathe Technology

Phill Short

- Cave Diving Adventures; one man's worldwide cave diving exploits
- Technical CCR Workshop focusing on Rebreather Safety

Arne Sieber

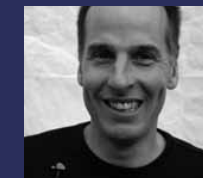
- The future technology of Sensors

Tomasz Stachura

- Graff Zeppelin; Deep Wreck Divers explore Hitler's Aircraft Carrier

Rick Stanton

- Doux de Coley and other European Cave Projects



Rick Stanton & Leigh Bishop

- DPV's for Wreck and Cave Diving

Rich Stevenson

- Getting started in CCR Diving



Rich Stevenson & Leigh Bishop

- The Development of British Wreck Diving over the last two decades

Bruce Wienke

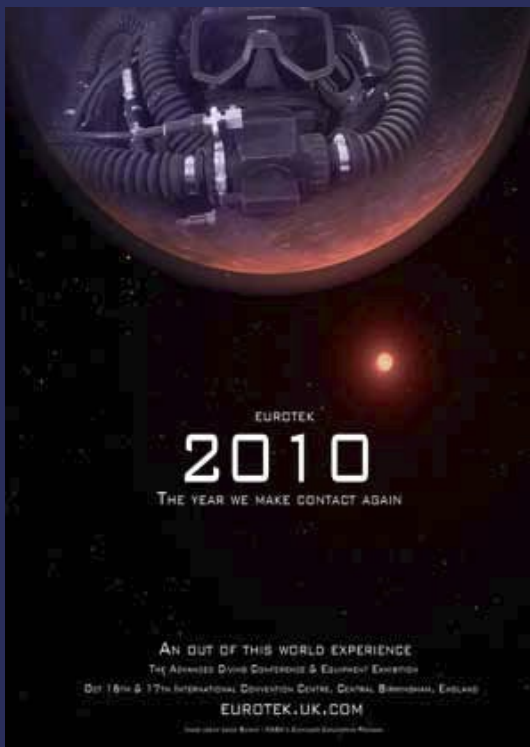
- Decompression Algorithms; The Good, The Bad and The Ugly
- Valuable Technical Diving Resources

Please note that these talks and speakers are subject to change without notice.

October 16/17

EUROTEK 2010

ADVANCED DIVING CONFERENCE



EUROTEK.2010 - the bi-annual Advanced and Technical Diving Event - will be held on Saturday 16th and Sunday 17th October in Halls 9, 10 and 11 of the International Convention Centre, Broad Street, Birmingham, England, B1.

Declared "a phenomenal Weekend" and "the best Conference of the year" by many .08 Delegates, EUROTEK is a "must attend" event for any diver wanting to get more out of their diving. You don't need to be a techie, just curious and hungry for more information. Tickets will be available when doors open at 08.00 Saturday morning priced £43 and £75 respectively for a Day/ Weekend Pass.

During the weekend in addition to the 40 different exciting talks and useful workshops over two days, there's a display of historic rebreathers and diving equipment being brought over especially from the Netherlands, and a storming Expo with over 40 UK and overseas specialist companies exhibiting. This makes EUROTEK.2010 the perfect opportunity for you to spend time and talk directly to the manufacturers and training agencies and get your questions answered.

Just about every name that's anything to do with technical diving will be attending to listen to a mouth-watering list of 29 speakers. "We're delighted that we have secured such luminaries as the record breaking Cave Explorer Rick Stanton, underwater Cinematographer Carl Douglas, Algorithm Author Bruce Wienke (sponsored by Suunto) and tech legend Tom Mount (sponsored by IANTD)", stated Rosemary E Lunn, EUROTEK Co-organiser. "In addition and back by popular demand is the ever charming Professor Dr Simon Mitchell.

At 2008 it was standing room only in his presentations and not everyone got to hear him speak, hence his return to EUROTEK.2010. Simon has the knack of being able to explain quite complex physiological information to divers in quite simple terms whilst keeping the medics engaged. Divers tend to leave his talks with a key piece of information that has suddenly become crystal clear whilst pondering "now why didn't I see that before"? No wonder the room is always packed when Simon is on". So come to EUROTEK.2010, catch up with some old friends, meet new people and learn more about advanced and technical diving.

"A phenomenal weekend and the best conference of the year"



Edited by Kelly LaClaire Gunild & Peter Symes

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POINT & CLICK ON BOLD LINKS



Dive Watches *Time, Technology & Style*



When trying to determine if a particular watch is suitable for diving, first of all, look for a water-resistance rating of at least 200 meters, or 20 atm. The apparent overkill on the depth rating means that the watch should hold up fine underwater for most normal diving conditions. But a watch claiming to be water-resistant to 100 meters (330 feet) should be sufficient for recreational scuba diving, especially since those safe diving limits are set at 40m (130 feet).

So what's the deal?

It is a matter of conventions that are, if not outright misleading, then certainly grounds for a great deal of confusion. However, the table (below) should provide some guidelines for buyers. First of all, the water-

resistance ratings provided by manufacturers result from testing done under controlled circumstances. Basically, they indicate resistance to water penetration, assuming there is no movement by either the watch or the water, at a particular depth. The ratings do not take into account what happens if the watch is bumped or jarred.

In reality, several factors are at work simultaneously on a watch while underwater. Pressure is the most significant, but as a diver moves through the water, additional pressure is exerted. The watch cases of diving watches must be adequately water (pressure) resistant and be able to endure the galvanic corrosiveness of seawater. So, the cases are generally made

out of materials like stainless steel, titanium, ceramics and synthetic resins or plastics. Gold may be a problem just because it's softer.

Seals must be used at each point where the case can be opened, and at other joints. This is primarily the case-back and crown (covering the stem). They may also be placed between the crystal and case unless a sealant is used. These seals, or gaskets are usually o-rings made of rubber or some other synthetic. Every watch made for diving should also feature screw-down case-backs and crowns. A case-back that screws down tight against a seal works much better than any type of back that is pressed in. The same goes for the crown; it needs to screw

in so it seals tight against the o-ring to prevent any seepage around the stem.

Pressure testing

Changing batteries in a dive watch invariably also

The Rolex Oyster Perpetual Submariner is a line of watches manufactured by Rolex, designed for diving and known for their resistance to water. The first Submariner was introduced to the public in 1954 at the Swiss Watch Fair.

Copied by other watch makers, the Rolex Submariner is recognised as a classic which has appeared in eleven James Bond movies



means it must go in for a renewed pressure test in hyperbaric chamber, so make sure you return your precious time piece to an authorized dealer.

Bezel

Analog diving watches will often feature a rotating bezel, which allows for an easier reading of elapsed time of under one hour from a specific point. This is also used to compute the length of a dive. The bezel is 'unidirectional', i.e. it contains a ratchet, so it can only be turned counter-clockwise to increase the apparent elapsed time. This is an important 'fail safe' feature. If the bezel could be turned clockwise, this could suggest to a diver that the elapsed time was shorter than it was, thus indicating a falsely short elapsed time reading, and therefore, falsely low air consumption assumptions, which are highly dangerous. Some dive watch models feature a lockable bezel to minimize the chance of unintentional bezel operation under water.

Ornamental feature of the past

With the advent of digital dive watches and the widespread use of dive computers, the exclusive use of a rotating bezel is now considered a rudimentary diving technique. Most contemporary dive watches with conspicuous 15 or 20 minute markings on their bezels are the result of copying a Rolex bezel design of the 1950s. Back then divers typically planned a dive to a certain maximum depth based on now obsolete U.S. Navy dive tables, and dove according to the planned dive profile. ■

Classification of diving watches

Watches are classified by their degree of water resistance.

Water resistance rating

Water Resistant to 50 m

Water Resistant to 100 m

Water Resistant to 200 m

Diver's 100 m

Diver's 200 m or 300 m

Diver's 300+ m for mixed-gas diving

Suitability

Swimming (no snorkeling related activity) and fishing.

Recreational surfing, swimming, snorkeling, sailing and water sports

Suitable for professional marine activity and serious surface water sports

Minimum ISO standard (ISO 6425) for recreational scuba diving.

Suitable for recreational scuba diving.

Suitable for saturation and advanced technical diving

Notes

NOT suitable for diving

NOT suitable for diving

NOT suitable for diving.

100 m and 150 m ratings are mostly seen on older watches.

The most common ratings for modern dive watches.

Watches designed for mixed-gas diving will have an additional marking **DIVER'S WATCH L M FOR MIXED-GAS DIVING.** ■





Dive Watches

Standards for dive watches

The standards and features for dive watches are regulated by the International Organization for Standardization in the ISO 6425 standard. Besides water resistance standards to a minimum of 100-meter depth rating, ISO 6425 also provides minimum requirements for mechanical dive watches—quartz and digital watches have slightly differing readability requirements. ■



Oris

Swiss manufacturer Oris has joined forces with the Australian Marine Conservation Society (AMCS) by launching the Great Barrier Reef Limited Edition dive watch. Fifty Swiss francs from each piece sold will be donated to AMCS to help protect and preserve the world's largest and most stunning reef system. Water resistant to a staggering 100 bar (1000m, 3281ft) the Oris boasts a host of impressive design elements: multi-piece stainless steel casing with super scratch resistant sapphire face; automatic mechanical movement; easy to read centralized hour and minute displays with dark orange luminescent hands and face markings; helium buildup release button for divers who use pressure chambers; neoprene carrying case with logo and key fob. Also comes with a customized AMCS diver's log book.

www.oris.ch



IWC

Swiss watchmaker IWC Schaffhausen, partner and sponsor of the Jacques-Yves Cousteau Society, has dedicated a fifth special edition to "Le Commandant" in honor of his 100th birthday: the Aquatimer Chronograph Galapagos Islands Edition. This finely crafted timepiece begins with a stainless-steel casing coated with matte black rubber making the watch pressure resistant to 12 bar (120m, 393ft) and comes with a barrage of special features. The sapphire glass dial makes the face nearly scratch proof (you can mar the surface with a diamond but nothing else will affect it) and the mechanical chronograph movement is self-winding and has a 44-hour power reserve. Each watch has an external rotating bezel, date and day display and a patented quick-change bracelet system for use with business or formal attire. IWC makes a sizeable contribution generated by proceeds from the sale of the Aquatimer to the Galapagos-based Charles Darwin Foundation. For 50 years, the foundation has been making visitors aware of the archipelago's uniqueness and providing them with guidelines to ecologically sound behavior and acting as sentries to ensure that the waters are not plundered and that the animals do not fall victim to poachers or predators imported from other seas.

www.iwc.com



Poseidon

Poseidon takes a more traditional approach to dive watches by offering the Chrono. Each watch has a large, easy to read rotating bezel, ultra accurate chronograph movement, super luminescent face index and hands as well as three separate timing dials for seconds, minutes and hours. Chrono's casing is made of stainless steel and is water resistant up to 20 bar (200m, 660ft) and comes in a plethora of face colors making this a fine timepiece for any serious diver. www.poseidonwatches.se



TAGHeuer

THE AQUARACER 500M CALIBRE 5 is as nice a dive watch as you will find anywhere and gives the wearer all the high-end options needed. The brushed stainless steel casing houses an ultra fine chronograph movement with automatic date surrounded by a unidirectional, soft-touch rubber bezel and is water resistant up to 30 bar (300m, 984ft). The crystal face is made of sapphire glass making scratches a virtual impossibility and the antireflective coating lets the luminescent hands and face indexes stand out in any light. For serious sport and technical divers, the 500M has a fine-brushed automatic helium valve which allows gas buildup in the watch to release due to time spent in pressure chambers or diving stations. The black rubber strap has a solid titanium clasp with safety push buttons for easy release and changes. www.tagheuer.com

Timeline

Early dive watches were often developed in response to military and professional needs. Later, they were designed for commercial diving, which started to appear in the 1960s. As a result, professional dive organisations came into being, touting needs for "tool" watches to help conduct dives safely at great depth.

1927 Rolex is credited with creating the first water-proof watch.

1932 Omega introduced the Marine, considered to be the first dive watch.

1930s Panerai produced a number of dive watches for the Italian Navy, water-proof to 650 feet.

1953 Blancpain produced the Fifty Fathoms dive watch worn by Jacques Cousteau in the film, *Le Monde du Silence*.

1954 Rolex introduced the Submariner—the watch of choice for James Bond in the first ten films.

1957 Omega Seamaster was introduced.

1967 Rolex Sea-Dweller introduced, first "ultra water resistant" dive watch, capable of depth to 610m.

1970 Omega Seamaster Professional introduced, capable of depth to 600m. ■





Dive Watches



Audemars Piguet

The high-class Royal Oak Offshore diver watch by Audemars Piguet can withstand pressures of 30 bar due to fine quality gaskets and the unique hexagon screw design mounting the case and face as secure as a sub hatch. With a new twist, the classic click bezel has been replaced with an internal rotating ring with diving scale that is controlled by a rubber coated crown mounted at 10 o'clock on the case. This keeps a diver from inadvertently moving the bezel while diving, always assuring any headings are taken and kept accurately. The finer points of the timepiece are just as impressive: self-winding, Calibre 3120 movement; stainless steel casing; luminescent coatings on watch dial and hands; hours and minute dive time measurements. We especially liked the rugged, octagonal face shape that dominates the face.

www.audemarspiguet.com



RedSea Holystone

RedSea, a new company started just this year by two avid watch enthusiasts, offers the Holystone, a professional dive timepiece with all the rugged extras you need when diving. Water resistant to 30 bar (300m, 984ft), this beautiful dive watch comes in your choice of stainless steel or black PVD (a long lasting protective coating used on high friction cutting tools). Each watch crystal is made of sapphire glass and the arms and face markings are layered eight times with special Lume-Tech coating for ultimate brilliance in dark areas. Both colors of the Holystone come with three separate bands—a five link steel brace-

let for dressing up, Black nylon for more casual wear or a dark rubber dive strap for saltwater use. The large clicking bezel is easy to grab, even with gloves, and best of all, this new watch is priced below US\$600. All watches will be available this winter, and if you place a pre-order, you will be automatically entered to win a free RedSea timepiece of your choice.

Redseawatches.com

Halios BlueRing

The Halios BlueRing is an aesthetic and beautifully crafted dive watch from a great independent brand in Vancouver, British Columbia, Canada. With only 100 models of each dial color, it offers exclusivity in ownership that extends beyond the distinct design and excellent packaging. If you missed your chance on earlier models, such as the Holotype, the BlueRing should be secured quickly since previous editions sold out in months, and the BlueRing is setting a pretty fast pace as well (as of late summer only the silver dial with brushed silver case is still in stock). Features include: water resistant up to 30 bar (300m, 984ft); highly calibrated ETA 2824-2 movement; silver dial with black bezel; domed sapphire crystal for outstanding scratch resistance. Now is the time to order a highly exclusive dive watch from a trusted and well known brand.

www.halioswatches.com/bluering



Luminox

Luminox has been the watch of choice for professionals like Navy SEALs, SCUBA legend Stan Waterman, the U.S. Coast Guard, law enforcement divers and many more. After 20 years of making 200 meter water resistant watches, Luminox has announced its 50 bar (500m, 1500ft) Deep Dive series. Specifically designed and constructed for use by professional divers, these watches can be taken to the deepest depths by technical divers doing their jobs, with all the attributes a true diving watch needs, including: stainless steel, PVD coated casing; screwed on crown with guard cover; sapphire glass face with anti-reflective coating; highly durable rubber strap; automatic helium release valve. The night vision tubes covering the dial, hands and bezel are ultra bright and are rated to last twenty-five years. This is serious gear for serious divers.

www.luminox.com

Watch strap

The choices you have for a strap are typically Rubber, Stainless Steel or Titanium.

Rubber: If its genuine—make sure to check—rubber is strong, comfortable and flexible. It will last for quite some time but will eventually deteriorate, and become brittle and susceptible to tearing.

Stainless Steel: Is fine for dive watches; the only thing to watch out for is checking that it is genuine stainless steel since other metal straps will rust or corrode.

Titanium: The best choice, if you can afford it, since it is stronger by a third over stainless steel and significantly lighter too, making it feel more comfortable as well. It's also more durable and more corrosion resistant than stainless steel, and hypoallergenic, too, which may be another consideration.

Further consideration: wet-suit clasp. This is a special clasp that makes the strap extendable so it's easy to adjust and wear over a wet-suit. ■





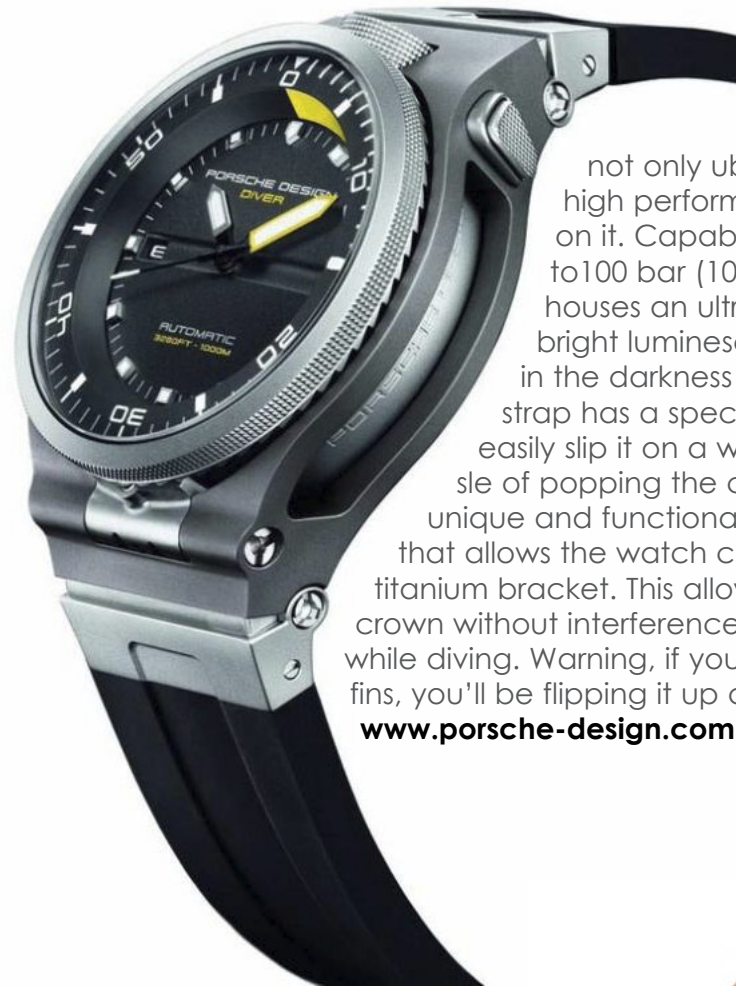
Dive Watches



Reactor

"Our new Poseidon has a number of firsts for us in terms of technology. In addition to the extreme 1,000m depth rating, the watch features an internal rotating bezel that can actually be adjusted underwater," stated Jimmy Olmes, president of Reactor, on their website. Their most seaworthy model to date, Reactor's Poseidon is built from stainless steel and has a substantially thickened case back and crystal face. The watch is available with a black and red dial with rubber strap, a yellow and black dial with two-tone black stainless bracelet, or a limited edition black and orange combination that will include both bands. The stainless bracelets include a wetsuit expander, another first for Reactor.

www.reactorwatch.com



Porsche Design

The first dive watch by Porsche Design since 1983, the P'6780 is not only uber-cool to look at but meets every high performance demand that can be placed on it. Capable of withstanding pressures at up to 100 bar (1000m, 3281ft), the stainless steel case houses an ultra fine automatic movement and bright luminescent dial that is easy to read even in the darkness at its furthest depth range. The strap has a special extension that allows a diver to easily slip it on a wetsuit covered wrist without the hassle of popping the clasp open. But perhaps the most unique and functional design element is a special hinge that allows the watch case to swing upwards out of the titanium bracket. This allows the wearer to quickly move the crown without interference and blocks accidental movement while diving. Warning, if you're ADD like some of us folks with fins, you'll be flipping it up and down endlessly.

www.porsche-design.com



Breitling

Breitling has revived the design of the legendary diver's instrument it launched in 1957. While the technical qualities that have forged the Superocean's reputation have been always been respected, the timepiece has been given a thoroughly updated look. The rubber-molded unidirectional bezel features sloping numerals that look and feel like a dive compass, and the notched edges make it easy to manipulate underwater even with heavy gloves for cold water diving. The strikingly distinctive dial is a continuation of the same vigorous design with oversized numerals and hour markers standing out nicely against the matte black face. This sleek and classy watch is water resistant up to depth of 1,500 meters and has all the attributes of a professional instrument, like the safety valve that automatically releases the accumulated helium when the internal over-pressure reaches around three bar, the self-winding chronometer certified movement and the extremely scratch resistant sapphire crystal that is anti-glare coated on both sides. For deep and dark dives, the hands and hour markers are brilliantly lit making timed calculations a breeze. Several bracelet designs (rubber or steel) and inner dial color combinations (yellow, red, blue, silver and black) are available. www.breitling.com

Victorinox Swiss Army

Precision timing meets extreme diving in the new Dive Master 500 Black Ice Chrono, now equipped with precision, self-winding movement in the same ultra-rugged and highly functional 43 mm sport watch from Victorinox Swiss Army. The 50 bar (500m, 1650ft) water resistance, which gives its name to the Dive Master 500 line, is maintained in this Chrono version which boasts a screw-in case back and crown, sapphire crystal with anti-reflective treatment. Of course, you'll find a unidirectional bezel and luminescent hands, hour markers, logo and bezel markers for super bright readings in deep or dark waters. This dive watch features enhanced legibility of its separate twelve-hour counter at 10 o'clock, date window and small second counter at 6 o'clock. The strap is genuine rubber and comes in several colors to match the dial you choose (black, red and orange). For a more stylish, sophisticated look, a stainless steel bracelet with gunmetal coated PVD is also available.

www.victorinox.com





Dive Watches

Just for Kids

Speedo Junior UV analog watch —Kids will love this fun and entertaining watch as the strap changes color when outside in the sun while simultaneously offering UV protection to the skin underneath.

Features include: fashion forward design and fun graphics; water resistant to 100 meters; unique comfort strap with pinless buckle; lightweight and waterproof case. Available in other sporty colors.

Retails for US\$40.00.

www.speedousa.com



Caretaking

Subjecting your watch to quick hot and cold temperature changes makes it much more likely to leak due to rapid expansion and contraction of the metal. In addition, chemicals like chlorine are hard on seals.

Take time following any saltwater diving, or swimming in a chlorinated pool to rinse off your watch with fresh water. Rotate the bezel also to flush out any sand. Taking an extra couple seconds for rinsing will make a big difference in terms of longevity, same as it does for gear. ■



The Hammerhead Chrono XL by Freestyle

Freestyle Speaks

Freestyle dive watches stand out from the pack.

X-RAY MAG's Gunild Symes interviewed Freestyle's marketing manager, Chad LaBass, to find out just what makes them tick.

GS: What makes your dive watches different from the others on the market?

CL: Affordability and durability add up to an overall value that separates us from our competitors. We understand that investing in dive equipment can be very expensive; we are proud to make dependable dive watches that don't have to be expensive to be effective.

GS: What makes your company different from others on the market?

CL: The Freestyle difference is

in our product standards. Every watch we make is water resistant to minimum 100 meters, all dive specific watches to 200 meters, and we back all of them with a limited lifetime warranty.

GS: There are different types of divers out there. Which watch do you recommend for each type of diver and why?

CL: Freestyle offers entry level dive watches. We aren't in the business of competing with dive computers or expensive dive watches. We offer quality and value-packed dive watches from US\$100-\$175 for the price-conscious diver. Our recommendations:

Warm water diver

—dives in the tropics, lodging in luxury resorts and liveaboards: **The Hammerhead Chrono XL**. Why? For a stylish and bold look in and out of the water.

Cold water diver

—technical diver, wreck diver, diving in the temperate zones: **The Precision**. Why? It's a proven

performer with analog and digital readout with a nightvision backlight.

Arctic diver

—technical diver, diving the extremes in the polar regions: **The Hammerhead**. Why? It's the staple of our dive line, no-nonsense style and durability.

Researchers

—conservationists and eco-conscious divers: **The Submersion**. Why? Choice between metal or polyurethane band

and comes with a nightvision backlight.

Economy-minded

—middle class divers and university students: **The Hammerhead**. Why? We challenge anybody to find a better dive watch for under \$100.

Weekend warrior

—occasional diver who wants to impress peers with a great dive watch: **The Hammerhead Chrono XL**. Why? For a stylish and bold look in and out of the water.

GS: Which models of your men's and women's dive watches are the most popular and why?

CL: The Hammerhead is our most popular model and has been for years. It's just one of those things, whether from word of mouth or just its classic dive style, the Hammerhead is always on top of our best seller list.

GS: Are there differences in preferences of features and styling in dive watches between

men and women? If so, what are they?

CL: Not necessarily for the Freestyle consumer, they are generally looking to us for a dependable dive watch at a fair price.

GS: What is the future of dive watches? New technologies on the horizon? New fashion and style attitudes? New philosophies in watches in general?

CL: For now we don't have any plans on investing in new technologies, as most of the time new technology will drive the price of watch up. We like our position in the market catering to the entry level diver, and we want to concentrate on offering the most durable and dependable dive watches we can make in the US\$100-175 range. If anything, we will find ways to make them even more stylish and comfortable.

GS: Tell us about your sponsorships in the field of diving.

CL: Currently, we don't have any sponsorship agreements with divers, however we do plan on adding that category later in the year. In fact, we have recently opened up a sponsorship application for aspiring divers:

www.freestyleusa.com/sponsorship

GS: Anything else you would tell our readers about your dive watches and your company?

CL: We are working on a new women's specific dive watch due out Holiday 2010. Stay Tuned! ■

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It sucks!

Cephalopods Jet-powered Masters of Disguise

Text based on Dr James Wood and Kelsie Jackson's *Cephalopod Lesson Plan*.
Adaption edited by Peter Symes

Cephalopods use color change to interact with their own species, with other species, and with their environments.

Most cephalopods—the group in which scientists classify octopuses, squid, cuttlefish and nautilus—can change color faster than a chameleon. They can also change texture and body shape, and if those camouflage techniques don't work, they can still “disappear” in a cloud of ink, which they use as a smoke-screen or decoy.

Cephalopods are also fascinating because they have three hearts that pump blue blood; they're jet powered; and they're found in all the oceans of the world—from the tropics to the poles, from the intertidal to the abyss.

Cephalopods have inspired legends and stories throughout history and are thought to be the most intelligent of the invertebrates. Some can squeeze through the tiniest of cracks. They have eyes and other senses that rival those of humans.

Brainy

The class *Cephalopoda*, which means “head foot”, are mollusks and therefore related to bivalves (scallops, oysters, clams), gastropods (snails and slugs), scaphopoda (tusk shells), and polyplacophorans (chitons). Some mollusks, such as bivalves, don't even have a head, much

less something large enough to be called a brain! Yet, cephalopods have well-developed senses and large brains. Most mollusks are protected by a hard external shell and many of them are not very mobile. Although the nautilus has an external shell, the trend in cephalopods is to internalize and reduce the shell. The shell in cuttlefish, when present, is internal and is called the cuttlebone, which is sold in many pet shops to supply calcium to birds. Squid also have a reduced internal shell called a pen. Octopuses lack a shell altogether.

Cephalopods are found in all of the world's oceans, from the warm water of the tropics to the near freezing water at the poles. They are found from the wave swept intertidal region

to the dark, cold abyss. All species are marine, and with a few exceptions, they do not tolerate even brackish water.

Ancient

Cephalopods are an ancient group that appeared some time in the late Cambrian period several million years before the first primitive fish began swimming in the ocean. Scientists believe that



Cut-away showing the chambers in a nautilus shell



ecology

the ancestors of modern cephalopods (Subclass *Coleoidea*: octopus, squid, and cuttlefish) diverged from the primitive externally-shelled *Nautiloidea* (*Nautilus*) very early—perhaps in the Ordovician, some 438 million years ago.

How long ago was this? To put this into perspective, this is before the first mammals appeared, before vertebrates invaded land and even before there were fish in the ocean and upright plants on land! Thus, nautilus is very different from modern cephalopods in terms of morphology and life history.

Cephalopods were once one of the dominant life forms in the world's oceans. Today, there are only about 800 living species of cephalopods. By comparison, there is 30,000 living species of bony fish. However, in terms of productivity, some scientists believe that cephalopods are still giving fish a run for their money.

Many species of cephalopods to grow very fast,



JON GROSS

The nautilus is similar in general form to other cephalopods, with a prominent head and tentacles. Nautiluses typically have more tentacles than other cephalopods, up to ninety. These tentacles are arranged into two circles and, unlike the tentacles of other cephalopods, they have no suckers, are undifferentiated and retractable.

Background resemblance is when the animal changes its color and texture to match as closely as possible that of its background.

reproduce over a short period of time, and then die. With overfishing and climate change, there may be more biomass of cephalopods now than anytime in recent history.

Color change

Cephalopods use their awesome abilities to change their color and appearance primarily for two things: camouflage and communication. The ability of the cephalopods to change



color is a trait that has evolved over time due to a greater need to avoid predators and become competitive in an environment shared with vertebrates.

These abilities, and the behaviors associated with them, have become a major contributing factor to the success of the cephalopod family and are great examples of adaptation—physically, through natural selection, and behaviorally.

more than one strategy for camouflage, and these will be discussed here.

Resembling the background

Background resemblance is the most well known form of camouflage. This is when the animal changes its color and texture to match as closely as possible that of its background.

Camouflage

Camouflage is usually a cephalopod's primary defense against predators. As cephalopods don't have the protection of hard shells like many of their mollusk relatives, they make an easy to digest meal for a hungry predator. Therefore, most cephalopods try to avoid being seen to avoid being eaten. As well as predator avoidance, camouflage can also be used when lying in wait for unsuspecting prey to pass. Interestingly, cephalopods have



JAMES WOOD

Squids

appear like a specific object in their environments. This is termed **deceptive resemblance**.

The Caribbean reef squid, *Sepioteuthis sepioidea*, is often seen floating vertically at the surface of the water with its arms pointing downward to resemble floating sargassum weed. Some octopus may curl all their arms up into a ball, and add texture to their skin to appear like a rock.

Octopus cyanea has also been seen swimming in a manner that makes it appear like a reef fish by swimming with all its arms together and creating false eye spots.

Deceptive resemblance

As well as simply trying to blend into a background, some cephalopods will attempt to make themselves



JAN DERK

JAMES WOOD

Deceptive resemblance



JAMES WOOD

Disruptive patterning being displayed by the cuttlefish, *Sepia pharaonis*. The large white band helps to break up the outline of the cuttlefish, making it harder to distinguish it from a complex environment when viewed from above by predators

One side of the body produces a pattern to attract a female while producing another pattern on the other side, which is directed at other males

It is hard to know for sure the first benefit that the adaptation of changing appearance had for cephalopods. The fossil record is spotty and does not provide many clues as to behavioral adaptations.

However, most scientists believe the initial benefit of the adaptation of changing appearance was **crypsis**, the ability to blend in with the envi-



JAMES WOOD

A California two-spot octopus, *Octopus bimaculatus*, displays its abilities to camouflage in different environments. This type of camouflage is known as background resemblance, as both octopuses have adopted colors, textures and postures to attempt to blend into the background

Disruptive patterning

Disruptive patterning is seen in many creatures as well as cephalopods and serves to break up the outline of the animal to confuse predators. It involves the chromatophores, which are used to create sharply contrasting patterns on the body, often wide stripes or spots. This is best seen in cuttlefish, which employ this technique more readily than other cephalopods.

Countershading

Countershading is used to help a cephalopod blend in when there is no substrate against which to match itself. For instance, squid that spend much of their time in midwater rather than on or near the bottom can be seen easily by predators from below. Photophores and reflector cells on their underside match the light coming in through the water column, to make the squid almost invisible to animals below it. Countershading also makes rounded surfaces appear flat. So, a squid with a darker top surface and shades gradually decreasing to a pale under-surface will be harder to spot when viewed laterally.

Deimatic behavior

Deimatic behavior is often used when camouflage fails, and the cephalopod is still threatened. It involves changing rapidly from the

color it was using to blend into its environment, to bold contrasting colors such as white and black. Some species of octopus will change instantly from their mottled appearance to bright white with black around their eyes. Deimatic behavior usually also involves body postures that make the animal appear bigger than it is. If this doesn't work and the animal is still threatened, cephalopods will then usually ink and jet away.

Communication

Cephalopods use color change as well as body postures to communicate, both with members of their own species as well as with members of other species. Many cephalopods have courtship displays in which males attempt to attract females by using chromatic displays (displays using color changes) to show that they are suitable mates. This is well developed in squid and cuttlefish but is less common in octopus in which complex courtship rituals have not yet been seen. Often during courtship, males will not only have to attempt to attract females, but also to fend off other males. As chromatophores are neurally controlled, the animal may be able to produce a pattern on one side of its body to attract a female while producing another pattern on the other side, which it directs at other males.



JAMES WOOD

Fighting between males also exhibits a lot of communication. With squid, time spent in acts of aggression involve mostly displays and very little physical contact. Squid will often show chromatic displays and body postures with increasing intensity until one backs down.

In midwater, light organs and photophores are thought to be used for communication. In the same way as color is used in shallow water, bioluminescence can be used where there is less light to attract a mate, lure prey and dissuade predators.

Predator avoidance may also involve some forms of communication to the predator. As with deimat-

ronment. This allowed cephalopods to be camouflaged so they could more easily catch their prey. Perhaps even more importantly, camouflage was the first line of defense against predators.

Much of cephalopod evolution is thought to be driven by predator avoidance. The earliest of cephalopods are thought to have used the ability to leave the bottom and swim up into the water column as a way to escape predators.

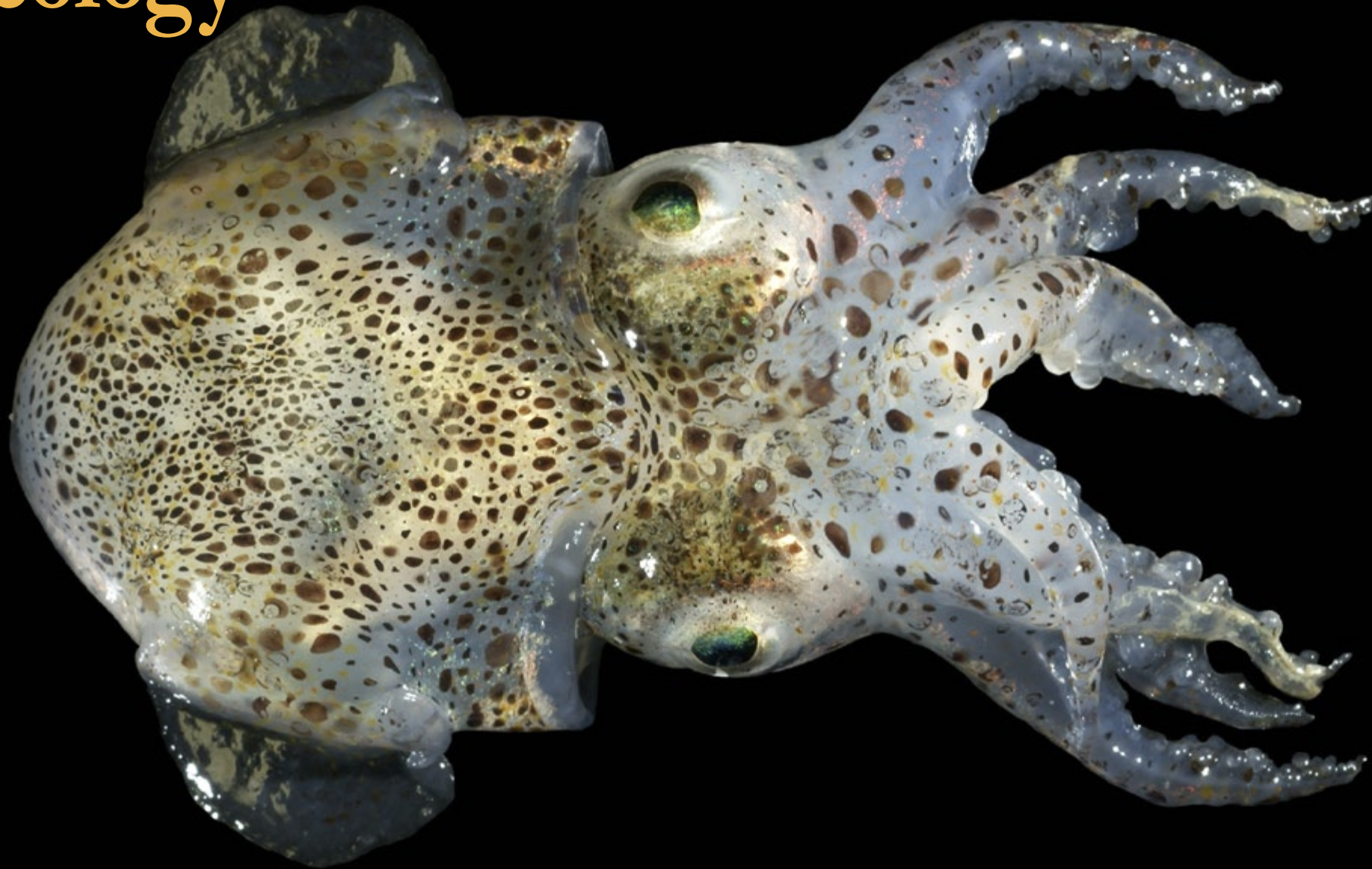
As both predators and their prey evolved, two major groups of cephalopods—the ammonites and nautilus—became some of the most common marine animals. These



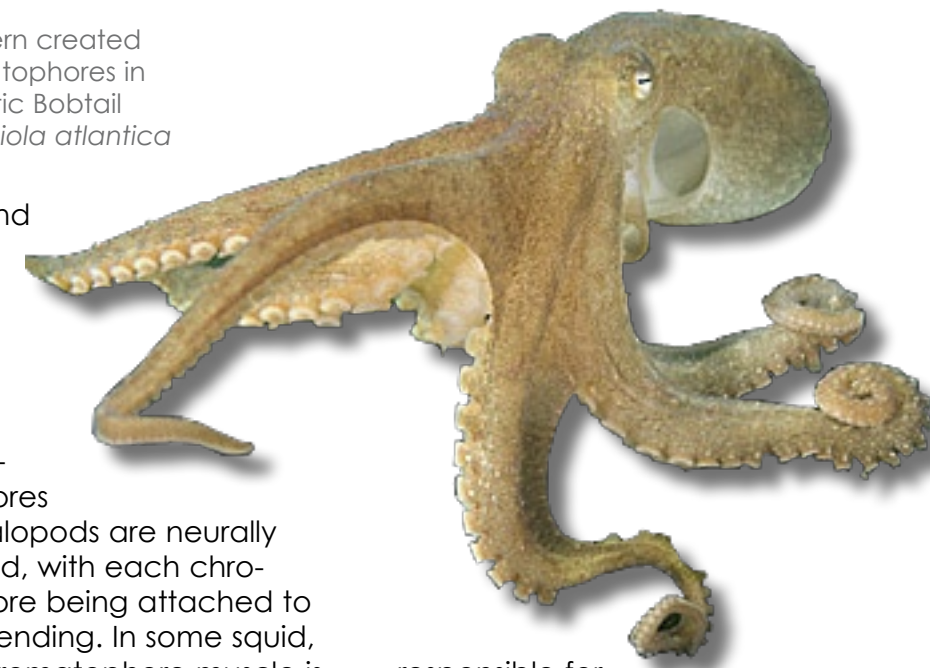
JAMES WOOD

Octopuses are, of course, not the only cephalopods to display background resemblance. A cuttlefish, *Sepia pharaonis*, is attempting to match the color and texture of the sand in its laboratory tank. Notice the white tipped papillae closest to the sand that give the appearance of small pebbles that can be seen in other areas of the tank. This ability not only protects the animal from predators, it also assists with hunting as prey can come quite close without realizing there is a hungry cephalopod nearby

two groups relied on their external shell to protect them from predators. The ammonites are extinct, and there are now only six species of nautilus in existence. All the rest of the modern cephalopods, the coleoid cephalopods, have reduced and internalized shells and have the ability to change color, texture and shape to camouflage and avoid detection from predators. ■



Skin pattern created by chromatophores in this Atlantic Bobtail squid *Sepioloidea attenuata*



ANDY MURCH

shrinks and hides the pigment.

Unlike in other animals, the chromatophores in cephalopods are neurally controlled, with each chromatophore being attached to a nerve ending. In some squid, each chromatophore muscle is innervated by two to six nerves that directly link to the animal's brain.

In this way, the animal can increase the size of one sac-cule while decreasing the size of another one right next to it. This allows the cephalopods to produce complex patterns, such as the zebra stripes seen in aggressive displays by male cuttlefish.

The speed at which this can be controlled allows the animal to manipulate these patterns in a way that makes them appear to move across the body. In some species of cuttlefish, it has been noted that while hunt-

ing, the cuttlefish may produce a series of stripes that move down their bodies and arms. Some scientists have suggested that this could be used to mesmerize prey before striking, but the purpose of this behavior has yet to be proven.

The pigments in chromatophores can be black, brown, red, orange or yellow. They are not

responsible for producing the blue and green colors seen in some species. Interestingly, many deep water forms possess fewer chromatophores as they are less useful in an environment in little or no light.

Iridophores

Iridophores are found in the next layer under the chromatophores. Iridophores are layered stacks of platelets that are chitinous in some species and protein based in others. They are responsible for producing the metallic looking greens, blues and golds seen in some species, as well as the silver color around the eyes and ink sac of others. Iridophores work by reflecting light and can be used to conceal organs, as is often the case with the silver coloration around the eyes and ink sacs. Additionally, they assist in concealment and communication.

Previously, it was thought that these colors were permanent and unchanging unlike the colors produced by chromatophores. New studies on some species of squid suggest that the colors may change in response to changing levels of certain hormones. However, these changes are obviously slower than neural-

ic behaviors, showing a predator that it has been spotted and attempting to make itself larger and more frightful than it is will at least often make a predator stop and think, giving vital seconds for escape. On the other hand, if the bluff is successful, the predator may back away, thinking that it is not as easy a target as anticipated.

Cephalopods have often been referred to as the chameleons of the sea. However, their ability to change color is more impressive than that of the chameleon. Unlike the chameleon,

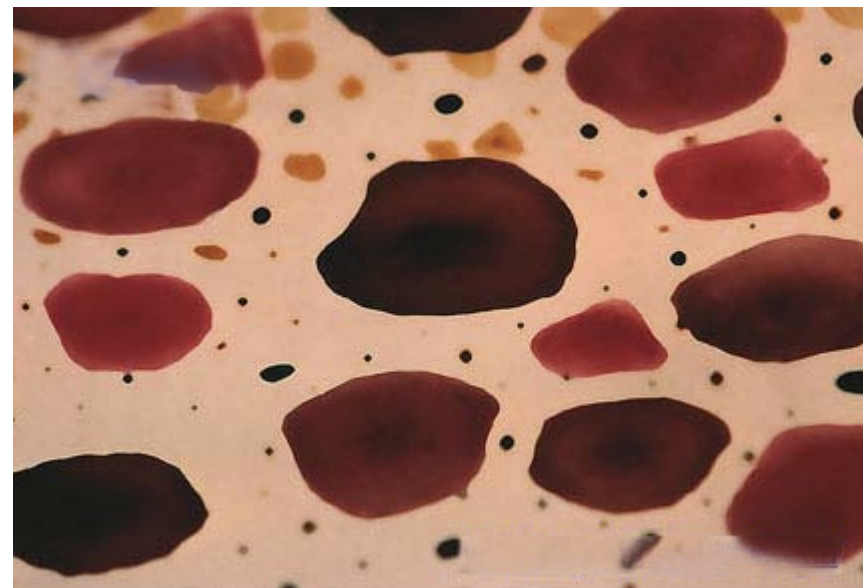
many of the cephalopod's color producing cells are controlled neurally, which allows them to change colors very rapidly.

The patterns and colors seen in cephalopods are produced by different layers of cells stacked together, and it is the combination of certain cells operating at once that allows cephalopods to possess such a large array of patterns and colors.

Chromatophores

The most well known of these cells is the chromatophore.

Chromatophores are groups of cells that include an elastic sac-cule that holds a pigment, as well as 15-25 muscles attached to this sac-cule. These cells are located directly under the skin of cephalopods. When the muscles contract, they stretch the sac-cule allowing the pigment inside to cover a larger surface area. When the muscles relax, the sac-cule



Closeup of chromatophores

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Chromatophores are located directly under the skin of cephalopods. When the muscles contract, they stretch the sacculle allowing the pigment inside to cover a larger surface area. When the muscles relax, the sacculle shrinks and hides the pigment.

ly controlled chromatophore changes. Iridophores can be found in cuttlefish, some squid and some species of octopus.

Leucophores

Leucophores are the last layer of cells. These cells are responsible for the white spots occurring on some species of cuttlefish, squid and octopus. Leucophores are flattened, branched cells that are thought to scatter and reflect incoming light. In this way, the color of the leucophores will reflect the predominant wavelength of light in the environment. In white light, they will be white, while in blue light, they will be blue. It is thought that this adds to the animal's ability to blend into its environment.

Photophores

Cephalopods have one final ability to change color and pattern, the photophores. These produce light by bioluminescence. Photophores are found in most midwater and deep sea cephalopods and are often absent in shallow water species.

Bioluminescence is produced by a chemical reaction similar to that of a

chemical light stick. Photophores may produce light constantly or flash light intermittently. The mechanism for this is not yet known, but one theory is that the photophores can be covered up by pigments in the chromatophores when the animal does not wish for them to show.

Some species also have sacs containing resident bacteria that produce bioluminescence such as the tiny squid *Euprymna*. Midwater squid use photophores to match downwelling light or to attract prey.

It is the use of these cells in combination that allow cephalopods to produce amazing colors and patterns not seen in any other family of animal. However, not all species of cephalopod possess all the cells described above. For instance, photophores may be necessary for animals in deep water environments but are often absent in shallow water forms. Deep sea species may possess few or even no chromatophores as their color changes would not be visible in an environment with no light.

Recent research has suggested that there may be some correlation between the amount of chromato-



Squids

JON GROSS



JAMES WOOD

phores (and hence the complexity of patterns available) and the type and complexity of a cephalopod's environment. For instance, midwater species may possess fewer chromatophores. While species living in reef type environments may possess more. However, further research still needs to be conducted in this area.

Cephalopod vision

Cephalopods are known to have excellent senses, and of these senses, their vision is perhaps the best studied. At first glance, cephalopod eyes look very similar to those of humans, whales and fishes. With the exception of the externally shelled and primitive nautilus, all cephalo-

Octopus burryi showing white spots due to leucophores

pods can perceive focused images, just like we can.

Cephalopods are invertebrates and other than being multicellular animals, they are not even closely related to vertebrates such as whales, humans and fish. Cephalopods, and their eyes, evolved independently. Why would animals so distantly related as a fish and a cephalopod have developed an eye that is so similar?

Colorblind

Given the amazing ability of cephalopods to change color perhaps the most surprising difference between vertebrate eyes and those of cephalopods is that most cephalopods are completely color blind. How do we know? We can train octopuses to pick black objects over white objects, white objects over black

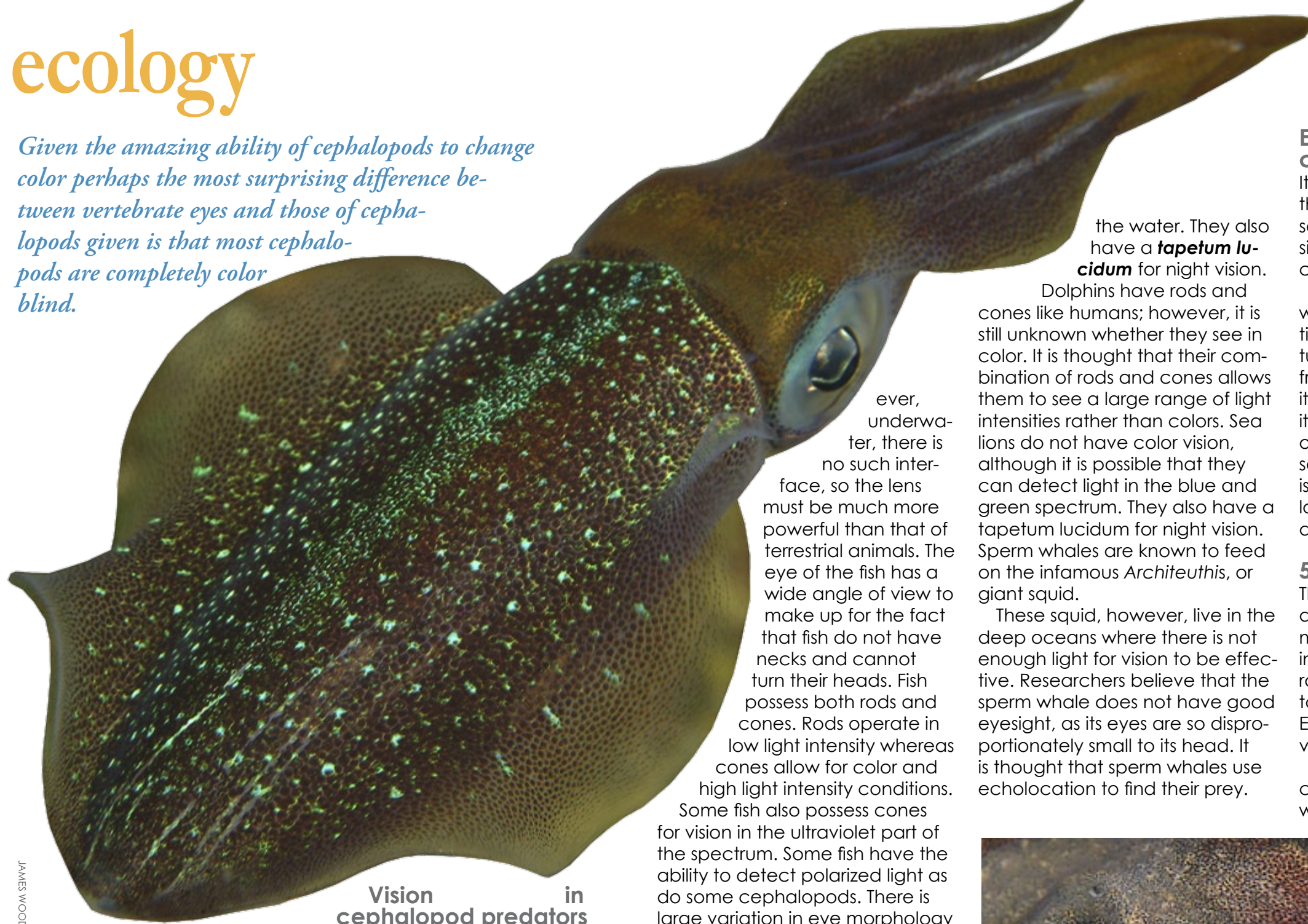
objects, light grey objects over dark grey objects and vice versa, but we can not train them to differentiate between colorful objects that look the same in grayscale. Also, most cephalopods only have one visual pigment. We have three.

Although many species have not yet been tested, the only cephalopod known so far to have color vision is the firefly squid, *Watasenia scintillans*. This species of midwater squid is bioluminescent and has three visual pigments. All other species tested so far only have one visual pigment.

Polarized light

Although most cephalopods can not see in color, it has been demonstrated that octopuses and cuttlefish can detect differences in polarized light—without wear-

Given the amazing ability of cephalopods to change color perhaps the most surprising difference between vertebrate eyes and those of cephalopods given is that most cephalopods are completely color blind.



JAMES WOOD

ing polarized sunglasses. Shashar and Hanlon showed that squids (*Loligo pealei*) and Sepioids (*Euprymna scolopes*) can exhibit polarized light patterns on their skin. Therefore, cephalopods can not only see differences in polarized light, they can also create patterns using these differences on their bodies. (See fact file on next page.)

Vision in cephalopod predators

The predators of cephalopods include fish—such as sharks—birds, marine mammals and other cephalopods. All of these predators have single lens eyes, although often there is some variation between them to make their eyes more suitable to their environment and behavior.

Fish On land, it is the air-cornea interface of vertebrates that gives most of the ability to focus. How-

ever, underwater, there is no such interface, so the lens must be much more powerful than that of terrestrial animals. The eye of the fish has a wide angle of view to make up for the fact that fish do not have necks and cannot turn their heads. Fish possess both rods and cones. Rods operate in low light intensity whereas cones allow for color and high light intensity conditions.

Some fish also possess cones for vision in the ultraviolet part of the spectrum. Some fish have the ability to detect polarized light as do some cephalopods. There is large variation in eye morphology within fish as they inhabit a large number of habitats with varying light regimes, from complex coral reefs to the pitch black of the deep sea.

Marine mammals that feed on cephalopods include dolphins, sea lions, and whales. Dolphins have a few adaptations to their eyes to assist them. For instance, they have muscles that can bend their lenses, so they can focus above

the water. They also have a **tapetum lucidum** for night vision.

Dolphins have rods and cones like humans; however, it is still unknown whether they see in color. It is thought that their combination of rods and cones allows them to see a large range of light intensities rather than colors. Sea lions do not have color vision, although it is possible that they can detect light in the blue and green spectrum. They also have a tapetum lucidum for night vision. Sperm whales are known to feed on the infamous *Architeuthis*, or giant squid.

These squid, however, live in the deep oceans where there is not enough light for vision to be effective. Researchers believe that the sperm whale does not have good eyesight, as its eyes are so disproportionately small to its head. It is thought that sperm whales use echolocation to find their prey.



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Squids

Evolution of cephalopod vision

It is known that nearly all living things including plants show some form of photosensitivity. How did this come to be?

Firstly, most life, with the exception of some deep sea vent creatures, is affected by light emitted from the sun, whether they require it for survival or are sensitive to it and must hide from it. All such organisms need to possess some sort of organ that allows an organism to know whether it is in high or low light, and possibly from which direction the light is coming.

500 million years

The ability to detect light with and eye has been developing for more than 500 million years and includes a variety of possible forms ranging from simple photoreceptors in single celled organisms like *Euglena* to the highly complex vertebrate eye.

The first "eye" seen in single-celled organisms and flatworms were simple photoreceptors that

Glossary:

The *tapetum lucidum* (Latin for "bright tapestry"; plural tapeta lucida) is a layer of tissue in the eye of many vertebrate animals, that lies immediately behind or sometimes within the retina. It reflects visible light back through the retina, increasing the light available to the photoreceptors. This improves vision in low-light conditions, but can

cause the perceived image to be blurry from the interference of the reflected light. The tapetum lucidum contributes to the superior night vision of some animals. Many of these animals are nocturnal, especially carnivores that hunt their prey at night, while others are deep sea animals. Although strepsirrhine primates have a tapetum lucidum, humans and other haplorhine primates do not. ■

Seeing Polarized Light

It has been shown through scientific experiments that squid, octopus and cuttlefish are able to detect polarized light as well as create signals using polarized light on their skin.

What the difference?

What is polarized light and how is it different from unpolarized light? Light is a form of electromagnetic radiation that travels as a wave. The wave doesn't just vibrate on one plane; instead, it vibrates on many planes

and in many directions at once while still traveling in the same general direction. Looking head on at a light wave, the assumption is that the wave is a straight vertical line as it moves toward the viewer. But, in actual fact, the wave moves vertically, horizontally, and diagonally all at the same time. This is how unpolarized light from the sun behaves, it is disorganized. Polarized light, on the other hand, only vibrates on one plane. The wave of polarized light, traveling toward the viewer appears as only one vertical or horizontal line

How does it happen?

Polarization can happen in a number of ways. Firstly, when light hits an object, it can become polarized if it is reflected, refracted or scattered off certain surfaces. Light may reflect off a non-metallic object or substance (like water) and become polarized. Polarized light that has experienced reflection will travel parallel to the surface of the object, which in the case of bodies of water, creates glare.

The amount of polarization will depend on the angle of the incoming light. When light undergoes refraction (i.e. when it

passes from air to water and gets bent), it may become polarized, although this time the polarized wave will usually travel perpendicular to the surface of the substance it has passed through.

Light may also become partially polarized by scatter-

ing, as light waves bounce

off particles while passing through a substance.

They can but we cannot

So why can cephalopods, and the majority of mobile marine animals, see polarized light and humans cannot? Cephalopods have different photoreceptor cells from humans. Cephalopods

have photoreceptor cells that contain microvilli. The microvilli of each receptor cell are lined up parallel to each other. Microvilli contain the visual pigment rhodopsin, which is also orientated parallel in the microvilli. Receptor cells are aligned at right angles to each other, and hence the microvilli of one receptor cell will be at right angles to that of the next receptor cell. The rhodopsin assist in seeing the polarized light. Because the microvilli are arranged at right angles to one another, the animal is able to distinguish between different planes that the light is traveling on.

Reflections

Cephalopods can use their ability to see polarized light in many ways. Firstly, it is thought that they can see through the reflection created by silvery fish scales to better identify prey and predators. Often this reflection is polarized. Just as humans put on polarized sunglasses to see through the glare created by polarized reflection off the surface of the ocean, the cephalopod can cut out

the glare of polarized light produced by reflection off fish scales to better distinguish prey.

Translucent prey may also be more visible for the same reason, as light reflecting off the tissues of the prey may be polarized, and while it may not produce glare, it would make the prey animal more visible to animals that can see this reflection such as cephalopods.

Manipulating polarisations

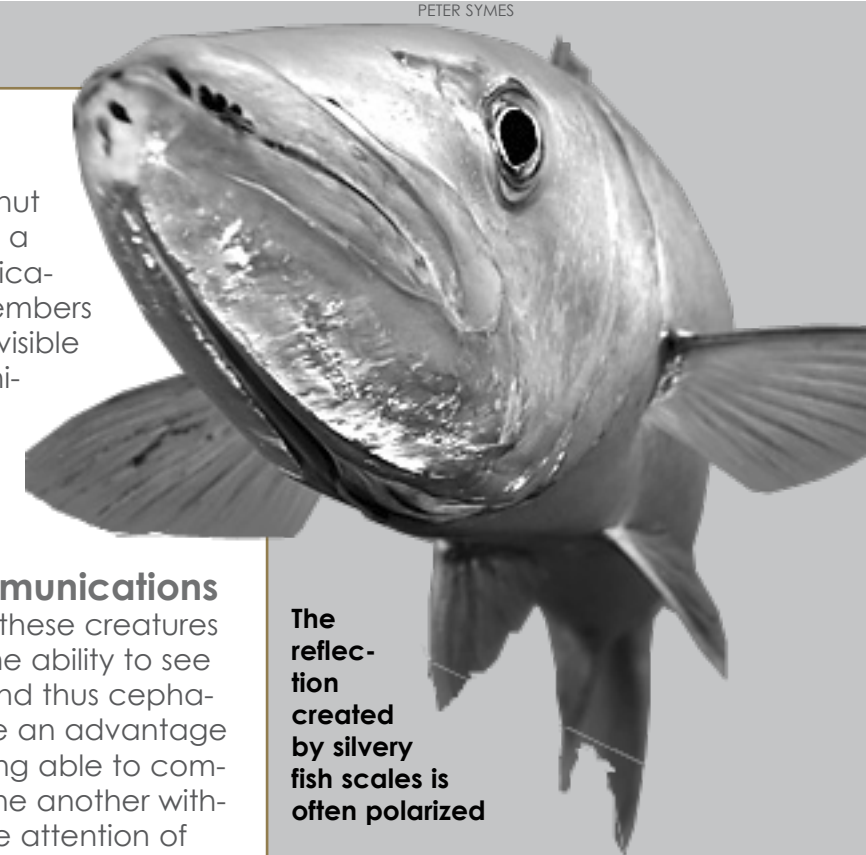
It has been shown that the iridophores on cuttlefish reflect

polarized light in a way that they can intensify or shut off. This could be a form of communication between members of a species not visible to some other animals, especially predators such as sharks, seals and cetaceans.

Invisible communications

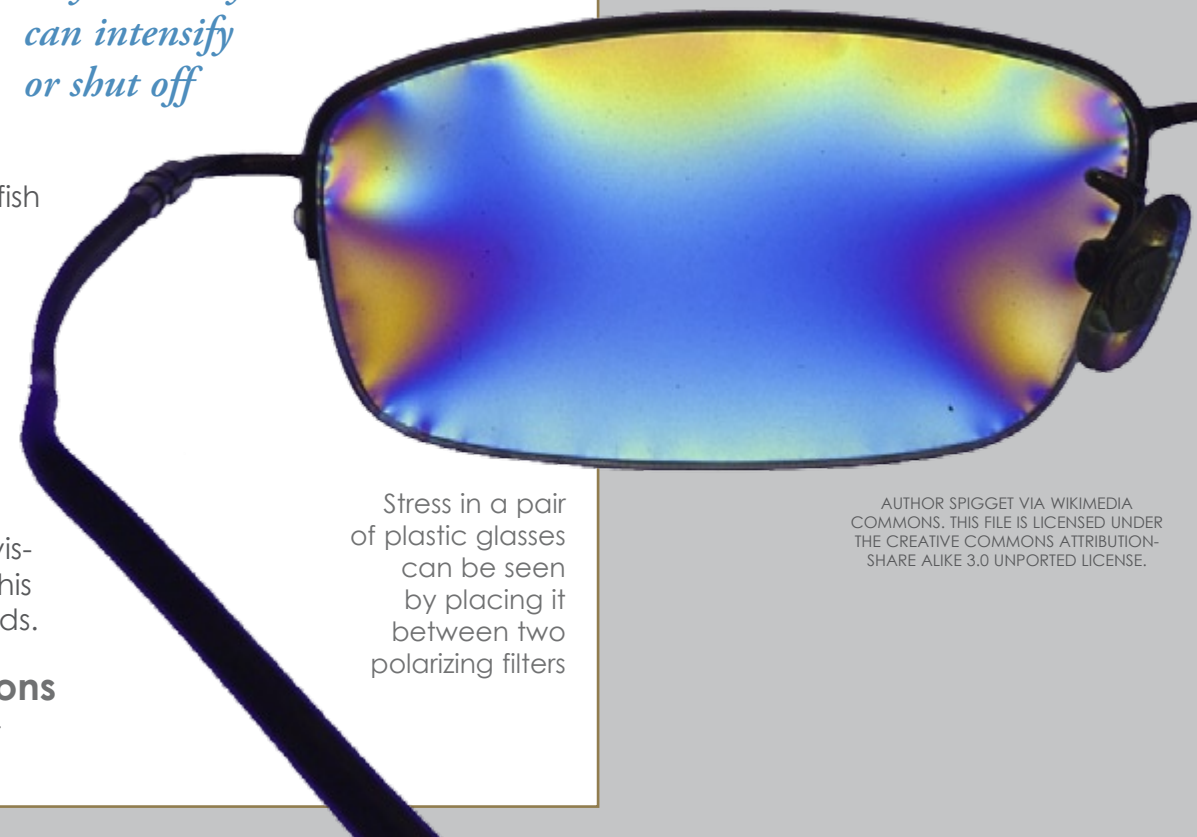
It is thought that these creatures do not possess the ability to see polarized light, and thus cephalopods may have an advantage over them in being able to communicate with one another without attracting the attention of predators. It is also thought that cephalopods and other marine animals that can detect differences in polarized light may use their abilities to detect polarization to assist them in navigation. ■

Cuttlefish reflect polarized light in a way that they can intensify or shut off



The reflection created by silvery fish scales is often polarized

Unpolarized light is disorganized. Polarized light, on the other hand, only vibrates on one plane.



Stress in a pair of plastic glasses can be seen by placing it between two polarizing filters

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The ability to detect light with and eye has been developing for more than 500 million years and includes a variety of possible forms ranging from simple photoreceptors in single celled organisms to the highly complex vertebrate eye.

could ascertain only the amount of light in the environment. The more advanced form of this was cup-shaped, which allowed the animal to discern from which direction the light was coming. However, this sort of eye did not allow the organisms to see as we think of it. Thus, the pinhole eye developed.

Pinhole eye

The pinhole eye is found in the Nautilus and consists of a small opening into a chamber, which allows a very small amount of light through. Light will pass through the pinhole after bouncing off different points of an object, and in this way basic shapes can be interpreted, not in any detail however. The hole is so tiny only a small amount of light can get in which makes the image faint. If the hole were larger, the image would be distorted. This type of eye is incapable of focusing on objects at different distances. Instead, the size of the image produced will change in relation to the distance away from the object.

The compound eye was the first true image-forming eye, which was thought to have formed some time during the Cambrian period, about 500 million years ago. The compound eye is common in insects and arthropods and consists of many ommatidia. Each ommatidia consists of a lens, crystalline cells, pigment cells and visual cells. The number of ommatidia will vary between species but may be up to 1000 per eye. Each ommatidia passes information on to the brain. This forms an image that is made of up dots, as if looking very close at a digital photo. A higher number of ommatidia mean more dots which make the image clearer. This type of eye is only useful over short distances. However, it is excellent for movement detection. For an animal to be able to focus on objects at different distances or even to produce a clear image of its surroundings at all, its eyes needed to develop lenses. It is thought that early cup-shaped eyes, like those of flat-



The pinhole eye of a Nautilus is incapable of focusing on objects at different distances. Instead, the size of the image produced will change in relation to the distance away from the object.

worms, contained a substance that protected them from seawater. If this substance were to bulge, it would form a pseudo lens that would help to make an image form more precisely, and this may be favored by the process of natural selection. Although the compound eye is full of lenses, the only way to make the image sharper with this design was to add more ommatidia. Of course, this means the eye would have to increase in size and can only do this to a point before it is too large for the animal. Thus, more complex lens eyes formed in both vertebrates and in cephalopods. Although both of these designs have many differences, there are also many similarities.

Cephalopod vs. Vertebrate Vision

As already stated, both cephalopods and vertebrates have very complex image-forming eyes with lenses. Both cephalopods

and vertebrates have single lens eyes. They work by allowing light to enter through the pupil and be focused by the lens onto the photoreceptor cells of the retina. However, between the two groups of animals, there are differences in the shape of the pupil, the way the lens changes focus for distance, the type of receptor cells that receive the light as well as some more subtle differences.



ANDY MURCH

JAMES WOOD

JAMES WOOD



In vertebrates the pupil is round, and it changes in diameter depending on the amount of light in the environment. This is important because too much light will distort the image, and too little light will be interpreted as a very faint image. The cephalopod pupil is square and adjusts for the level of light by changing from a square to a narrow rectangle.

The way in which the two groups use the lens to focus differs. Vertebrates use muscles around the eye to change the shape of the lens, while cephalopods are able to manipulate their lens in or out to focus at different distances.

The receptor cells of vertebrate eyes are rods and cones. The cones are used for vision in high light environments, while the rods are used in low light. The time of day the animal needs its vision to be most effective will dictate the ratio of rods to cones. Cephalopods, however, have receptor cells called rhabdomeres similar to those of other mollusks. These

contain microvilli, which allow the animal to see polarized and unpolarized light (see page on polarization vision).

Lastly, the way in which light is directed at the retina differs between the two groups. Cephalopod retinas receive incoming light directly, while vertebrate retinas receive light that is bounced back from the back of the eye.

Evolution

The evolution of cephalopods is thought to be due to an evolutionary "arms race". Over the course of cephalopod history, they have moved from the sea floor, lost their shells, developed abilities to change color, shape and texture as well as the ability to communicate in complex ways. It was their capacity to adapt to changing pressures that ensured their survival as a family. Those that did not adapt mostly became extinct.

The first cephalopods appeared 500 mya, before bony fish existed. These first cephalopods had a hard external shell like many other mollusks but

were able to leave the ocean bottom and swim to escape predators.

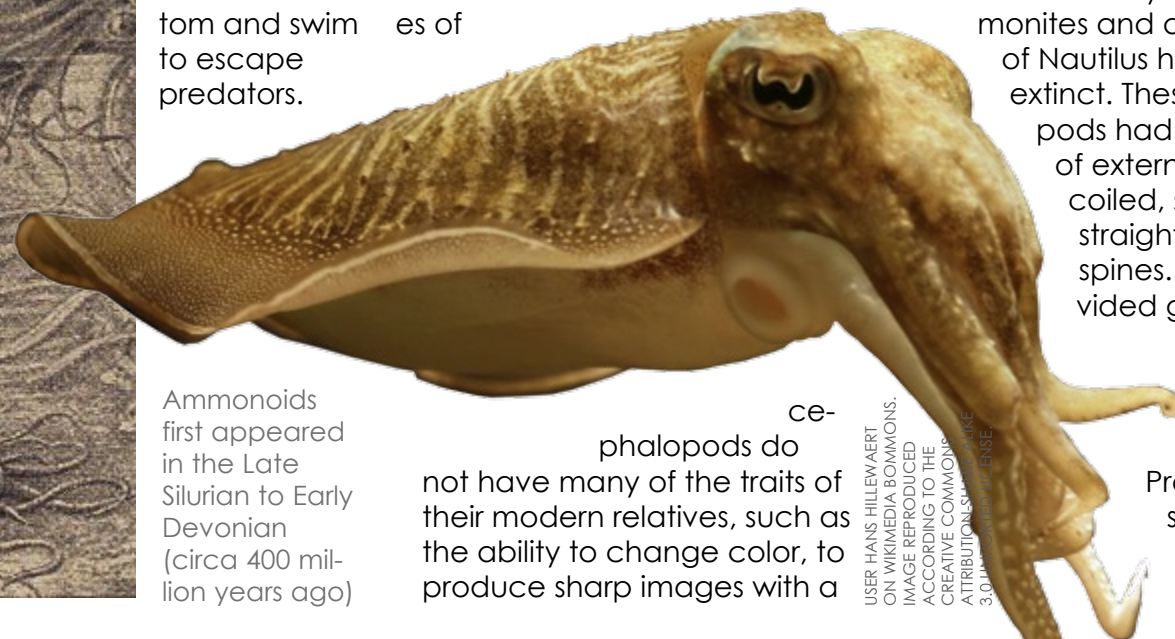


Ammonoids first appeared in the Late Silurian to Early Devonian (circa 400 million years ago)



When a predator came along, all the cephalopod had to do was let go of the bottom and float away like a hot air balloon. One of the first advances may have been the creation of multiple chambers connected by a **siphuncle**; this allowed these early cephalopods to slowly change their buoyancy.

Other early advances were likely to have been the ability to swim slowly to control direction. Two groups of cephalopods, the Nautiloids and Ammonoids (570 mya), depended on their external shell and ability to swim to protect them from predators. Both of these sub-classes of



cephalopods do not have many of the traits of their modern relatives, such as the ability to change color, to produce sharp images with a

lens-based eye, or the ability to swim fast.

It is hard to say why the Ammonites and all but six species of Nautilus have become extinct. These cephalopods had a wide variety of external shells, some coiled, some long and straight, some with spines. These shells provided good protection from predators but inhibited the animals' mobility. Predation pressure has long been thought to be one of

the major forces driving cephalopod evolution. Perhaps as species of bony fish, many of which swim much faster than an externally shelled cephalopod, appeared in the early oceans, armor just wasn't enough, and of those species that depended on armor, almost all have become extinct.

Differently strategy

Modern cephalopods have evolved a different strategy. Instead of a heavy protective external shell, they have reduced and internalized this armor. The loss of the heavy armor frees them from the weight of carrying it around and the energy needed to produce it. Most modern cephalo-

Squid fossil hundreds of millions years old

Squids

pod are active predators. Instead of heavy armor, they rely on speed and visual tricks to avoid being eaten. Some scientists have suggested that these adaptations were in response to pressure from predators. Indeed, many of the tricks such as the ability to change color, shape and texture as well as the ability to produce a visual ink decoy seem to be aimed directly at their predators. ■



JAMES WOOD

Glossary:

The siphuncle is a strand of tissue passing longitudinally through the shell of a cephalopod mollusk. Only cephalopods with chambered shells have siphuncles, such as the extinct ammonites and belemnites, and the living nautilus, cuttlefish, and Spirula. In the case of the cuttlefish, the siphuncle is indistinct and connects all the small chambers of that animal's highly modified shell; in the other cephalopods it is thread-like and passes through small openings in the walls dividing the chambers. ■



whale tales

Edited by Kelly LaClaire

Blue Whales Visit California

Groups of Earth's largest creatures—the blue whale—have given amateur whale watchers and charter boat operators in California reason to celebrate, by showing up in abnormally large numbers in the San Pedro Channel off the California coast where upwards of 2,000 of the giant cetaceans come to feed each summer. Hunted almost to extinction in the 1960s, the enormous whales—averaging about 80 feet long and weighing between 150,000 and 300,000 pounds—have been making a slight comeback in recent years reaching numbers of around 10,000 worldwide. Scientists suggest that vast krill clouds may be the reason so many whales are being spotted. Whatever it is, researchers and whale enthusiasts alike are extremely happy about it. ■



POSTVERK F2ROYA - PHILATELIC OFFICE / PUBLIC DOMAIN

Giant sperm whale fossil has the biggest bite ever

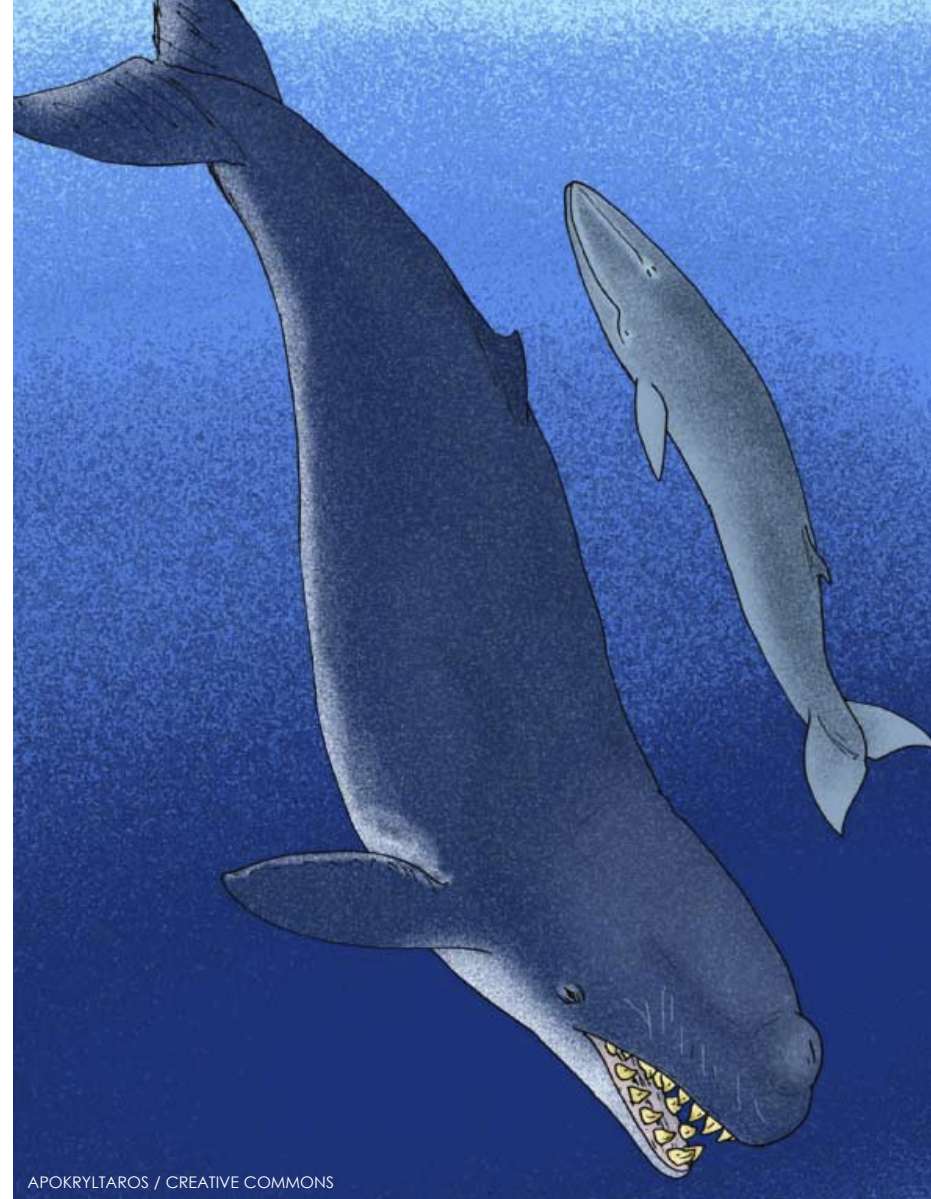
Scientists uncovered an ancient sperm whale fossil dated at 12-13 million years old in a Peruvian desert. This new, but extinct, species has been dubbed *Leviathan melvillei* and has teeth much larger than the sperm whales of today. The name derives from a combination of the Hebrew word *livyatan*, which refers to a giant sea monster, and American novelist Herman Melville, who wrote *Moby-Dick*.

Researchers recovered 75 percent of the animal's skull, which contained a massive set of teeth, some as long as 36cm—close to 10cm longer than any other sperm whale tooth ever recorded. This also led scientists to figure

the average length of these whales to be 13-18m long.

The sperm whales existent today do not have functional teeth in their upper jaw and feed by suction, usually on squid and the like. The *Leviathan melvillei* fossil, on the other hand, had giant teeth in both its upper and lower jaws, and a skull that seems to have supported powerful jaw muscles that scientists believe to enable the whale to hunt like modern killer whales, or orcas, and probably fed on baleen whales.

The giant snout of the fossil suggests that it had a large spermaceti organ, a series of oil and wax reservoirs reinforced by connective tissue that could have served such functions as echolocation or ramming capabilities while fighting or hunting. SOURCE: NATURE.COM ■



APOKRYLTAROS / CREATIVE COMMONS

Artist's rendition and comparison of the prehistoric whales *Livyatan melvillei* and *Cetotherium* from Middle Miocene Peru

Tracking whales like birds in the Gulf

Some environmental reports have suggested that upwards of three-quarters of the nearly five million barrels spilled in the Gulf of Mexico have been cleaned up. But Professor Christopher Clark, head of the bioacoustics research program at Cornell Lab of Ornithology (the study of birds) and one of the scientists monitoring the long-term affects of the disaster, said the remaining oil could prove harmful to whale and dolphin populations and cause "very long term consequences on the health of the Gulf".

To find out just how much ongoing damage is being inflicted, Clark's team is tracking

whales and dolphins by song and call, just as they would flocks of birds above the sea. "What we do is deploy instrumentation along the bottom of the ocean, or suspended in the water, that records sound for many, many months at a time. We deploy these strategically in areas we think the animals are most likely to be, and where the oil spill will most likely have an impact," he said.

By listening, instead of just looking, Clark and his researchers are more likely to gain important data on the social interaction of the

animals within their pods and groups as well as insights into hunting activities, which will be vital in discerning whether or not the Gulf ecosystems are struggling. To learn more about Clark and his work, visit www.birds.cornell.edu. ■



Whale Friendly Lawns

Is your lawn looking greener than ever? If you answered yes, chances are you are using a chemical fertilizer to keep it that way. Unfortunately, every time it rains or you water your lawn, run-off gets into our local storm drains and brings some of those toxic chemicals into the local rivers and streams. This in turn harms fish and wildlife and promotes algae growth, which limits the amount of salmon that can live and reproduce. The chain effect continues by lowering salmon numbers, thus making it harder for Earth's cetacean populations (whales, dolphins, porpoises) to thrive. But you can make a difference by committing yourself to being a responsible homeowner and limiting your chemical fertilizer use or switching to all-natural fertilizers. You can also join the Whale Friendly Lawns Campaign by signing up at www.acspugetsound.org, the web site of the American Cetacean Society. ■





whale tales

What's in your tuna?

Just because that can of tuna in your pantry at home says "Dolphin safe" on the label doesn't mean it's "marlin-safe" or "turtle-safe". Before you pick up your next can of Chunky Albacore at your local grocery store, here's something to keep in mind: the Monterey Bay Aquarium's well-regarded Seafood Watch Consumer Guide has recently begun telling shoppers to avoid all canned tuna except for the those few labeled "troll caught" or "pole-and-line" caught.

Most of the world's tuna catchers use dolphin safe procedures,

and this should be applauded, but all too often when hundreds of tons of tuna are caught, so are thousands of other species of "bycatch"—the industry term for unwanted species caught up in the nets—including sharks, rays, turtles and marlins, which are then killed and discarded.

"The real problem is giving ourselves high fives for solving the tuna-dolphin problem when we've just created other problems," said Timothy



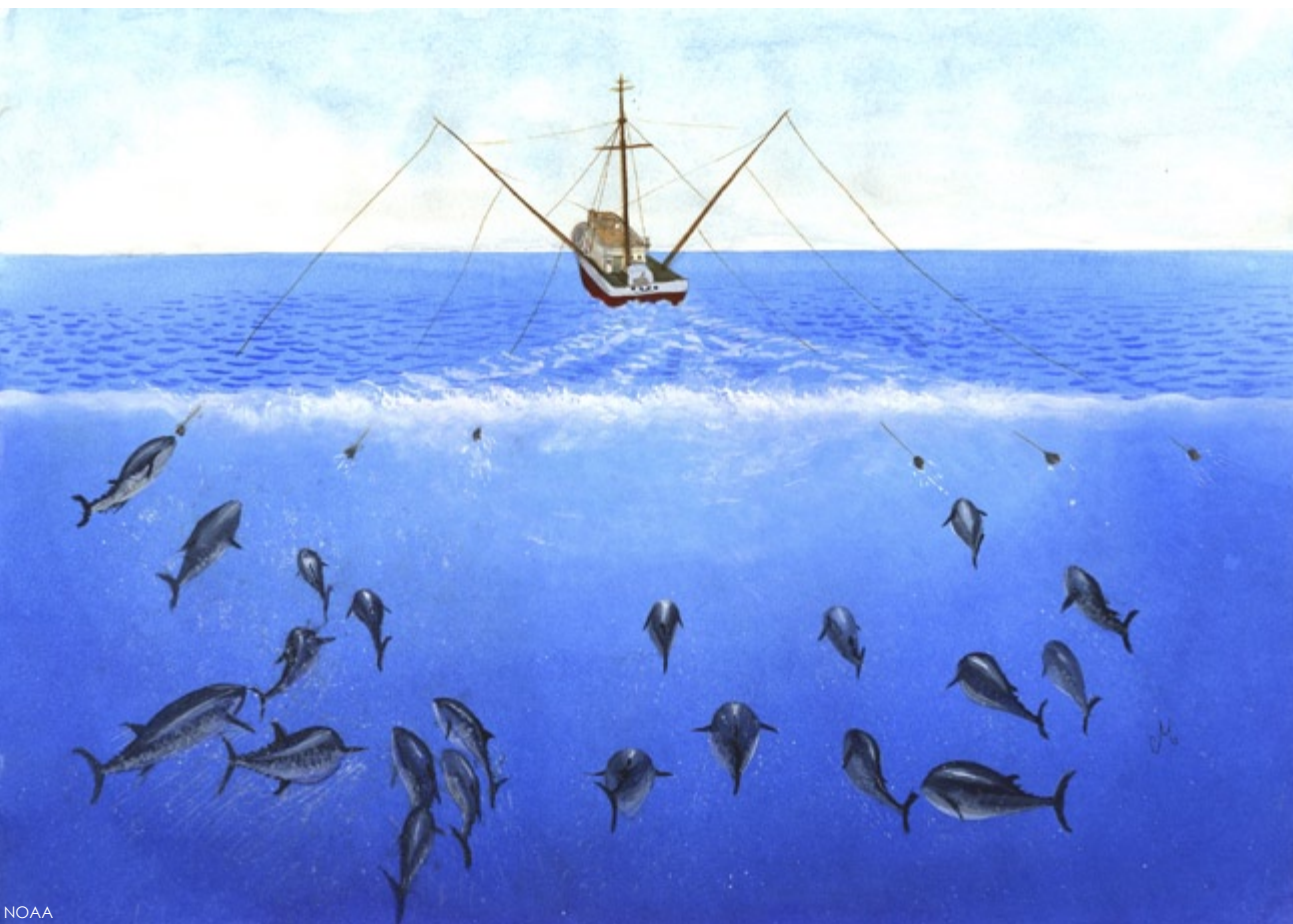
Essington, a scientist at the University of Washington.

Troll-caught refers to a method of fishing near the ocean's surface using short lines attached to barbless hooks. These hooks are hidden inside rubber "hoola skirts" that dance in the water and attract young albacore. Ten to 20 of these simple jigs are towed behind a slow-moving boat.

Pole-and-line fishing refers to catching tuna one at a time the old fashion way—with a fishing pole! This, by far, is the safest and most environmentally friendly way of sustainable fishing and keeping bycatch out of the huge commercial nets of massive fishing fleets.

If you now find yourself asking where you can find these kinds of "friendly caught" tuna, well, be prepared to look a little harder than usual. Fortunately, pole-and-line and troll caught tuna are becoming more and more popular with smaller retail food chains, and if you ask your local grocer to bring it in, you may be pleasantly surprised to find that they can usually accommodate your request. Just be sure to thoroughly check the labels and remember: the "dolphin-safe" label can be misleading. Buyer beware.

SOURCE: FORBES.COM, PACIFIC FLEET TUNA ■



Artist's rendition of trolling for tuna

POWERED BY
DUAL ALGORITHM

PELAGIC Z+ PELAGIC DSAT

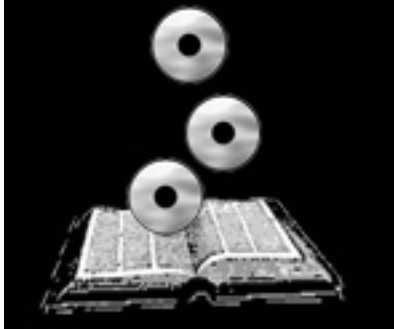
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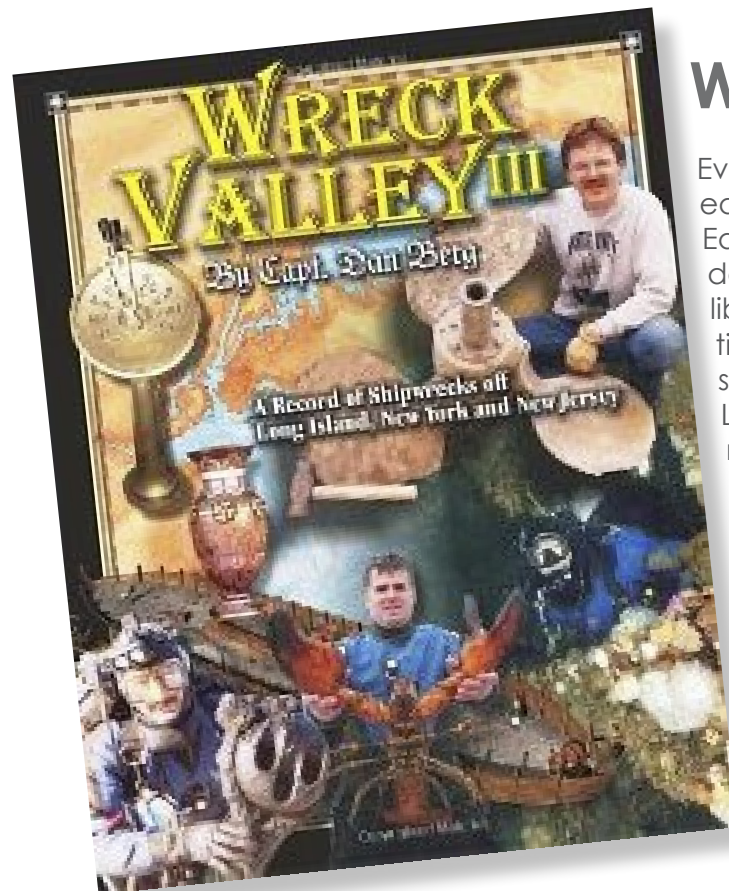




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Wreck Valley has a new look

Even if you already have Dan Berg's *Wreck Valley* first and second editions, check out *Wreck Valley III*. A disclaimer is in order: Sterner Editorial helped copy edit this edition. What follows is a general description of the book, which joined the other editions on the office library shelves, where they've been since 1986 and 1990 respectively. The 188-page soft cover from CreateSpace is a total revision of Berg's earlier books that examine nearly 150 wrecks off Long Island, New York and New Jersey, USA. Although they're mostly the same wrecks as in the earlier editions, the text is updated throughout with some serious fact-checking. Where the new edition shines is in the layouts. Some 400 of the 550 illustrations are in full color. Many are wreck divers' dream scenes: local divers beaming over braces of trophy lobsters and newly recovered or beautifully restored artifacts that are testaments to the value of retrieving items before they rot into the seabed. There also are site maps hand-drawn by locals who visit the wrecks and side-scan sonar images sprinkled amid lively layouts that make the edition more fun to read. Private boat operators will like the GPS numbers for the wrecks and reefs, instead of the Loran coordinates listed in the second edition. Wrecks are in

alphabetical order so the lack of a table of contents up front isn't a problem. For quick reference, wrecks and page numbers are presented in the index that closes the book. Also in the appendixes are leads to more info in the bibliography and suggested reading entries with Web addresses. It's available as a traditionally printed book or in digital form that can be downloaded into your reader or computer. ISBN: 978-1452867717. www.AquaExplorers.com



Picture facing cozy icy dives

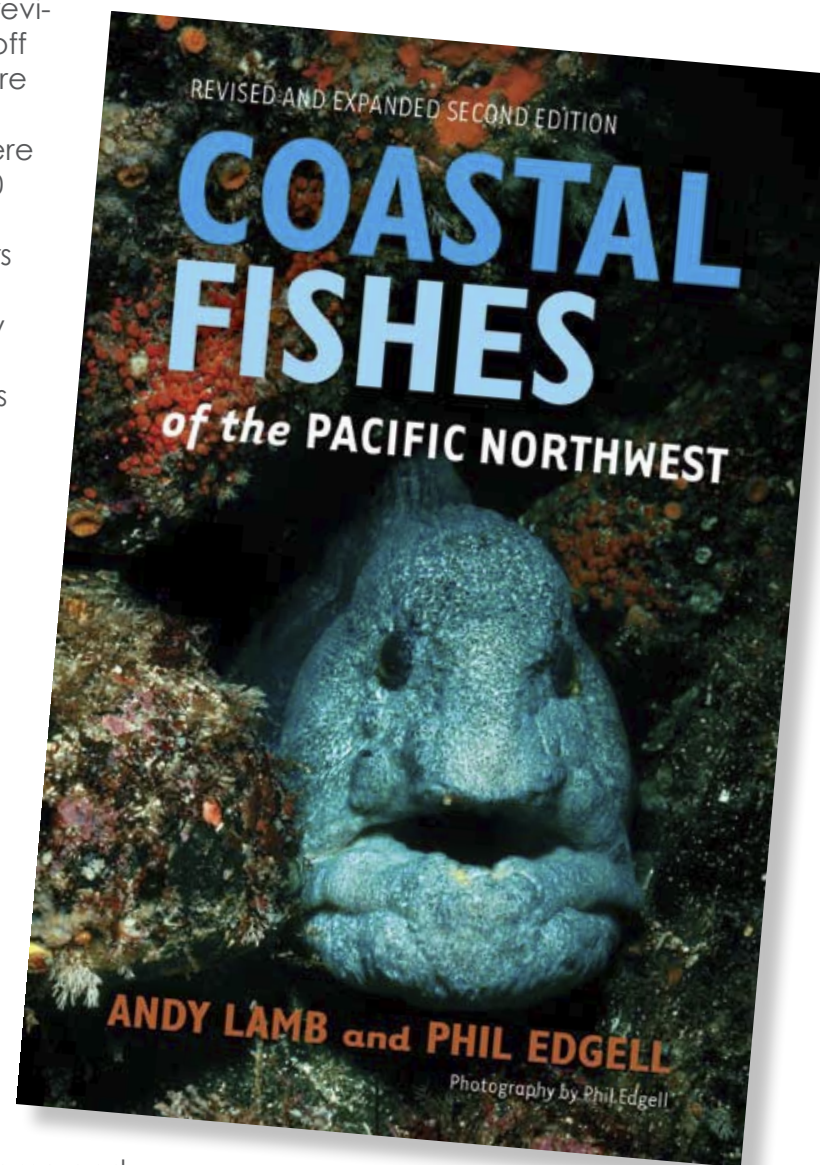
With a thick enough under suit even the coldest waters can seem toasty except for the exposed flesh around your mouth. The way to overcome having a numb face is to switch to a full-face mask. American team, Steve and Kristine Barsky have just released a DVD, *Choosing and Using Full-Face Masks*, to help divers select and use the mask that's considered essential gear by ice divers, commercial and public safety divers. The Barskys teamed up with Ocean Futures diver and TV personality, Blair Mott, as well as public safety diving instructor, Jeff Morgan, to cover full-face masks in the 48-minute video. Topics include how to select a mask, how to rig it, how to use it with

scuba and with surface-supplied air, emergency procedures and mask maintenance. In addition to the mask video, the DVD has two bonus features. Operation Safe Water is a 13-minute clip featuring San Bernardino, California, Sheriff's Department and FBI teams' tips on diving contaminated water. The other bonus is a presentation of masks through history as well as manuals and catalogs. ISBN: 978-0-9740923-4644. www.hammerheadpress.com

Meet Pacific NW denizens

Anyone diving in Pacific Northwest waters of North America should consider packing *Coastal Fishes of the Pacific Northwest* in the dive bag. The Harbour Press soft cover by Andy Lamb and Phil Edgell is 336 pages of photos and facts about the denizens from Central California to the Gulf of Alaska. The contents page has silhouettes of fish beside the name and chapter pages of the various species. This helps readers to quickly find information about the curious critters they saw on a dive. Various species are presented in photographs, many by Edgell, and line drawings that provide details to distinguish one subspecies from others.

Data is presented in outline form covering the scientific name, maximum size, distribution, habitat and comments with factoids about the fish. The book closes with an appendix of resources including Web addresses, phone numbers and mailing addresses, and a bibliography that points readers to more information about the fish. There is a comprehensive index to quickly refer to specific creatures. It's printed on quality slick paper that lets photos shine and feels like it'd resist water drips on a dive boat. The authors are well versed. Lamb is a marine naturalist with the Vancouver Aquarium, and Edgell has worked as a fish culturist at Fisheries and Oceans Canada at the Robertson Creek Hatchery on Vancouver Island. ISBN: 978-1-55017-471-7 www.harbourpublishing.com





Edited by
Peter Symes

Text and photos by Andy Murch

For centuries, the Diamond Shoals off North Carolina have been collecting shipwrecks. Hundreds of crumpled merchant vessels swamped by Mother Nature's fury and scores of battle scarred war machines torn apart by enemy shells loom above the otherwise featureless substrate. Subjected to racing currents and pounded by relentless surge, each wreck eventually erodes into an unidentifiable debris field. But in the interim, while the doomed ships still hold their structure, they are magically transformed into vibrant marine oases.

Initially, planktonic life forms looking for a permanent home attach themselves to every available inch of real estate. Larger invertebrates like snails and small crabs soon follow and begin grazing on the newly seeded decks. Within a season or two, blennies, angelfish and other small tropicals have arrived from who knows where, and the ghostly corridors are filled with swarms of silvery baitfish that morph from one shadowy corner to the next.

Bermuda chub peck away omnivorously at anything slow enough to constitute lunch, and amber jacks sweep

down from the heavens to scoop up the weak and injured.

Suspended in the water column, schools of shimmering Atlantic Spade fish practice their synchronized swimming techniques, while motionless barracudas hang in groups around the remaining

masts like living sign posts pointing to other distant oases.

Lording over the entire food web, enormous sandtiger sharks hover in the choicest locations, or patrol slowly back and forth with their unblinking eyes and implacable, snaggletooth grins.

The Sandtiger shark

Sandtiger's belong to the mackerel shark order, but they share few characteristics with their fast moving mako and white shark cousins.

There are three species of sandtigers: the smalltooth sandtiger, which

is rarely encountered except at great depth around Malpelo Island; the big-eye sandtiger, which is extremely rare and inhabits even deeper water than its smalltooth cousin; and the common sandtiger that many divers around the world have come to know and love.

Seize the Day

— a lesson from Mother Nature



shark tales



CLOCKWISE FROM LEFT: Sandtiger shark with diver; Barracudas above the wreck of the *Spar*; Lionfish; School of Atlantic spade fish. PREVIOUS PAGE: Sandtiger shark inside wreck

Even beyond the diving community, sandtigers are well known celebrities. Their ability to gulp air in order to counteract their negative buoyancy means that they do not have to swim continuously to avoid sinking. This makes them popular sharks in public aquariums because they are less likely to swim into the walls and inflict damage on themselves.

However, long-term incarceration in small aquarium tanks does have an adverse effect on the sharks. After a few years in captivity, sandtigers often show signs of abnormal growth patterns including stunted fins and hunched backs.

Even in the wild, sandtigers have their problems. Many populations struggle with parasitic growths in their mouths, and I have seen sandtigers with spine deformations and even one albino that had somehow managed to survive till adulthood.

Sandtigers (called ragged-tooth sharks in Africa and grey nurse sharks in Australia) are unique in



more ways than one. They are livebearers that produce two offspring (one in each uterus) per season. The developing embryos indulge in inter-uterine cannibalism. Once they have devoured all of their smaller siblings, they begin consuming a constant supply of unfertilized eggs that are chan-



feed as often as faster swimming species. That is a great advantage for large predators that have to rely on a limited food supply like the sandtigers on the wrecks of North Carolina.

But, sandtigers are also ram ventilators, and their casual approach

to swimming may in some ways limit their oxygen uptake, making them more sluggish and possibly even slower witted than other mackerel sharks.

Sandtigers are not picky eaters. They are known to consume bony fishes, small

neled into the oviducts—a feeding strategy known as oophagy.

The sandtiger's ability to mooch slowly along with a stomach full of air is a fascinating adaptation, but in some ways, it may be a double-edged sword. It allows the sharks to conserve energy, which means that they do not have to

ums. However they got there, they appear to be flourishing. As they have no natural enemies, it looks as though the ecosystems that they have invaded may be changed forever by their presence.

One of the best known wrecks off the North Carolina coastline is called the *Spar*. It is a thriving 300-foot long artificial reef that was sunk about a two-hour run from Morehead City. Because of its elevation and intact super-

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Andy Murch



THIS PAGE: Sandtiger sharks' ability to gulp air to counteract their negative buoyancy means they don't have to swim continuously to avoid sinking

environments are in a constant state of change. Change can seem scary, especially when humanity is involved in manipulating the natural order of things, but the wrecks of the Diamond Shoals are a manipulation as well.

Five hundred years ago the biggest topographic anomalies on the sea floor were probably a few small Viking ships. A thousand years ago there would have been nothing on the Diamond Shoals except an occasional whale carcass.

Now that large vessels are equipped with 21st century navigational aids and better marine safety protocols, North Carolina's crumbling underwater habitats are unlikely to be replenished. It'll take a while, but in a century or two there will be very few manmade structures left on the seafloor. That means, no more colonies of invertebrates, no more levitating sandtiger sharks and no more lionfish.

Mother Nature rolls with the punches. When conditions permit, she presents us with jewels like the marine oases we have right now.

The lesson to be learned from her is never to waste an opportunity. So, dust off your dive gear and enjoy the wondrous diversity of marine life on the shipwrecks of North Carolina while you can.

Find out how you can help to protect sharks by visiting elasmodiver.com/protectingsharks.htm ■

structure, it is often packed with sandtigers.

In recent years, it has been plagued by red lionfish, but during a productive weekend shooting sandtigers on the *Spar* this summer, I was unable to locate a single invader. Could it be that the sharks have developed a taste for spicy Asian cuisine? It's a nice thought, but it is more likely that the lionfish have either migrated into cooler water for the summer, or they are hiding in the bowels of the wreck where sandtiger photographers seldom venture.

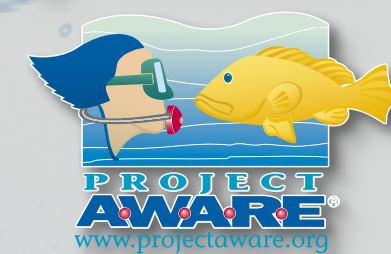
It may seem like a catastrophic problem, but before you lose too much sleep over the lionfish invasion, consider this: marine



Help Give Sharks A Fighting Chance



Join divers worldwide demanding sharks get the protection they deserve



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Shark and ray watching could bring significant economic benefits to UK coastal communities



A joint study with La Universidad de la Laguna (Tenerife) shows that shark and ray watching by divers is bringing millions of pounds into the Canary Islands economy every year. Leading independent think-tank NEF (New Economics Foundation) said similar stories could be told in the United Kingdom if better conservation measures are put in place.

"This study reminds us that the marine environment is a key economic asset to countries such as the UK. Wildlife tourism in the UK already brings millions to our local economies but much of the marine environment remains an untapped resource that needs to be looked into in more detail," stated Aniol Esteban, head of environmental economics at NEF.

"Sharks and rays could be a very

exciting starting point to explore the benefits for UK marine wildlife tourism. Better conservation of the marine environment will undoubtedly bring opportunities for UK coastal communities helping them secure longer term income flows and employment," he added.

The study revealed diving companies on the Spanish mainland were missing out on the attraction of sharks for divers, but those inter-

viewed stated a higher frequency of shark and ray sightings would be very beneficial for their businesses.

Shark and ray watching by divers brings in €17.7 million (£14.5 million) to the Canary Islands each year. The United Kingdom has 21 types of sharks and 16 types of skates and rays in its waters, including the basking shark, which is the world's second largest fish. ■

Algae blooms damage sharks' brains

Toxins produced by red tide events can alter shark brains, resulting in "hyper-excitability" and even death, according to a new study.

Brevetoxins, which are brain-changing compounds synthesized by some harmful algal blooms, have now been shown to affect a free-ranging marine species. In this case, researchers focused on lemon sharks, but they believe many other types of sharks could fall victim to the toxins.

"Sharks are exposed via consumption of brevetoxin-contam-

inated water and food, such as shellfish," co-author Niladri Basu explained to Discovery News, mentioning that the toxins can easily cross the shark's blood-brain barrier that otherwise protects the brain.

"Once inside the brain, brevetoxins bind very strongly to a protein that controls sodium flow," added Basu, an assistant professor of environmental health sciences at the University of Michigan School of Public Health. "By disrupting sodium flow in the brain, nerve cells will over-fire and cause hyperexcitability and ultimately result in death." ■

SOURCE: AQUATIC TOXICOLOGY.

White sharks making a comeback off California

A longstanding statewide ban on fishing for white sharks, an increased survival rate among young white sharks because of fishing gear restrictions, and an expanding sea lion population as a prey source are chief reasons for the comeback.

Christopher Lowe, a professor at Cal State Long Beach, who has performed extensive tagging of juvenile white sharks off Southern California in the United States and has pored over data dating back generations, said personal observations and increased incidental catch rates of small white sharks by commercial fishermen help support his contention. ■

Welcome to Papua New Guinea



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technical matters

When combined with a poor choice of equipment placement or a lack of storage space, the diver can end up looking like a Christmas tree with pieces of equipment randomly clipped on and dangling from every conceivable spot.

Technical Diving Equipment

The equipment used by technical divers differs considerably from that used by recreational scuba divers. Even when it appears similar, the technical diver will usually either carry more equipment or configure it slightly differently. In this article, we will look at the different equipment configurations used by technical divers, the reason for those differences and also whether there are any lessons recreational divers can learn from these configurations.

Over the years, recreational diving has developed a standard set of equipment configuration. Despite different makes and models there is a consistent set of gear shared by the majority of recreational divers. Buoyancy control is usually provided by a jacket style buoyancy compensator (BCD). The diver's main cylinder contains the majority of their

breathing supply, which is delivered via a primary regulator. A spare regulator or octopus is usually carried to provide a

source of air to the buddy, or in the case of a problem with the main regulator. Additional equipment is often carried in the pockets of the BCD or clipped onto it.

Technical divers have quite a different set up designed to deal with a different set of conditions to those experienced by the recreational diver. There are a wider range of styles of equipment configuration, although all of these styles have been developed to address the same key requirements.

Redundancy

The key requirement for any technical diving configuration is that it provides an adequate level of redundancy. Technical diving usually involves mandatory decompression stops, and it may be anything from a few minutes to a few hours before the diver is able to ascend to the surface without risking decompression illness. In this case, the loss or failure of any piece of vital equipment would be a major problem. As a result, the technical diver looks to provide redundancy of equipment so that he can resolve equipment problems whilst still completing the required decompression.

Equipment that is required for the safe completion of the dive should always have a backup.

Even if you never plan to explore the far end of a cave or dive to 100m, there are still some aspects of technical diving kit configuration that would benefit a recreational diver:

- Streamline your kit and eliminate any danglies.
- Ensure you have redundancy for any critical kit.
- Make sure you carry enough gas to deal with the worst case.
- Consider a long hose on either your octopus or your primary.
- Ensure your backup regulator is always accessible.
- If you have a single delayed surface marker bouy, then make sure it is orange or red.

Don't be a Christmas tree

By adding backups, the technical diver ends up carrying significantly more equipment than the recreational diver. If this is added in a haphazard way, or without consideration of how the configuration will work as a whole, it is very easy for the technical diver to become overwhelmed with equipment.

Many divers carry equipment "just in case" it is needed without ever thinking about what is really required. When combined with a poor choice of equipment placement or a lack of storage space, the diver can end up looking like a Christmas tree with pieces of equipment randomly clipped on and dangling from every conceivable spot.

This dangling equipment can introduce a number of additional risks. Firstly the diver may have so much clutter that when they need to get a specific item of emergency equipment, they cannot find it amongst all the other equipment. Secondly, dangling kit may become lost, caught in a piece of wreckage or entangled in a line.

Tech gurus John Chatterton and Richie Kohler trying to disentangle themselves after a technical dive

ROSEMARY E. LUNN



Text by Mark Powell

applied by the recreational diver to ensure their kit is streamlined and the Christmas tree effect is reduced.

We all know that human beings are not designed to breathe underwater. For this reason, divers need to take their own breathing gas with them when they dive. It is essential that enough gas is taken to complete the dive. For a recreational diver to run out of air is bad enough, but for a technical diver, it is not an option. If a recreational diver runs out of air on a no stop dive to 20m, they simply have to get to the surface. However, on a decompression dive where the diver may still have 20 minutes of decompression to complete, they are faced with the decision of staying down, completing the decompression and drowning, or going to the surface and risking decompression sickness. This is a choice that should be avoided by ensuring that there is always a sufficient supply of breathing gas.

Twins

The use of a 'pony' cylinder may provide enough gas to allow an ascent from recreational depths, but the volume of these cylinders is simply not enough to allow an ascent plus decompression stops from greater depth. This means that a pony cylinder is not sufficient redundancy for technical diving. The use of twin cylinders or twinset is a way of providing this redundancy.

A twinset is usually made up of two identically sized cylinders with a regulator connected to each cylinder. These can vary in size. Twinsets comprising two 7l cylinders are popular with recreational divers who want to have additional redundancy, but for technical diving, cylinders smaller than 10l do not provide a sufficient volume of gas. Twinsets made up of 12l, 15l, 18l or even 20l cylinders are available but, for the majority of technical divers, twin 12l cylinders provide a good balance of weight and gas volumes.



VIKKI BATTEN



A pony cylinder is not sufficient redundancy for technical diving

Streamline

In order to avoid this Christmas tree effect, technical divers try to streamline their equipment and the placement of it. Contents gauges are clipped on rather than allowed to hang down. Reels, Delayed Surface Marker Bouys (DSMBs) and emergency equipment are stored in pockets rather than dangling on a lanyard. The same principles can be



ders provide a good balance of weight and gas volumes.

Twinsets can be configured as independent or manifolded. Independent cylinders provide complete redundancy, as there is no link between the two cylinders. Thus, if one cylinder has a problem, the other is completely independent. However, as the two cylinders are independent, the diver has to switch from one to the other in order to balance the gas usage in the two cylinders. Whilst switching regulators should be easily within the skill set of a technical diver and should be a routine action, it can sometimes be forgotten when the diver is in the middle of a problem.

The other option is to manifold the two cylinders together. This involves connecting the two cylinders at the valves by means of a manifold. This has the benefit that the gas from both cylinders can be accessed from the primary regulator. The disadvantage is that, in the case of a problem, the diver must shut down the problem regulator, or isolate the two cylinders by means of a valve in the middle of the manifold, otherwise the gas from both cylinders will be lost. For this reason, it is essential that a diver with a manifolded twinset can carry out a 'shutdown' to prevent the complete loss of their gas.

In twinsets, the two cylinders are often connected at the valves by means of a manifold



Long hose

One of the most distinctive aspects of a technical diving setup is the use of a long hose. A typical recreational diver will have their main regulator and then an 'octopus' regulator, which can be donated to their buddy in case of emergency. This octopus reg is often, but not always, on a slightly longer hose than the main regulator.

Technical divers tend to use a much longer hose, from 1.5m to 2m in length. There are a number of reasons for this. When diving in an overhead environment, such as a cave or inside a wreck, then if one diver were to go *out of air* (OOA), it may be difficult to swim out whilst in the side by side position that a normal length octopus would require. With a long hose, the divers can be one in front of the other and so can easily swim through restrictions.

Of course, most recreational divers will never go anywhere near a cave or any level of wreck penetration but a long

hose is still useful, even in an open water environment.

If you try to ascend while breathing off your buddy's short hose, you will need to be very close together. Sending up a DSMB, controlling the ascent and holding a safety stop are much more difficult when you are very close together and 'in each other's faces'. Combined with the stress of the initial OOA, this can be enough to turn a difficult situation into a full blown incident.

The long hose gives you the space to perform all of these tasks with enough room to remain comfortable and composed.

It is possible to use

The first reason for donating the regulator in your mouth is that you know this regulator is working.

a long hose configuration even on a recreational single cylinder set up.

Which regulator?

The long hose could go on the octopus, but most technical divers put the long hose on their primary regulator.

This is because, in the case of an OOA, they would plan to donate the regulator in their mouth. This is not what the majority of divers were taught in their entry level courses, so why should this method be adopted?

The first reason for donating the regulator in your mouth is that you know this regulator is working. The OOA diver will be under stress and putting a working regulator

in their mouth is the quickest way to calm them down. Another reason is that many people believe that an OOA diver is more likely to take the regulator from your mouth rather than hunting around for an octopus.

The last reason is that technical divers frequently carry multiple cylinders. These cylinders carry gases that are only breathable at certain points of the dive. If you breathe the gas at the wrong depth, then oxygen toxicity could be a very real risk. We know that the regulator in our mouth always contains breathable gas, and so by donating this regulator, we are ensuring that the OOA diver is getting a safe source of gas.

Bungee

Of course, if we donate our regulator, then that leaves us with no regulator. This is not a situation that we want to be in for very long. If we now need to start hunting around for our backup, ensuring that we don't take a deco gas regulator mistake, by

then we are just moving the problem along from

Rich Walker (left) demonstrating the reach of the long hose. In what is known as the *Hogarthian configuration*, it is the primary regular that is fitted with this long hose, which is routed around the head. The secondary regulator is fitted with a normal length hose and is suspended just below the chin on a bungee cord as seen on author Mark Powell below. See main text for full explanation



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the OOA diver to ourselves. For this reason, the technical diver does not store his backup in his pocket, or clipped on somewhere on his chest, but instead, he stores it on a bungee around his neck. This means that once they have donated their primary, it is just a question of ducking the head and putting the bungied backup into their mouth.

It is possible to use a twinset and long hose setup in conjunction with a standard BCD style jacket, providing that the jacket is sturdy enough. However, it is more common to use a twinset with a wing style BCD, back-plate and harness. The

wing provides the ability to have increased buoyancy to offset the twinset and also puts the buoyancy in the same place as the twinset. This usually makes the setup more comfortable than a BCD style configuration. The harness also reduces the amount of equipment and clutter that the diver has on their front. This is important if we are trying to maintain a

streamlined configuration. When this type of setup is correctly configured it can be much more comfortable than a single cylinder and pony mounted on a BCD style jacket.

Technical divers will often carry multiple gases, for use on different parts of the dive. One or more rich nitrox mixes are used to speed up the decom-

There is a convention that says that a red, or orange, delayed surface marker bouy (DSMB) is used as the main one



ROSEMARY E. LUNN



Stage cylinders



pression, and there may even be an additional gas that is breathed during the descent. These additional gases are carried in what are typically known as stage cylinders. These are usually clipped into the diver's chest and their waist and hang at their sides.

Marker buoy

Amongst technical divers, there is a convention that a red or orange DSMB is used as the main DSMB. They would also typically carry a spare DSMB complete with spare reel or spool. In addition, most technical divers also carry a yellow DSMB. This is used to signal that the diver has a problem and requires additional gas or other help. Typically, this is sent up the same line as the main DSMB and will often have a slate attached, which allows the diver to indicate what help they need. Of course, there is always the potential for confu-

sion if a recreational diver has a yellow DSMB, and so all the recreational diving agencies through the British Diving Safety Group have agreed that if recreational divers carry a single DSMB then this should be red or orange rather than yellow.

The use of rebreathers has become very common in technical diving but that is a subject for another article...

Mark Powell is one of the leading technical diving instructors. Mark has been diving since 1987 and instructing since 1994. He is a full time technical diving instructor for a number of the leading agencies and teaches all levels up to and including Advanced Trimix. Mark has led a number of expeditions to various parts of the world including the Middle East, Costa Rica, Malta and the Red Sea but is usually found diving the wrecks around the coast of the UK. ■

GLOSSARY

Back Gas — The gas carried in your main (back mounted) cylinders.

Stage Cylinder — a) In the United Kingdom, a generic name for any cylinder carrying additional gas to that in the main cylinder.

Stage Cylinder — b) In cave diving, a cylinder that is dropped or 'staged' at a specific point in the dive. As such, it could contain deco gas, travel gas or bottom gas.

Side Slung — Another name for a stage cylinder, so called because it is usually connected or slung on the diver's side.

Deco Gas — The gas to be breathed during some of the decompression stops and used to speed up the rate of decompression. The stage cylinder used to carry this may also be referred to as a deco cylinder.

Travel Gas — Gas that is used during the descent if the back gas is not breathable on the surface. The stage cylinder used to carry this may also be referred to as a travel cylinder.

Bottom Gas — Sometimes the back gas in the twinset is not enough and an additional stage cylinder of the same gas is carried to breathe during the bottom time portion of the dive. The stage cylinder used to carry this may also be referred to as a bottom gas cylinder.

Bailout Gas — The gas carried by a rebreather diver in the event that they experience a problem with their rebreather. They would switch onto this bailout gas and then continue the ascent breathing from the bailout cylinder(s).

turtle tales



Edited by
Bonnie McKenna

Sea turtles from the Gulf oil spill have been released in Florida

Two boats of wildlife rescuers released 42 Kemp's Ridley sea turtles, plucked from the waters near the Deepwater Horizon oil spill, got a second chance.

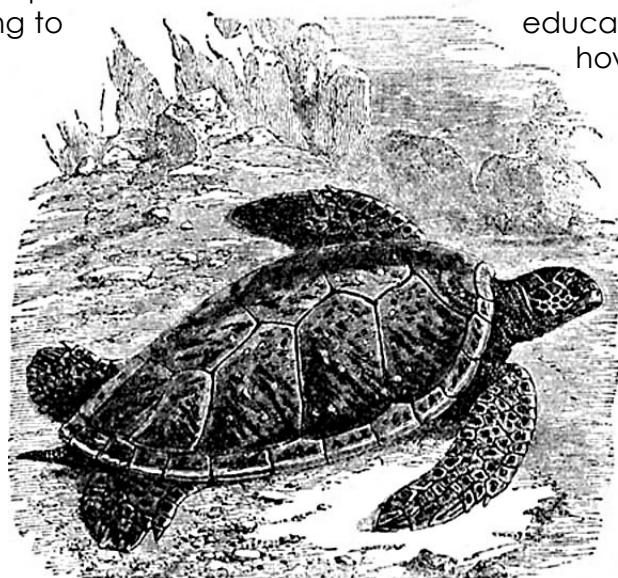
The releases, Florida's wildlife officials said, was the largest number of rescued sea turtles returned to the Gulf of Mexico; thus capping a remarkable journey of rescue and recovery.

The juvenile turtles were rescued between June and August. Of the 42 turtles, 37 were victims of the oil spill, and the other five were found stranded in Mississippi, but without oil on them. More than 150 oil spill turtles are still waiting to be released.

Once at the release site, the turtles were each taken out of their crates, and their tags recorded before being released. ■



Kemp's Ridley sea turtle



FILE ILLUSTRATION



NOAA FISHERIES / MARCO GIULIANO / FONDAZIONE CETACEA

Loggerhead turtle (*Caretta caretta*)

Guana Research Reserve volunteers and staff track and protect sea turtles

The Guana Research Reserve on Ponte Vedra Beach in Florida has been busy tracking and protecting loggerhead sea turtle nests this nesting season.

Loggerhead turtles are the most common sea turtles in the area. Approximately 72 nests are recorded each year, but this year the number of nests has more than tripled.

Don Eastman, Guana Reserve biologist said, "We may be experiencing a baby-boom on our beaches."

Nesting season runs to the end of October. This season, to date, records indicate more than 250 nests have been counted along the seven-mile beach.

The biologists believe that public education and making shrimpers use turtle excluder devices on their nets could be contributing to the increase in the number of nests.

A cadre of 18 trained volunteers has been the key to the success of the research program. Volunteers not only adopt nests but also educate people on the beach and through a lecture series on how to protect sea turtles. ■

The forgotten flatback sea turtle expedition

The Sea Turtle Restoration Project is working with activists in Australia to protect the little known flatback sea turtles that live in the area of Western Australia known as the Kimberley. If you would like to receive some information, to volunteer or to discuss this exciting sea turtle and out-back adventure, contact Teri Shore at tshore@tirn.net. ■



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Submerge your senses



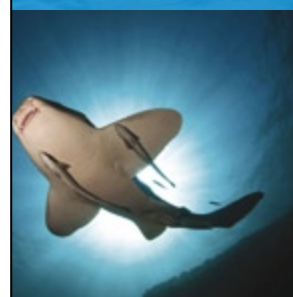
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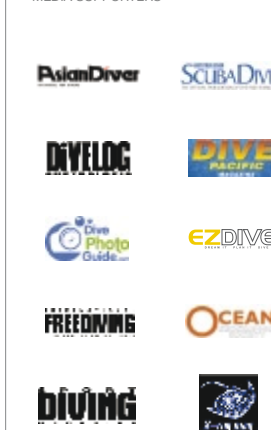




photo &
video

Edited by
Peter Symes
& Scott Bennett

Choosing the almost black back-
ground (in the image below)
allowed me to select the fish and
isolate it from the background in
post production on the computer

Field Work



Text and photos
by Lawson Wood
www.lawsonwood.com

Now, we have our camera and all of its ancillary added on bits. We have checked that everything works. We have our chosen format decided. We have our laptop and portable hard drive all packed up and ready to go on location, but where are we going and why go there in the first place?

Research

Getting to know your subject is perhaps easier than you think, however, we really do not have a whole lot of spare time underwater collecting knowledge on our subject matter. Rather, we read up everything that we can about any behavioural oddities; we talk to other photographers who have been to the location we have chosen; and we research as much as possible, quite a lot of which can be found readily available on the Web.

Timing isn't everything, so they say, but in underwater photography, timing is everything, whether it is the time of day, month, season or year. There are climatic changes annually as well as water temperature fluctuations. Some of the best diving to be done in the Caribbean, for instance, is in August and September, but it is blistering hot on shore, and there



is a fair chance that you may get caught up in one of the periodic hurricanes, which can sweep through the entire area. Typically, hurricane season is from 1 June to 30 November.

There are similar seasonal activities destined to spoil your photography in virtually every location on the planet. Plan any trip well in advance and you will not be disappointed.

More often than not, it is pot luck at the end of the day and your own conviction that you can get good photographs from every dive. If the viz is bad, take close-ups. If daytime conditions are terrible, dive at night.

One time, in the Red Sea, there were a simply staggering amount of jellyfish. They covered the entire surface of the sea and filled the water column for two days. Many people complained, but I concentrated on jellyfish photographs!

Pelagic fish and mammals also have seasonal migration routes. One can photograph humpback whales in Rurutu in French Polynesia in October, or whalesharks in the Seychelles in November, or leafy sea dragons in southeast Australia in February, or basking sharks in June in the Irish Sea and the Sardine Run off

Juvenile Queen Angelfish (*Holacanthus ciliaris*), Cayman Brac, Cayman Islands —105mm lens, ISO 100, Sea & Sea YS180 flash, 1/125th second at F16





photo & video

Christmas Tree Worm (*Spirobranchus giganteus*), Cayman Brac, Cayman Islands—60mm lens, ISO 200, Sea & Sea YS180 flash, 1/125th second at F16

BELOW: Divers at sandbar off Grand Cayman

South Africa in February—the list goes on. The point is that whatever your desire, someone will more than likely have been there before you, taken photographs there, or even written a book.

I once spent over 50 minutes in seven metres of water inside the crumbling remains of a small shipwreck on the northwest shore of Cayman Brac, in the Cayman Islands. The wreck was a former inter-island landing craft by the name of the *Barbara Ann*. Inside the stern section about three metres square, I found a juvenile queen angelfish (*Holocanthus ciliaris*). It was around 3cm from head to

tail outfitted with outlandish, incredibly vivid colours.

As you can imagine, such a small colourful fish was also very timid. But after watching the fish and creeping closer, armed with my trusty Nikon and 105mm lens, I was able to ascertain its swim pattern where it would perform a figure eight and hide behind part of the old ship's interior mid journey.

I took a photograph, it darted for cover, but then started its normal route, so I took another photograph. It swam for cover. But after a few more photographs, it got used to me. I could soon anticipate its route and managed to take three or four absolutely great photographs of this shy and elusive fish.

Having such a nice and cooperative subject allowed me the time to choose my backgrounds as I took the photographs. Choosing the almost black background allowed me to select the fish and isolate it from the background in post production on the computer. This clean image could now be superimposed on another photograph for instance or used as a graphic representation in a feature article.

Empathy

No matter how we try to be invisible to our photographic subject, inevitably we are just those big ugly, ungainly creatures that blunder around without too much

thought, sometimes getting too close to subjects and at other times not seeing the big picture. You can only start to become more familiar with your subject matter if you can have some empathy and understanding of the intrusion into their personal space.

Humans are just the same in this respect. If a stranger gets uncomfortably close, then we automatically back off or turn and be prepared to fight. Our adrenalin peaks, and it is the primeval fight or flight reflex. Well, apply this sentiment to the underwater world when approaching a new subject for the first time.

The creature may be light or pressure sensitive, such as Christmas tree worms (*Spirobranchus giganteus*), and you may only get one chance at the photograph. If you encounter this subject in calm water with perhaps overcast skies, then when your flash fires, the worm instantly disappears into its tube home in the coral. Similarly, if you find these normally shy animals in well lit turbulent waters with perhaps some surge, you can

usually take two or three photographs at different angles before the creature eventually withdraws, if at all.

Christmas tree worms are both light and pressure sensitive and so must be approached slowly and with empathy, as there may be only the one chance of taking the photograph before they retreat.

Lawson was raised in the Scottish east coast fishing town of Eyemouth and spent his youth exploring the rock pools and shallow seas before learning to scuba dive at the tender age of 11. Now over 44 years later, Lawson has been fortunate to make his passion his career and has authored and co-authored over 45 books mainly on our underwater world. Lawson is a founding member of the Marine Conservation Society; founder of the first Marine Reserve at St. Abbs in Scotland and made photographic history by becoming the first person to be a Fellow of the Royal Photographic Society and Fellow of the British Institute of Professional Photographers solely for underwater photography. ■



cinema of dreams



www.seacam.com





10 Bar releases housing for Sony NEX-5

10 Bar has released a housing for the Sony NEX-5 camera. Supplied with a standard dome port and lens ring, the housing sports an aluminum front, acrylic back, and is rated to a depth of 60m. Suitable for the Sony NEX 18-55mm lens, it features mechanical controls for all functions and will allow for TTL strobe exposure via fiber optic cables.

www.10bar.com



Fantasea FP7000 Housing for New Nikon Coolpix P7000!

Fantasea Line has announced its new housing for the Nikon's new Coolpix P7000 digital camera. Rated to a depth of 60m/200 feet, the FP7000 housing is manufactured to the highest professional standards of function, style and durability and is ideal for snorkellers and divers alike. Designed to be compatible with a complete Accessory System, all controls are easily accessible and labelled for comfortable operation.

Also included is a special mount for lighting accessories, double O-ring seal, removable double fiber optic cable connection and removable flash diffuser. The robust construction is shock resistant and protects the camera from water, sand, dust, frost and other damaging elements.

The expected release date is set for early 2011. Pricing has not yet been made available but other housings are in the US\$100-\$130 price range.



Sanyo Announces Full HD Dual Xacti Underwater Camcorder

The new Dual Camera Xacti is a full HD (1,920 x 1,080) camcorder that records MPEG4 video at depths of up to ten feet underwater. Weighing in at a mere five and a half ounces with dimensions of 3.37 by 1.47 by 4.34 inches, its compact size is a definite travel plus. It can record over 480 minutes of video in addition to 14-megapixel still photos. Other features include a CMOS sensor (14.4 megapixels), wide angle lens and a 5X optical zoom. The Xacti also offers a couple of proprietary features: a "double-range zoom," which enables the use of a 12X zoom for wide angle to telephoto recording, as well as High-Speed Sequential Shooting, for up to 22 photos at seven frames per second. It is compatible with SD, SDHC and SDXC cards. List price: US\$349.99 www.us.sanyo.com

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Inon X-2 Housing for Panasonic Lumix GF1

Inon has released its X-2 housing for the Panasonic Lumix GF1. The corrosion-resistant body design is constructed from lightweight aluminum alloy. Featuring multi-coated lens port compatibility, the housing features controls for almost every feature on the GF1, plus fiber optic bulkheads for external strobe sync. INON plans to support INON 45mm macro, 14-45mm, 7-14mm and 8mm fisheye lenses. An optional leak sensor is also available. www.inon.jp



Light & Motion Releases the Fathom Wetmate 65 Degree Wet Lens

Light & Motion has announced the shipping release of the new Fathom Wetmate 65 degree wide angle lens. Utilizing a robust press-fit system with the flat-port, the Fathom Wetmate 65 is designed to fit all 2010 Sony Light & Motion underwater video housings. Engineered with the highest quality glass on the market and boasting a low distortion rate of only 1.40 percent and a 50 percent zoom through rate, it can be instantly mounted and removed underwater for optimum "one dive" shooting versatility. Price: US\$579.00 www.uwimaging.com



Full High-Definition Underwater Camera

Ocean Presence Technologies has announced the latest addition to its line-up of high-definition underwater cameras: the AquariCam® OPT-12HD. This new Full HD fixed lens camera comes with a 120x optical/digital zoom and provides the highest resolution available with a wide fixed lens. Designed for public aquariums, especially for use in small tanks, it enables visitors to simultaneously view the full high-definition live video stream. The AquariCam-HD can cover a wide 50 degrees of monitoring area with great efficiency and features a 10x optical with an additional 12x digital zoom.

High-definition image sensors now make digital zooming practical without significant image quality loss. Cameras are connected using a single hPoE (High-Power-over-Ethernet, IEEE802.3at compliant) marine-rated cable. Underwater lighting, floating battery packs and wave generator power systems are also available. For more information on this and other HD-IP cameras, visit: www.oceanpresence.com



Nikon 24-70mm Coffee Mug Arrives

For those Nikon users who just can't get enough of their lenses, Canon Mug has added a Nikon version to their popular line of mugs and thermoses. The Nikon AF-S 24-70mm 2.8 features a stainless steel interior and features a fully zoomable lens barrel. The black thermos coffee cup comes complete with a gold box and a drawstring bag to carry it around in. A one-piece lens mug/barrel retails for US\$49.99, and ten pieces are also available. Just keep your real lenses to avoid unpleasant accidents. www.canon-mugs.com





Dry shooting in wet places

The newest underwater photo kit from Sea & Sea is almost like two products. First, there's the DC-GE5 12.5 megapixel digi-camera that is waterproof to 16 feet without the housing. Yet, the company is marketing it with a polycarbonate housing that allows full access to the camera's controls to a depth of 180 feet. Since it is waterproof, there is little worry about condensation or minor flooding killing the camera in the



housing. Outside of the housing, it withstands rain or sea spray while pursuing outdoor activities. The camera features a 2.7-

inch liquid crystal diode display screen, four-power optical zoom and a lens that zooms from 38 to 152 millimeters. In macro mode, it focuses to a mere 2.3 inches. Sensitivity can be set from ISO 64-3,200, and the shutter speeds range from 1/2000th of a second to 30 seconds. It can be used to shoot 30-frame-per-second movies and has built-in effects including panoramas. Automatic face detection and image stabilization ease snapping shots on the go. It has 16 megabytes of internal memory and accepts SD/SDHC memory cards of up to 16 gigabytes. A lithium-ion battery and charger is packed with the camera along with a USB cable and Arcsoft editing software. The housing weighs less than 14 ounces on land, but only 1.05 ounces underwater. An optional accessory lens can be affixed while underwater to shoot wide-angle images. Grips were positioned on the housing to ease holding the unit and gaining access to the controls.

www.seaandsea.com

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Focus on sharpness

Autofocus does fairly well for shooting on the fly, but to really get things just right there is nothing like manually focusing the single-lens-reflex-style cameras in a housing. Sea & Sea has a new accessory to help discriminating photogs fine-tune their images. The VF45 prismatic viewfinder replaces the original housing viewfinder. It eases focusing by providing 1.2 power magnification of the entire viewfinder area. The angled eyepiece rotates 360 degrees in 90-degree increments to it can be positioned in the most comfortable position whether being used to shoot portrait or landscape images. The VF45 is made of an aluminum alloy that has been anodized for corrosion resistance. At 2.3 by 3.9 inches and weighing less than 14 ounces, it slips easily into the gadget bag.

The VF45 is currently compatible with the MDX series housings including the MDX-7D, 5DMKII, D300s, D700, D300*, 40D*, PRO D3*. *Requires LCD window be replaced, please contact your retailer for parts information and availability. A release date is set for the end of September with an MSRP of \$1,075.00. www.seaandsea.com



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Unique Dive Site

The Rio Negro's Amazons

The *Inia geoffrensis*, more commonly known as the pink dolphin, is nicknamed locally as 'Boto' and resides in the waters of the Rio Negro. Although still poorly known, this species is considered the most intelligent of the five species of freshwater dolphins. The pink dolphin has a melon-shaped head, a thick and elongated back, a crest instead of a dorsal fin, and disproportionately large ventral fins and tail—all of which making it less refined than the common dolphin. Yet, when you see its agility and wild grace underwater, it makes you think of the legendary Amazons.

The pink dolphin's flexibility is unique; its spine allows it to perform impossible contortions compared to other dolphins. Thanks to its flexible neck, it can turn its head 180 degrees. The dolphin's sight is quite keen, despite its small eyes. Its very sharp high-frequency communication system allows it to move in the Rio Negro's dark waters and detect its prey. As with all dolphins, sound waves are emitted through air bags under the respiratory openings, albeit the pink dolphins sound waves are amplified by the mass of fatty tissue found in its voluminous melon-shaped head. While some of the sounds it makes can be heard by humans, most are inaudible due to their high frequency.

The Rio Negro

The source of the Rio Negro (Black River) in Colombia, continuing its journey to Brazil, through the rich Amazonian forest. Here, it converges with the Rio Solimões to form the Amazon. From afar, the Rio Negro

appears to be black, but with a closer look, it is actually dark brown. This dark color is due to the humic acid that forms due to the incomplete decomposition of the phenol contained in the vegetation of the sandy clearings.

Both rivers, the Rio Negro and the Solimões, meet south of Manaus, the capital of the Amazon. The Solimões source begins in Peru. Its waters are clearer (beige in color), and it is filled with sediment. The meeting point of the two rivers is a most impressive sight, as they do not blend together. They continue to run alongside one another for approximately forty kilometers (25 miles) before finally mixing.

This can be compared to a glass filled partially with water and partially with oil. They simply do not blend.

More surprisingly, the fish species living in the respective rivers do not cross over onto the other side; they stop at the border.

This phenomenon, whereby the waters do not mix, is due to several factors: a difference in pH (potential



Text and photos
by Michel Braunstein

Pink dolphin coming out of the dark (above); Sailing on the Rio Negro (top left)





Hunting dolphins (top right) Get this image on a new T-shirt at www.sharktees.com

hydrogen) levels; the Rio Solimoes is basic, whereas the Rio Negro is acidic in nature; and large temperature differences, ranging from 28°C to 35°C (82-95°F) in the Rio Negro River and a much cooler Rio Solimoes with temperatures ranging from 20° to 22°C (68-72°F). The last significant difference is in the speed with which the rivers run. The Amazon flows at a speed of 8km per hour (5 miles per hour) and the Rio Negro at 3km per hour (1.9 miles per hour).

Pink dolphin behavior

During an expedition to the Amazon in 1992, the Cousteau Society studied the pink dolphin. Unable to isolate the animal in a pool, they had difficulty analyzing

its behavior.

The pink dolphin lives peacefully alongside another species, the *Sotalia fluviatilis*, or gray dolphin (gray dolphin enters the Amazon River from the sea).

The pink dolphin has no natural predators, except man, and is a dreaded hunter. Piranhas fear it because it feeds on them, as do the "Pirarucu"—the famous giant fish—and the Cayman. It feeds on catfish, various crustaceans and other fish.

The pink dolphin lives in the Amazon basin. It can be found all the way up to Ecuador and Peru, where it is called "Bufeo colorado" (colored dolphin). It can also be found in the Orinoco basin, where the Rio Negro source starts (Colombia, Venezuela). You may

often see it in areas where there is a great concentration of fish or where the rivers converge.

I was fortunate to see the dolphins in the Rio Negro, near the Arou lodge, 60km from Manaus. There is a place where they frequently visit and from which they can be observed. If you are lucky enough, you can even get near them and swim with them. This is a unique experience. It is impressive to see these huge of 2.5- to 3-meter long animals come out of the dark and move with amazing agility, especially when hunting. They are so fast in the water, making it difficult for photographers to immortalize them on film.

The origin of its color is not clear; it could be caused by the capillaries under its skin. Some of



Feeding the dolphins (above and bottom left)

Thanks to the pink dolphin's flexible neck, it can turn its head 180° (top left)



the boto's can also be pale blue or even albino.

The pink dolphin is very active in the local mythology; some native tribes of the Amazon worship it, while others think of it as the devil and hunt it. The gray dolphin is usually considered as sacred. A traditional myth of the Amazon tells us that the pink dolphins emerge out of the water come nightfall, transform into handsome young men and seduce the young women. They then resume their original shape and return to the river early in the morning.

Threatened status

A mere 20 years ago, the species was not threatened by extinction. However, its population is decreasing significantly due to intensive fishing, deforestation, forest fires, destruction of the habitat (dams, agriculture, construction), extermination by fishermen—who are angry because dolphins destroy fishing nets—river pollution due to raised mercury levels, fishing methods using explosives and overpopulation.

To date, no one knows exactly how many specimens still exist,

but the dolphins of the Amazon are definitely important for the regional ecosystem. It is mandatory that we look after them because of their vital position at the heart of the planet's lung.

Michel Braunstein's passion for the sea was born when he was a child watching Jacques Cousteau's movies. At 20, he started diving and doing underwater photography. Since then,

he's never stopped taking underwater pictures, first with the Nikonos V, and today, with a DSLR. Recently, Braunstein started an exceptional scuba t-shirts website at www.sharktees.com. To see more photography by Braunstein, visit: www.braunstein.co.il—a website which won the prize for best promotional website at Antibes World Festival of Underwater Pictures in 2007. ■



TOP TO BOTTOM: The pink dolphin sports a crest instead of a dorsal fin; The pink dolphin's flexibility is unique—its spine allows it to perform impossible contortions compared to other dolphins; Splendid botos are very important in keeping the balance of the regional ecosystem

TOP TO BOTTOM: Swimming with pink dolphins in the Rio Negro; Piranha fish fear pink dolphins because they feed on them—therefore there is no danger to humans from piranha fish when swimming where the dolphins are circling; Dolphins circle around the fishermen's nets; At night in the Rio Negro, a speeding cayman alligator also fears the pink dolphin



Caelum Mero



P O R T F O L I O





Text edited
by Gunild Symes
All images
by Caelum Mero

Underwater fashion photographer, Caelum Mero of Australia, has developed a unique personal style that is fun, fabulous and poetic. He invites us into an underwater realm of mystery, magic and grace. X-RAY MAG's Gunild Symes caught up with him to find out the story behind his inspiration.

PREVIOUS PAGE:
Clowning Around. "This image took ages to produce," said Mero. "It's actually one clown. I created a separate layer, horizontally reversed the original image and pasted it down to make it appear like two clowns."

GS: Tell us about yourself, why you started creative work with the subject matter and medium you have chosen, and what inspired you to become an artist and fashion photographer.

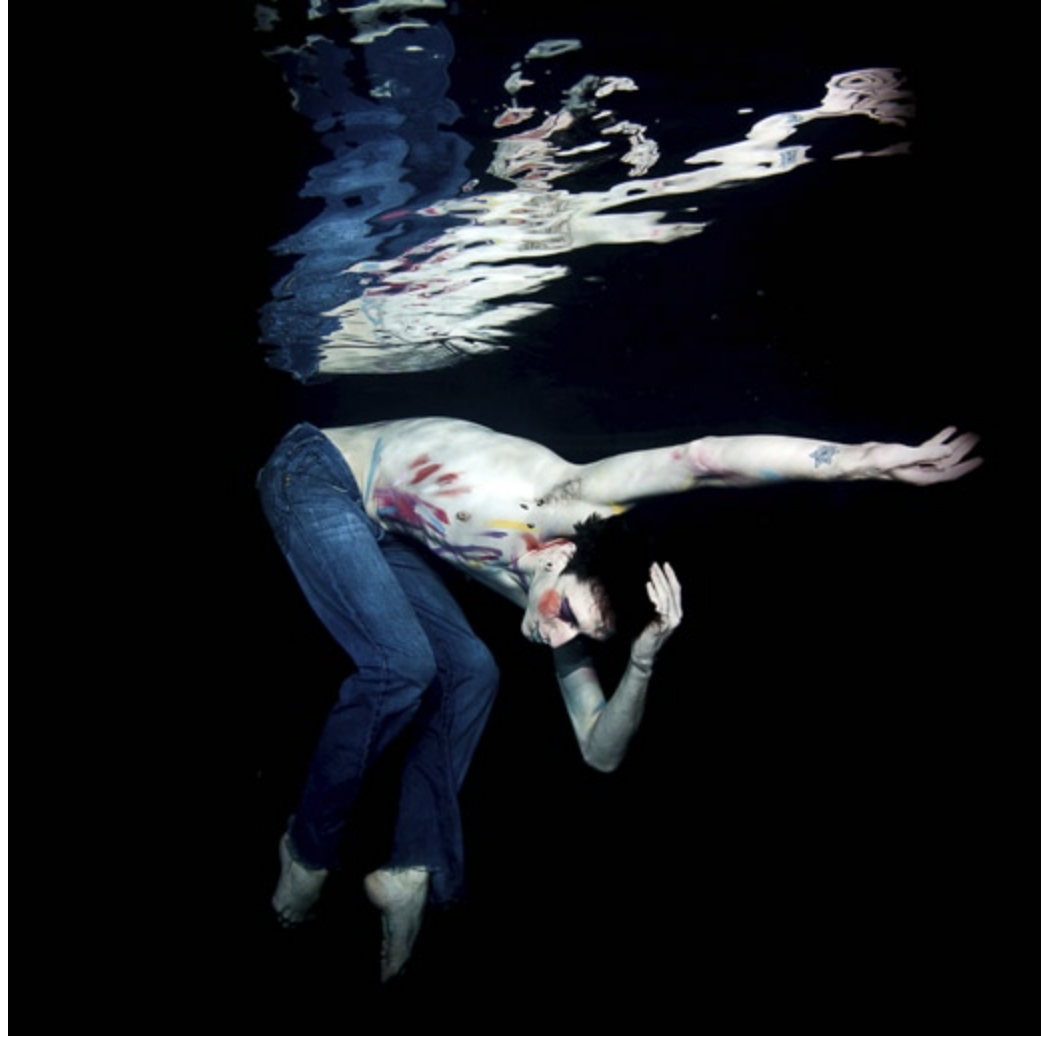
CM: My foray into underwater photography began during university where I was studying

marine biology and started to really get into diving. Once I was accepted into post graduate research for university, I was no longer able to dive as much as I was used to, and it started to drive me crazy! Luckily, the apartment I was living in had a pool, and so I managed to convince

a friend of mine (who happened to be a Swedish model) to pose for me underwater. This was done purely to satisfy my cravings for underwater photography. But soon enough I was hooked on the creative aspect of this new style of photography, and I soon realized that it wasn't necessarily the diving I was missing but rather it

This image entitled, *Wildlocks*, was produced for a hair salon. Fake dreadlocks are pinned to the models with hundreds of bobby pins. "It was a nightmare to work with," said Mero. ABOVE: Mero used two off camera flashes synced via fibre optics to wash out the bottom half of the image in white

All images produced with a Nikon D90, Ikelite Housing, Ds 51 strobes, Ds 125 Strobes, Tokina 10-17mm, Nikon 12-24mm, Nikon 60mm



was the photography.

Before long, I was shooting two to three times a week in the pool and constantly practicing and learning new techniques. Getting into fashion photography was just a natural extension of what I was already doing. Fashion photography is brilliant, as it allows you to combine the technical aspects of photography with no hindrance on your own personal creativity.

GS: What was your training and education as an artist and fashion photographer and how did you develop your personal style? Do you have any role models, artistic, cultural or political influences?

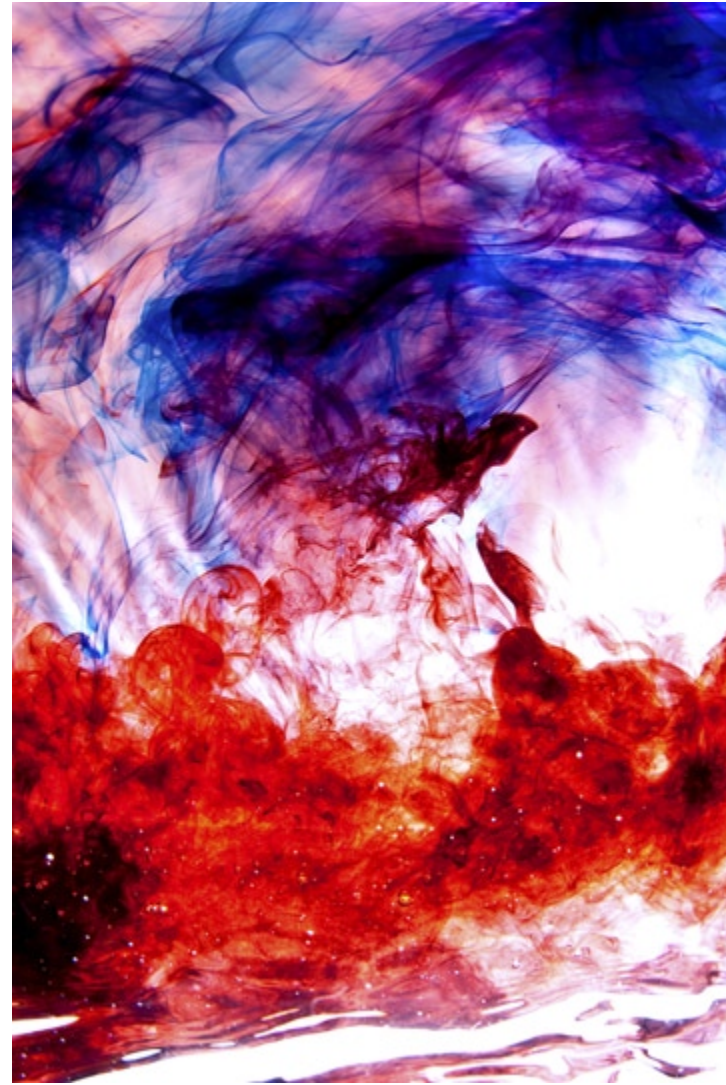
CM: My own training and education

as a fashion photographer came purely from trial, error and a healthy dose of obsession. I would constantly read and review prominent fashion photographers works and techniques.

My own personal style is still developing and definitely not cemented yet. I'm constantly evolving the way I shoot, and I'm currently working on a new major body of work at the moment.

My photography role model has to be the technically flawless Howard Schatz. His work is always an inspiration to view, and I often find myself checking out his work before a big shoot to help me focus.

"This poor model had some heavy duty makeup applied to produce the colours scene here," said Mero. "The makeup artist left before giving him the product to remove it. Apparently, he was coloured like that for a few days."



From an artistic point of view, I would have to say that I draw a great deal of inspiration from Salvador Dali. I believe that the underwater world can be used to generate some stunning surrealist photography.

GS: Tell us about your artistic method... what is your process, how do you

Mero

Mero used a scuba tank on the bottom of the pool with some pantyhose over the nozzle to produce these fine microbubbles

Food dye in a bath tub (below)





choose a subject and compose a shot?

CM: That's a complicated question! Well first and foremost, I always look for and examine the natural light at my location. I believe firmly in using natural light for underwater fashion photography. For the artistic side of things, I tend to find my subjects and ideas in very odd and peculiar locations. I spend so much time underwater, that I often find myself wondering how people and objects would look floating around in a pool!

GS: *Tell us about your experience under the waves. Where are your favorite*

spots and what most inspires you about the underwater world and the oceans?

CM: The underwater world has been such a major part of my life for the last six years. I studied marine biology, worked as a marine biologist, researched marine biology and then became a full time underwater photographer. Every day, I'm either in the water, editing photos from the water or planning a shoot in the water.

My favourite spots are the cold, remote, hard to get to and almost untouched dive sites that you can find along the rugged coastline of Victoria, Australia. Some of these sites are only dived a few times a year. A place that is also particularly special to me is Lizard



Mero

FAR LEFT: A complicated shot actually taken at a horizontal plane and flipped into a vertical shot. The fake eye lashes were a nightmare to work with, said Mero.

LEFT: "This shot was great fun to produce," said Mero. "We used a variety of costumes to get the right look for the umbrella. The lights above the pool gave the water the lovely orange tones you can see."

ABOVE: Two off camera strobes were used to illuminate this model from below. The hardest part was finding a good dress that would suit the image, said Mero.

Island in the Great Barrier Reef, where I spent two months researching my honours thesis.

The most inspiring aspect of the underwater world is its dynamic nature. Everything is constantly in motion and changing. To capture this on film is such a brilliant challenge.

GS: *What are your thoughts on art and marine conservation? How do you see them influencing one another, you and your audience?*

CM: If you can produce an art piece that conveys a message—whether it be about the beauty, rarity or plight of our oceans—then you're directly impacting marine conservation.

I originally started underwater photography to raise awareness about my



BELOW: "This image was hard to produce," said Mero. "I had to get the model to pretend she was holding a ball of light underwater, and then I added it in later in Photoshop."

Mero



"This image has been flipped upside down," said Mero. "The model jumped in and slowly floated to the surface, which is when I captured this image." RIGHT: Bath tub and food dye

local marine ecosystems, which none of the local public seemed even remotely aware about. I was determined to bring back meaningful and beautiful images from these unknown ecosystems.

GS: Why art? Why is art important?

CM: I produce art because if I don't, it slowly drives me mad! I have all these ideas running around in my head, and if I don't try and photograph them, they never seem to go away. I tried drawing, painting and a few other mediums, and photography is the only artistic medium that really allowed me to produce the ideas that I have, effectively.

Art's importance lies in its ability to

communicate and convey a sense of feeling and emotion... or sometimes just a random idea. It's the communication behind art that makes it so important. The concept behind an image doesn't need to be obvious or uniform, it can be totally ambiguous, but as long as each viewer draws their own conclusion about the image, than it's a successful art piece in my opinion.

GS: When you teach workshops, what is your focus or mission or point of view you like to share with students?

CM: I mostly focus on the practical side of photography and try to teach students how to achieve various cam-

era and lighting effects. I leave the creative composition up to the students. I try to give them the tools necessary for them to go out and build upon their own ideas. The last thing I want to do is dictate to a student what good composition is without taking into account their own creativity and opinion on good photography.



OUR NEXT ISSUE

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Happy Diving!



ANDY MURCH



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