Edited byGunild Symes
&Catherine G S Lim

ALL IMAGES COURTESY OF THE MANUFACTURERS

POINT & CLICK
ON BOLD LINKS

Gifts for Sea Lovers

Valentines Day is just around the corner...

Artistica Blue Hawaii

From the timeless legend of Medusa, to the awe-inspiring majesty of the tropical reefs and beyond, Artistica Blue Hawaii Jewellry Collection includes 700+ creations crafted in platinum-glazed sterling silver with real diamonds and ocean blue topaz. With craftsmanship backed up by three generations' worth of experience, each piece comes with a lifetime warranty. Part of the proceeds goes towards maintaining a healthy marine environment. Medusa's Shield Octopus Pendant (left) shows the octopus shape of the guardian queen who is said to protect ancient Atlantis and its treasures. Beyond the Reef Fish Heart Pendant (above) is designed with two tropical fish, diamonds and blue topaz available for US$110 at:
Crystal-fox.com

Crystal-fox.com

Romantic Sea Myths

Iemanja, the goddess of the ocean and the "national" Orixa of Brazil, is the highlight of this intricate papercutting by artist Kay Weber of San Francisco, California, USA. This 20 x 14 inch piece is just one of Weber's many papercutting creations, in which he gives traditional legends and mythology a modern appeal. Hmm... what mythical tales of fantasy come to mind when you gaze upon this image? Price: US$500.00 **Absolutearts.com**

Mermaid Dreams

Fancy a mermaid in your home? No, we're not talking about re-runs of *Splash* on the telly—rather, this stunning 7.5 x 10.25 inch stained glass window cling handmade by Window2theSoul in Sadler, Texas, which can stick to any window, sliding door or other non-porous surfaces. And if you ever want a change of decor, simply peel it off and move it to another room in your home. Painted on acrylic glass with UV protection—won't fade. Custom orders welcome. **Artfire.com**

Whale on a Bike

Now, this is something you don't see every day—a gray whale riding a bicycle, on a t-shirt. Created by husband-and-wife team Adam and Coryn of Dark Cycle Clothing in Tampa, Florida, USA, this memorable image is hand-screen-printed in black gray ink onto 100% cotton black American Apparel t-shirts with an additional two inches of length. Whatever your message to the world, be it whale conservation or eco-friendly public transport, you will make a splash wherever you go! Price: US$18.00 **Artfire.com**

Sea Lovers ...Gifts

A Whale with Heart

Here's another whale that breaks the norm. This humpback whale is literally bursting with love, not just water. Designed by Corrie Kuipers from the Netherlands, this quirky design is printed on a 100% combed cotton American Apparel t-shirt. Sizes start with a junior/very small fit. **Skreened.com**

Oceanic Tattoo Fish Tie

Now here's a way to wear your vacation fantasies to the office in style with this necktie designed by Michael Phipps of Orem, Utah, USA. It's practically teeming with Polynesian Tattoo-style fish, seaweed and coral. Every image you see is an original creation that's been carefully screenprinted by hand on a microfibre Umo Lorenzo tie. Price: US$15.00. **Artfire.com**

Mermaid Kissing Man on Moon. 24 x 18 inches. Price: US$195.00 **Etsy.com**

Mermaid and Whale Wall Sculpture. 20 x 31 inches. Price: US$495 **Etsy.com**

Frivolous Tendancies

Creative, whimsical, joyous, and fun to look at. These words spring to mind as one glances upon these colourful sculptures designed by John and Robbyn Runyon of Frivolous Tendancies in Ashland, Oregon, USA. And, looking at these two in particular—a mermaid with the man on the moon and three mermaids riding a whale—it's also inspiring to note that they have been painstakingly salvaged and recreated from recycled metals. Many styles of mermaid pieces are available. Their hair is cut, curled and styled using the same recycled metal. Glass eyes from the artisans' kiln are used as well as recycled copper starfish. Two hooks soldered on the back make for easy hanging for indoor or outdoor use. Each sculpture is signed and dated and hand painted with outdoor acrylic metal paint. International shipping available. Price range: US$39.00-495.00.

A GIFT OF LOVE

Adopting an animal, or a natural area, is a gift of compassion and conservation that keeps giving. It is a thoughtful alternative to buying stuff that may actually pollute the sea and imperil its creatures.

ADOPT A WHALE

Through adoption programs you learn about whales such as orcas in the wild and in captivity, as well as how orcas in the Northwest United States and British Columbia have been studied and individually identified. Donation: $25.00 **Savethewhales.org** or **Whale-museum.org**

ADOPT A DOLPHIN

In the resort town of Hisaronu on the southern coast of Turkey, two bottlenose dolphins—Tom and Misha—were kept in a small, deteriorating pool. They were fed frozen fish and were clearly traumatised, showing signs of deep distress. Despite this, tourists were oblivious to their suffering, and willing forked out GB£50 to swim with the two dolphins. You can help rehabilitate and retrain these dolphins to return to their natural home in the wild. Donation: GB£10.00 **Bornfree.org.uk**

ADOPT A MANATEE

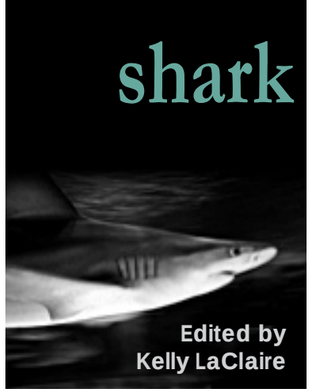
Adopt a manatee and help protect an endangered species. Funds from the Adopt-A-Manatee program go toward initiatives and activities that help protect manatees and their habitat. Unlike other animal adoption programs, the manatees in this adoption program are real, living manatees—individuals with known histories. Donors can even visit their adopted manatee at one of three locations in Florida. Donation: US$25.00. **Savethemanatee.org**

ADOPT A SHARK

Adopting a shark is a progressive and unique way to get involved in shark and ray conservation. AdoptaShark is also an educational program for adults and kids because everybody learns a ton of information about sharks and the oceans. Donation: US$50-100. **Adoptashark.com**

ADOPT A REEF

You can help protect some the world's most fragile and diverse ecosystems when you Adopt a Coral Reef today. The Nature Conservancy's Adopt a Coral Reef program raises funds for critical coral reef projects in the Bahamas, Dominican Republic, Palau and Papua New Guinea. Donation: US$50 and up. **Adopt.nature.org**




NOAA

Cousteau visits Nassau in attempt to ban commercial shark fishing

Pierre-Yves Cousteau, son of legendary, Jacques Cousteau, visited Nassau recently to personally support the Bahamas National Trust (BNT) and the Pew Environmental Group's (PEG) campaign asking the government to enact legislation banning commercial fishing of sharks in the Bahamas.

Such a ban would help ensure the US$78 million that shark related tourism (essentially diving) is estimated to bring to the Bahamas annually.

Because of the global decreases in shark populations from over-fishing, primarily due to the demand in Asia for shark fins soup, a long-line fishing ban in the 1990s helped the Bahamas remain with an abundant population of sharks.

Now, Cousteau, along with the BNT and the Pew Environmental Group is asking that the government take a bolder proactive stance towards protecting this resource through legislation banning all commercial fishing of sharks.

Cousteau pointed out that the shark diving industry in the Bahamas —estimated to have brought in $800 million to their economy over the last 20 years—could be severely threatened in the near future if the ban is not put in place immediately, citing examples in other parts of the world as proof.

"I know that divers like to see large animals underwater. Because of lack of protection in the Mediterranean, sea sharks have been completely exterminated. People used to go to the Red Sea to see sharks but there are now no more there either because of a lack of legislation," he said. "The Bahamas is one of the last places where people can come and enjoy watching sharks. If we let the sharks be depleted the demand will be there but the supply will not, and the Bahamas will miss a huge economic opportunity going forward."

The decision to ban shark fishing may take time, as governmental change is often slow and mired in bureaucratic-soup, but the fact that the discussion has been started and supported by opinion leaders such as Cousteau is a good sign for the future of sharks in the Bahamas. ■

SOURCE: BBC


NOAA

Small islands to become Pacific leaders in shark conservation

The Commonwealth of the Northern Mariana Islands (CNMI) has taken a decisive step to become the first U.S. territory to ban shark finning. The CNMI consists of 14 volcanic islands of the Pacific—most notably Saipan, Tainan, and Rota—and is located between Hawaii and the Philippines.

With a unanimous vote, the Commonwealth House passed minority leader Diego T. Benavente's (R-Saipan) bill seeking to prohibit any person from possessing, selling, offering for sale, trading, or distributing shark fins in the CNMI.

House Bill 17-94, based upon similar legislation passed in Hawaii earlier this year, now heads to the governor for final ratification.

"I am very happy," Benavente said. "I consider this a milestone legislation because it not only benefits the Commonwealth as far as putting our place on the world map in protecting sharks, but it also helps the international movement to protect sharks."

Once the bill is signed into law, it is hoped that the shark fin soup trade in the CNMI will cease. Marine scientists point to shark finning as the principal reason for the decline in shark populations worldwide, estimating that 70 million sharks are killed each year in the hunt for fins that will end up in soup. Some shark populations have fallen as much as 90 percent in certain parts of the world as a result.

Two international groups, Shark Savers and WildAid, have publicly extolled CNMI's efforts. "Increasingly, the countries most dependent on the ocean are rallying to the defense of sharks, perhaps the ocean's most important inhabitants," said Michael Skoletsky, of Shark Savers. "The CNMI's intelligent decision to preserve sea life will benefit future generations and attract lucrative underwater tourism, rather than allowing foreign fisheries and shark fin cartels to plunder its resources." ■

New shark sanctuary announced in Indonesia

Indonesia has announced that a shark sanctuary has been declared for the entire 17,760 square miles of Raja Ampat.

The Sanctuary will provide full protection for sharks, rays, manatees, turtles and exotic fish illegal caught for the aquarium trade as well as exclude the highly destructive practices of reef bombing. The Shark Sanctuary, described by many scientists as an area with the most diverse marine life on earth, is the first of its kind anywhere in Indonesia, the largest island archipelago in the world.

The declaration is in direct response to a massive global campaign initiated by Shark Savers, an international conservation organization, and Misool Eco Resort. The campaign gained widespread support of thousands divers and conservationists, tourism groups and diving companies from all over the world.

"This new Shark Sanctuary owes its creation to thousands of ocean advocates who expressed the urgent need to protect sharks, mantas, and other marine life," stated Michael Skoletsky, Executive Director of Shark Savers. "Divers experience the oceans from the inside and are increasingly taking responsibility for ocean and shark conservation. Underwater ecotourism is a vital tool to counter the rampant exploitation of the world's remaining sharks and bio-rich marine ecosystems."

Raja Ampat boasts 1,397 species of fish and over 600 species of coral and, as a result, has suffered severe overfishing that has threatened sharks that play a vital role in regulating the health of fish species, population balance, and coral reefs. Despite this, nearly75 percent of the area's shark species are threatened with extinction.

"Sharks are being killed for their fins, mantas are being killed for their gills, and rare reef fish are being caught for aquariums," said Peter Knights of WildAid. "It's tragic that so much of Raja Ampat's biological treasure is destined for consumers who are unaware of the impact." ■

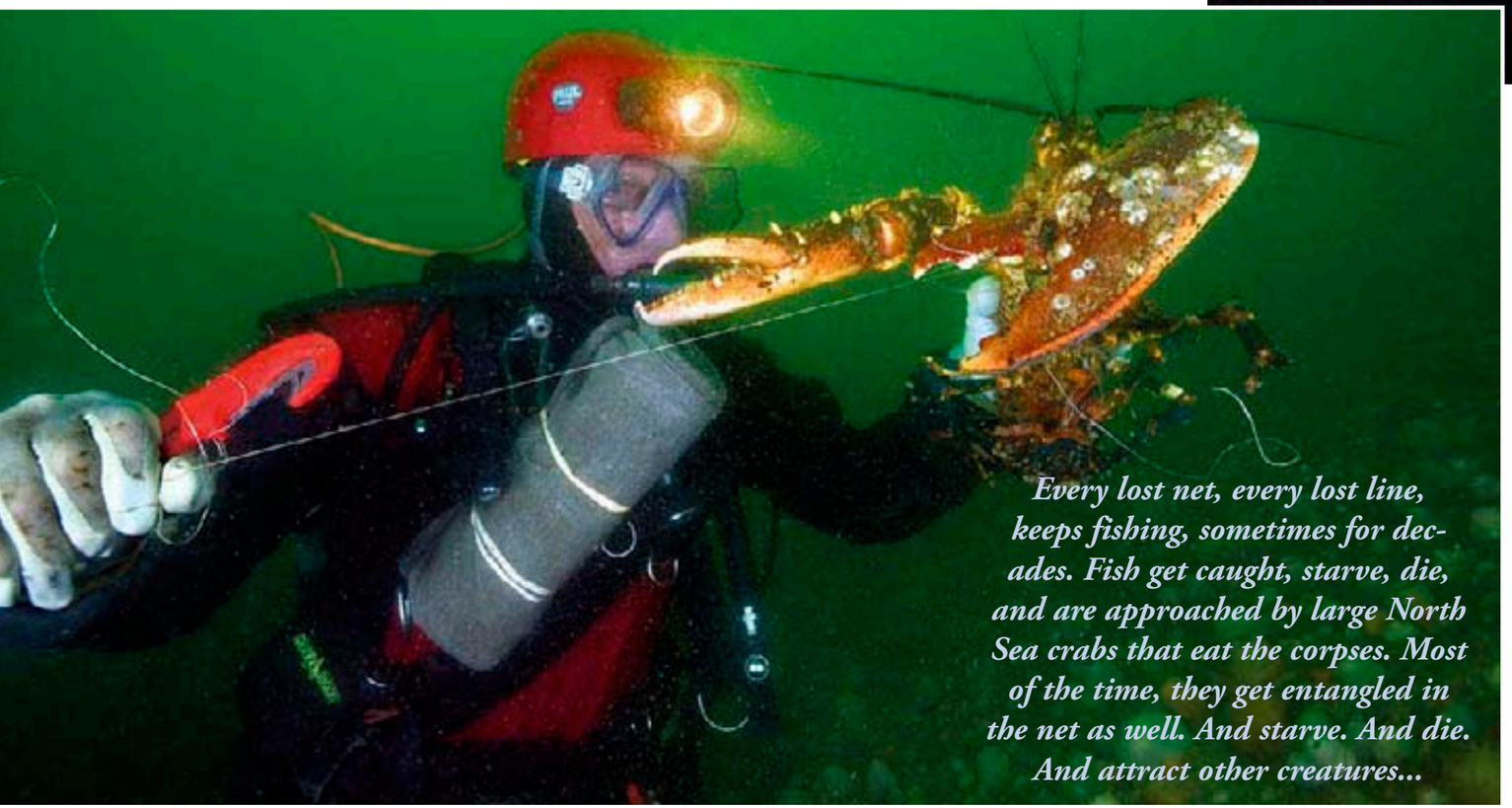
SOURCE: SHARK SAVERS.ORG

Ghostfishing
adventure

—Discarded, lost nets keep on fishing even after they have been relieved of duty

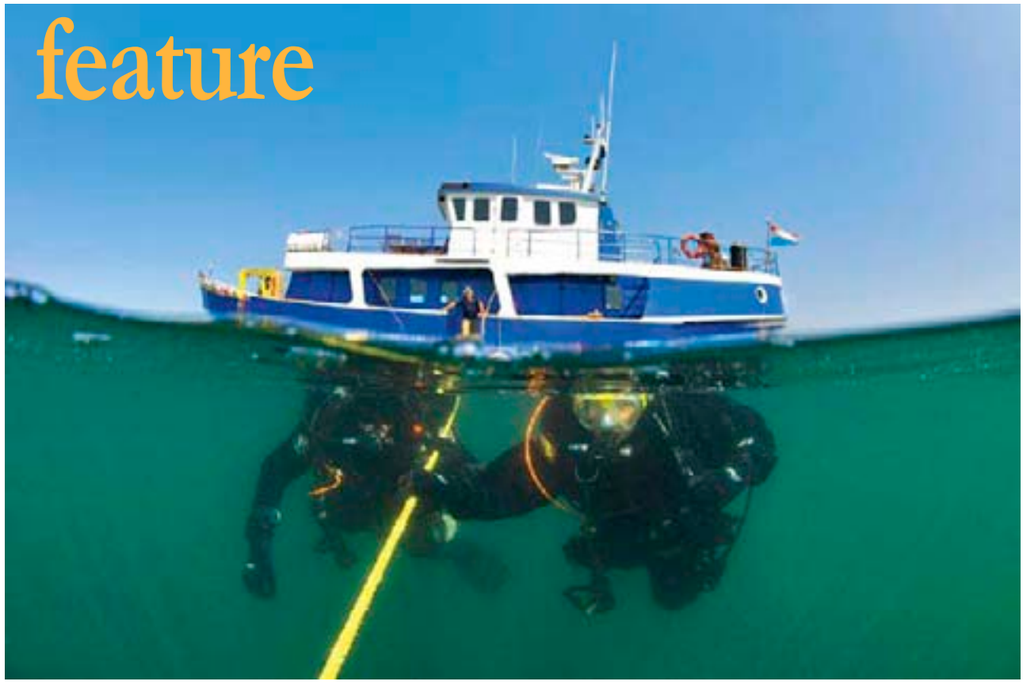
It is the nightmare of every diver who dives the Dutch North Sea—getting entangled in a fishing line of old net, unable to free yourself. The Dutch wrecks are becoming an ever popular destination for both the fishing and diving industry. A threat to both, fishing boats and anglers can lose their nets and lines on wrecks, and divers can lose their lives. This year, a new project was initiated to clean the wrecks of their burdens of abandoned fishing gear—*Duik de Noordzee Schoon*, or Dive Our North Sea Clean. This summer, photographer, Peter Verhoog, was a member of the project team and captured the beauty and the dangers of adventurous diving.

Text and photos by Peter Verhoog



Every lost net, every lost line, keeps fishing, sometimes for decades. Fish get caught, starve, die, and are approached by large North Sea crabs that eat the corpses. Most of the time, they get entangled in the net as well. And starve. And die. And attract other creatures...

CLOCKWISE FROM TOP: In good visibility, a net can easily be found; Crab, unable to move, forever caught by a copper pipe and fishing lines; Ben releases a lobster from a fishing line



CLOCKWISE FROP TOP LEFT: Divers descend along the anchor line to the wreck; Divers swim by a fishing net; Peter jumps off the ship for a photo dive on the wreck of the *Elbe*; Ben cuts a dangerous, thin fishing net from the wreck

Ghostfishing

Diving the North Sea is always an adventure. Even though the weather can be unpredictable, more and more divers have started to explore the wreck sites each year. But wreck diving can be dangerous, too. I have dived the wrecks of *my* North Sea for over a decade now, and I have seen the number of lines, hooks, sinkers and nets explode. On several occasions, my slow swimming exploration over a wreck was suddenly interrupted—something held me back. It could be a line, a line and hook, or a fine-mesh net that was almost invisible. The only solution was getting out a sharp knife and cutting the lines or net—a task that can be daunting under low visibility and in a tidal current. Most of the time, I needed the help of my buddy to survive.

As cod and flatfish are becoming scarce in the Netherlands, an ever increasing

number of people try to make extra money by fishing on the wrecks. For them, there is no quota, as officially, they are not professional fishermen. At a profit of over seven euro's per kilo, wreck fishing is a great hobby and the large boats that leave almost every weekday are crowded. The catches are mostly composed of undersized cod that are not even sexually mature, which goes to restaurants and are also sold privately.

But angling is not only a threat to the fish. Every year, an estimated 100,000kg of poisonous lead are left behind in the sea, as many anglers lose their lines, sinkers and hooks. The professional fishing industry fishes with the nets as well, and use standing nets and dragnets on the sandy floor around the wrecks, which are occasionally left behind, as one wreck or another refuses to let them go. None of those visitors have a clue as to what is going on underwater once they have departed.

When they head back to port, a tragedy unfolds. Every lost net, every lost line, keeps fishing, sometimes for decades. Fish get caught, starve, die, and are approached by

THIS PAGE: Scenes from the rescue dive

RIGHT: Snagged by wreckage, a fishing net remains left behind by fishermen

THIS PAGE: Scenes from the rescue dive ABOVE: Anemones at the boulders of the *Queensfort*. RIGHT: The bow of the *Queensfort* with camerawoman Klaudie

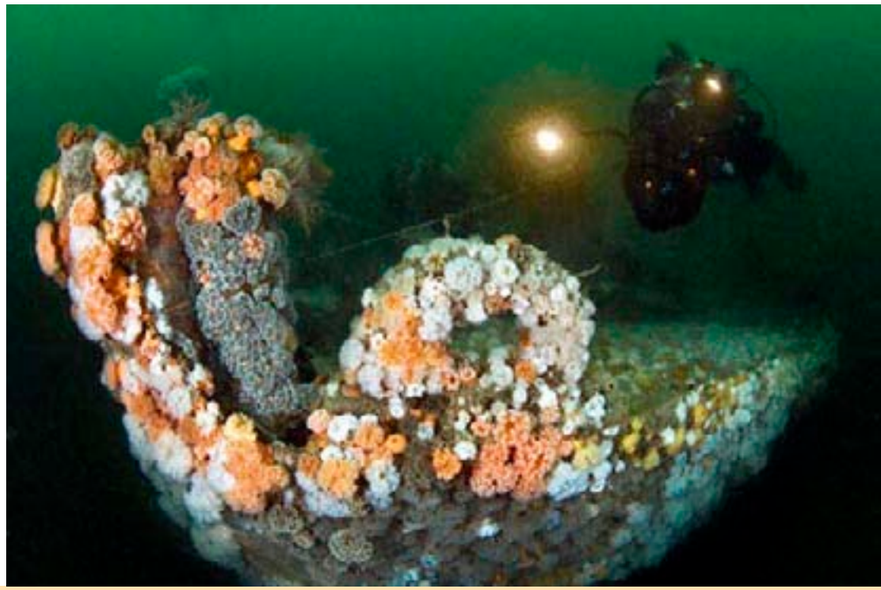
large North Sea crabs that eat the corpses. Most of the time, they get entangled in the net as well. And starve. And die. And attract other creatures.

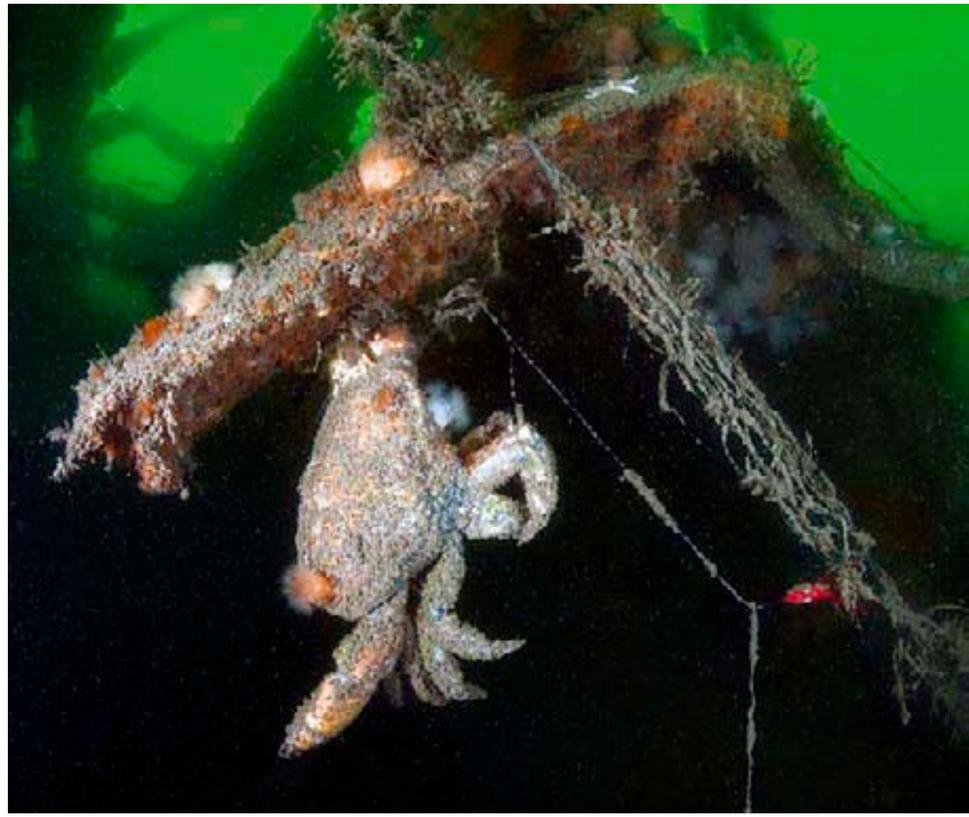
The North Sea is a shallow, sandy sea, and the wrecks form artificial reefs that justify their unnatural presence by the wealth of marine fauna they attract. But some wrecks are completely covered in layers of nets and are now barren ruins of the fascinating biotope they once were.

Rescue team

Any North Sea diver has witnessed these events. My wife, Georgina, and I regularly freed crabs, cut lines and removed parts of net. But to be honest, our fellow divers were more interested in exploring the wrecks and their artefacts than saving creatures.

Luckily, there are now more people who have come to the rescue of the innocent crabs and fishes under the surface. The people of the project, Duik de Noordzee Schoon, have been cleaning nets for one and a half years now, and their efforts are beginning to pay off.





Klaudie Bartelink and Ben Stiefelhagen, the founders, have succeeded in putting together a group of dedicated divers, who receive free training and free clean-up trips on the condition that they commit themselves to cleaning wrecks during those dives.

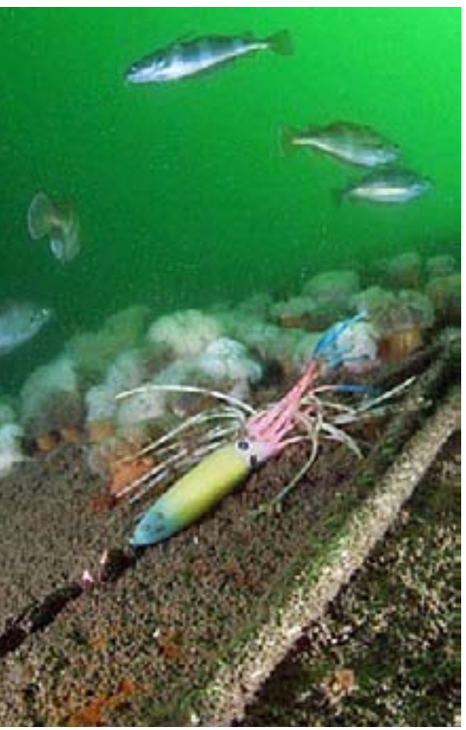
Klaudie and Ben have also funded the project with their own money, but are now partly supported by a Dutch foundation.

As they were also planning on publishing a book, they asked me to be an added extra member of their team this summer—an invitation I gladly accepted! I documented their training and their dives and witnessed them rescueing countless animals and removing many, many lines, hooks, sinkers and nets.

Extra benefits

It is easy to blame anglers and the fishing industry. Most people who enjoy a day of fishing on the North Sea are

THIS PAGE: Scenes from the rescue dive. TOP LEFT: 23-pound bombs near the wrecks. TOP RIGHT: A crab can hang on a fishing line for weeks. ABOVE: A bow with portholes



THIS PAGE: Scenes from the rescue dive. TOP RIGHT: Ben cuts fishing lines from the wreck

absolutely unaware of the havoc they cause. Ben and Klaudie therefore contacted the largest sport-fishing association in Holland to discuss options and proposed the use of biodegradable lines, like Bioline™.

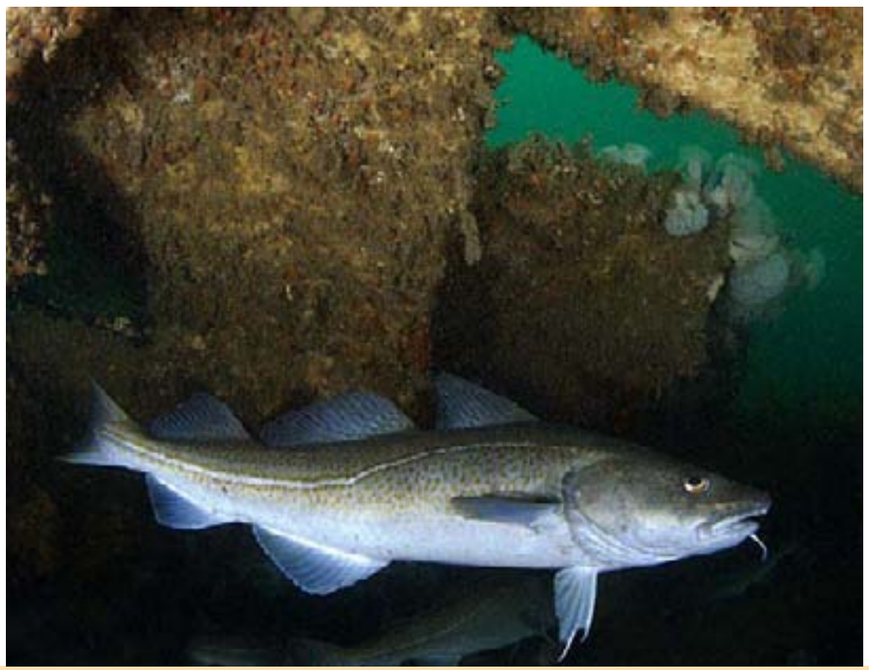
Normal fishing lines are made of monofilament, which can take over 500 years to decompose. Bioline will degrade in five years. The partners are also investigating the possible use of biodegradable nets and ceramic sinkers and have also made arrangements for a “pick-up service”. Captains of fishing boats who have lost a net can contact this service, so the net can be retrieved.

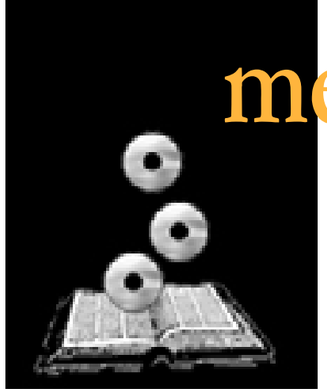
The project attracted a lot of publicity and even received a prestigious Dutch nature prize, which can partly fund next year’s activities.

And I had a great summer not only witnessing work being done for a good cause but also enjoying the wonders of my North Sea from a different point of view, capturing unique images.

For more information, visit: ***www.duikdenoordzee-schoon.nl*** *(Dutch only) or Peter Verhoog’s website at:* ***www.peterverhoog.com*** ■

ABOVE: Ben and Marc with a net with a lot af crabs stuck in it
RIGHT: Crab in an ammunition box with cordite





POINT & CLICK ON BOLD LINKS

The Apps are coming

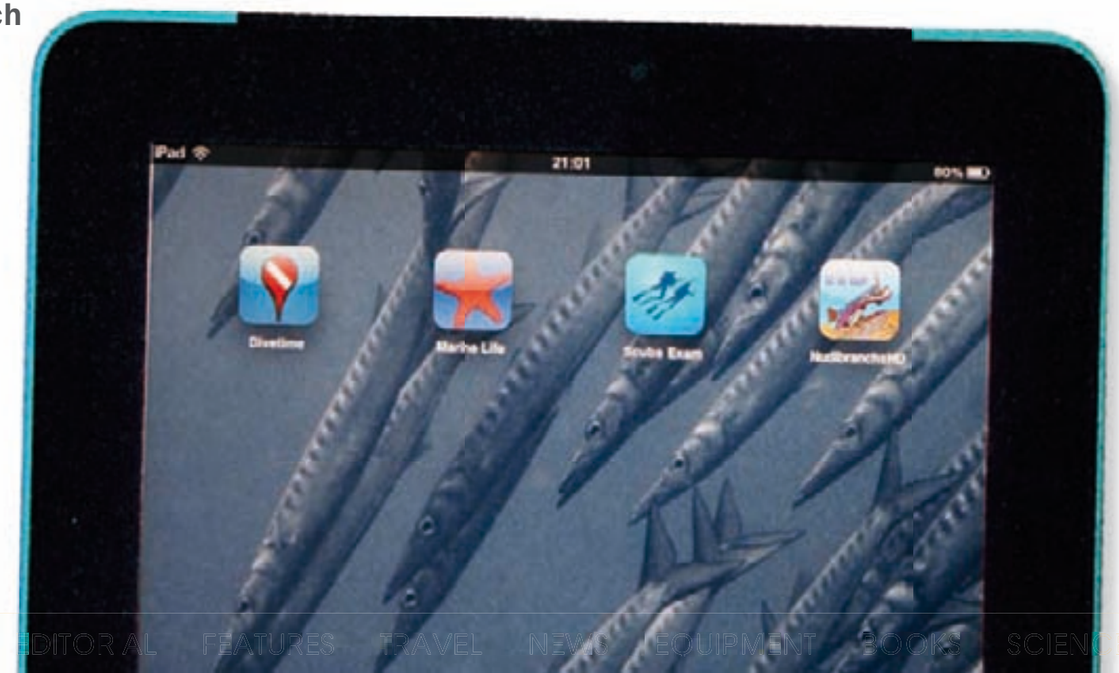
Scuba Exam screenshots. On the right an example of one of the quiz questions

Text by Peter Symes

The advent of smart phones iPod, iPads, and the new generation of tablet PC have created a surge in 'apps', which are small programs—a special kind of software unlike the programs you install and run on, say, a PC. We have taken a look at four very different apps, which are available in the iTunes app store.

Scuba Exam

The main feature in Scuba Exam is a quiz with 50 questions on diving theory that will let you test how strong your knowledge is, say, if you are facing an exam. It also comes with a compact encyclopaedia that includes a list of common terms and expressions as well as a brief tutorial on the most important aspects of dive theory, such as the various physics and laws. It is quite handy if you are out on a liveaboard and need to look something up, or settle a debate, or you can rehash your theory while you sit in an airport lounge waiting for the next flight. The quiz seems to be aimed at open water or entry level, and as such, doesn't hold many challenges for the experienced diver. After trying it out several times, the only criticism I have concern the quiz questions about some of the dive hand signs, as they are not universal and do not always mean the same thing. But, overall, you get plenty of value for the US$2.99 that the full version costs; there is also a free *lite* version.



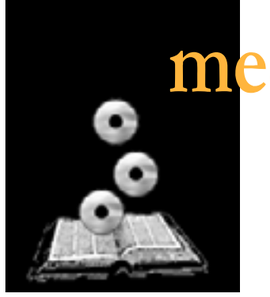
DiveTime

"The World's Largest Online Dive Site Database," read the blurb. That sounded promising, so I parted ways with another $3.99 to take this app through its paces. This app let me search dive sites and dive shops, which can be searched either via keywords, a *nearby search*—I suppose that it hooks up with the device's built-in GPS, if it has one—or via a map, which looks and seems to work a bit like Google maps. For the purpose of testing, I believe that our location is optimal. Our main office is located in Denmark, which on one hand is not one of the big dive destinations, yet has decent diving with lots of interesting dive sites and a lively dive community. Unsurprisingly, I soon found that the list of dive shops was incomplete and a number of the existing entries were not up to date. And of course, there were only a tiny fraction of the many local dive sites listed. But let's be fair and keep in mind that it is impossible to keep such directories up to date, and the bigger they are, or purport to be, the more daunting the task is. I would have liked to have seen more local dive sites listed.

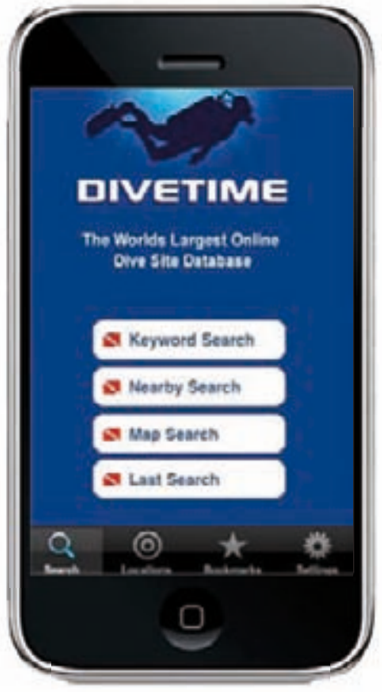
For some of the more well-known dive locations, there seems to be a decent list, but other, less fashionable regions are left blank. This is all testament to the inherent weakness that many of these directories and databases have, whether they are online or in the form of an app.

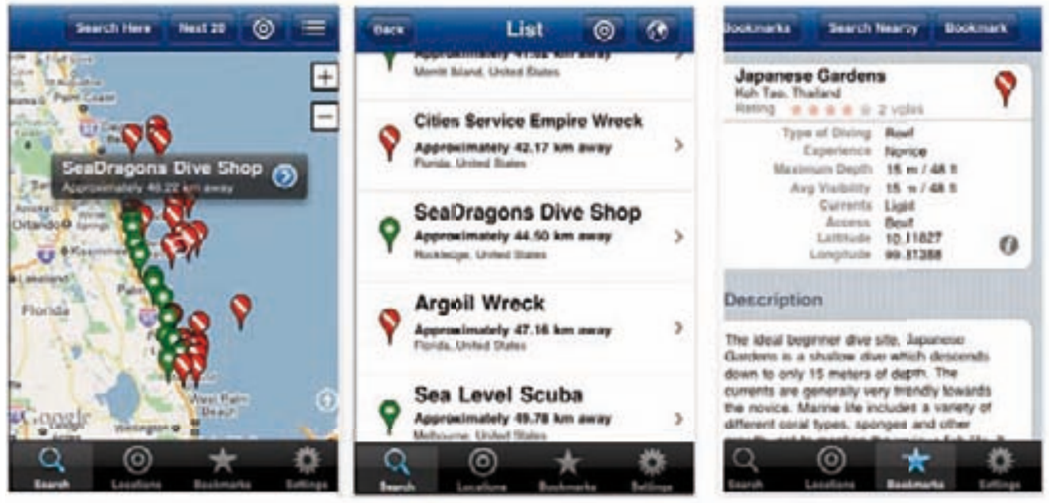
Ultimately, they are dependent on reports and input from users, which is a notoriously unreliable and inconsistent source method. Many—I would say almost all—of the big dive portals, which are often launched with lots of fanfare, seem to fall flat on their faces after a short while, because they rest on the premise that content will be generated and kept up by the users (aka: the *community*)—an assumption which invariably soon turns out to be a fallacy.

All such directories, no matter how comprehensive, will be limited in a number of ways. However, that does not mean that they are not useful or worth the investment—c'mon, $3.99 isn't going to break anyone's piggybank. As for looking up local dive sites, I would know



Computer Apps





Some of the screenshots from the DiveTime app—the strongest, yet perpetually incomplete features include the search function and the list of dive sites and dive shops

better myself anyway, so I see more use for the app when I am going travelling.

Since I have seen how the app performs in regards to my own locality, I am aware that it is not perfect and has plenty of blank spots, but does it really matter? In my opinion, it doesn't, because if I am visiting another region, the issue at hand is not whether the list is complete but whether I can look up some dive shops that can take me out.

A good feature is the coupling between the app and a browser. The app links directly to the dive shop's homepage or its entry on DiveTime's own portal. Dive sites are also and in a similar manner linked to an entry to DiveTime's portal, which has far more room for information, and I believe that this is also where users can provide info. Returning to the app after visiting the Web in this manner, I was pleased to see that it reopened where I left it—some apps start all over at their main page.

Nudibranchs HD

It is only too easy to get fascinated by these colourful but very alien-looking creatures. Of the 3,000 plus described species, many have only scientific names, which can make identification a real head scratcher.

The Nudibranch HD app shows 100 of what I can only presume to be the species most commonly encountered by divers. Although a hundred species is hardly a comprehensive database, search functions that use body type, colours and other easily determinable features which allow the novice user to quickly narrow down a search in order to identify the creature in the field or captured in an image.

A little name game allows the user to practice identification in a fun way, although I found it was very tricky to get anything right, due in large part to the species having Latin names only. Who knows, with a little more practice, it may catch on.

What I feel is missing in this app is any kind of information about the species; we only get to match an image to a name and that's too little. I would like to see some basic biological information such as geographical range, habitat, size and so forth.

As a little dessert, the app has a little video sequence, *nude ballet*, with some quite nice footage of nudibranchs. It is not an award-winning documentary, but can always be used to impress the uninitiated.

The biggest drawback is clearly the small number of included species, which prevents it from being really useful. Released in December 2010, the app retails for $2.99 on iTunes.

Screenshots from Nudibranch HD. LEFT: The database is searchable, but why bother? With a mere 100 species, you can quickly scroll through the collection anyway. CENTER: The perhaps most useful feature, where you can identify a species by checking off a list of physical features. RIGHT: The Nudi Game, in which you can test your knowledge of species names. I don't know how useful that is

Marine Life eGuide

Authored by acclaimed international author and underwater photographer, Neville Coleman, this app is as close to a mobile marine encyclopedia as it gets. From fishes, to bryozoans, ascidians and even seabirds and marine plants—when it comes to the marine life of the Indo-Pacific, this app is impressively comprehensive, to say the least.

I live on the opposite side of the planet, so I was left with a desire to be able to look up species closer to home. Nonetheless, I must commend Coleman for the enormous task undertaken to put so many species into this app. I have not had a chance to count, but when the introduction states that it contains more than 2,000 photographic examples—I believe it.

This and many other apps have been designed foremost with iPods, iPhones and smart phones in mind, and their smaller screen calls for a very simple design as well as images with a somewhat limited resolution. Many apps, including this one, will also work on iPads and tablets although they will either sit in the regular size in the centre of the screen, or be magnified to fill out the larger screen, with the result being some images appear grainier—a concern that Coleman voiced to me.

It does not seem to be a problem though, as the images also look fine on an iPad. However, I would prefer a version of the app made specifically for the iPad and tablet, which can take better advantage of the larger screen.

The built-in species introduction provides a good overview, not only of the guide's organisation, but also of general taxonomy. So, if you ever wondered how kelp differs from flowering land plants, or why a comb jelly is not really a jellyfish, you will find the answer here. Each species entry contains additional fields where the user can enter logbook notes such as location, dates and comments.

At $19.99, this app is in a different category price-wise, but you get what you pay for. The app is very good, comprehensive and useful. In fact, this app has now become the first and preferred encyclopedic reference I resort to when I need to identify a species from the region. ■

This cascade of menus in Neville Coleman's *Marine Life Identification eGuide* demonstrates the underlying taxonomic structure and how comprensive the guide is. These screenshots show the iPod for which it is designed but it works fine on the bigger iPad as well

The images are top-notch and even though the resolution has been set with the iPod or iPhone in mind, they don't seem to suffer much from being displayed on the much bigger iPad

In the log-book, the user can add notes to each species, such as where it was spotted

Many diving deaths should be preventable ... a diver ought to be able to minimise his or her chances of becoming a statistic by understanding and influencing the factors which are now known to be associated with diving deaths.

—Dr Carl Edmonds

SCUBA Diving

What are the risks, really?

—learn what makes you a safer diver

Text by Dr Carl Edmonds
Photos by Kate Clark and Scott Bennett

Experience of life suggests that anything which is fun tends to be either illegal, immoral, fattening or dangerous. Recreational diving partly conforms to this universal law, ranking below hang gliding and parachuting but above most sports in regards to the risk of a fatal accident.

Statistical evidence

Diving statistics from the United States, United Kingdom, Canada and Japan all show diving death rates of 15–30 per 100,000 divers per year, with the statistical chance of a fatality being about 2-3 per 100,000 dives. These figures tend to contradict the misinformation issuing from some sections of the diving industry (fatalities of < 4 per 100,000 divers) which would have us believe that diving is a very safe recreation. It is not, but then we accept risks every day. Even driving an automobile to a dive site carries an appreciable (but much less) risk of death—a possibility which we generally regard with equanimity. This article will show that many diving deaths should be preventable and that a diver ought to be able to minimise his or her chances of becoming a statistic by understanding and influencing the factors which are now known to be associated with diving deaths.

Dying with weightbelt on

The information presented here is mainly based on data gathered by valuable studies involving recreational diving fatalities. They have been conducted in different countries, but show strikingly similar results. The U.S. recreational diving deaths, originally compiled by John McAniff of the University of Rhode Island and then NUADC, are now collected and reported on by DAN, which recently analysed 947 open circuit scuba divers. The DAN survey also included technical divers, who dive deeper, longer and with gases other than compressed air. The BSAC do a similar job in the United Kingdom, and DAN-AP Diver Fatality Project is the Australian compiler. Unfortunately, significant data is frequently not available, and so relevant causal factors are often underestimated. Another Australian approach (the ANZ series of diving fatalities) was to select and analyse only the accidents in which sufficient data was available to make the analysis credible, and to determine what factors materially contributed to the fatality. Most of our statistics come from this source and are rounded up, for simplicity.

Diving Fatality Data

- 90% died with their weight belt on
- 86% were alone when they died
- 50% did not inflate their buoyancy vest
- 25% encountered their difficulty first on the surface, 50% actually died on the surface
- 10% were under training when they died
- 10% were advised that they were medically unfit to dive
- 5% were cave diving
- 1% of "rescuers" became a victim

Age

The recorded deaths range from children (pre-teens) to septuagenarians. Some decades ago the average age of the deceased was in the early 20's. Then there developed a small increase in the middle

First published in the first (1876–1899), second (1904–1926) or third (1923–1937) edition of *Nordisk Familjebok,* this illustration shows a diving set developed by Rouquayrol and Denayrouze with a barrel-shaped bailout air tank on the diver's back

ages (45-60 years). This bimodal curve has now become distorted on the other side, and the average scuba death age is now 43 years. The reasons for this increasing age of death are:

- The "youngsters" from the 1970-80 scuba diving boom are now older.
- Cardiac disease, the sudden death syndrome, affects the elderly and diving introduces more cardiac hazards than many other sporting activities.
- Diving is becoming a lifestyle option for the increasingly active and affluent elderly, with more older people taking up this sport.

Gender

In the 1990s, one in ten of the fatalities were women. The actual percentage of women in the overall diving population was about one in three, suggesting that women are safer divers than men. Even now females account for only 20 percent of the deaths.

Diving experience

In most series, one-third were inexperienced, one-third had moderate experience and one-third had considerable experience. The most dangerous dives were the first dive and the first open water dive. In half the cases the victim, based on witness statements and previously logged dives, was extending his diving experience (depth, duration, environment, equipment etc.) and thus did not have the experience to undertake the final dive. For this reason, any diver extending any of his dive parameters (depths, durations, environments, equipment) is advised to do this only with more experienced supervisors.

Major causes of death identified at autopsy

According to death certificates, most

FILE PHOTO: KATIE CLARK

divers ultimately drowned (over 80%), but a number of factors usually combined to incapacitate the diver before this terminal event. Drowning is really only the final act in a sequence of events that lead up to this. It is a reflection of the medium in which the accident happens, more than the accident itself. Often it obscures the real cause of death. Unless there are other factors, drowning should never happen to a scuba diver, as the diver carries his/her own personal air supply with him! Drowning develops because of preceding problems, such as cardiac disease, pulmonary barotrauma, the stress disorders, unconsciousness from any cause, salt water aspiration, trauma, equipment difficulties or environmental hazards, etc.

Contributing factors

Deaths usually followed a combination of difficulties, which alone may have been survivable. The factors contributing to deaths are easier to understand when classified, and we have categorised them into the following groups:

In Part One of this series, we have a closer look at:
- Diving techniques (inadequate air supply, buoyancy, buddy system)
- Human factors (medical, physiological, psychological)

In Part Two, we have a closer look at:
- Equipment factors (misuse, faults)
- Environmental factors

Diving Technique

—Inadequate Air Supply

In the ANZ survey in half the deaths (56%), critical events developed when the diver was either running low or was out-of-air (LOA, OOA). When equipment was tested following death, few victims had an ample air supply remaining. The DAN survey found 41% in this situation. Most problems arose when the diver became aware of a low-on-air (LOA) situation. Some divers then died while trying to snorkel on the surface, attempting to conserve air (8%). Concern about a shortage of air presumably impairs the diver's ability to cope with a second problem developing during the dive, or causes the diver to surface prematurely and in a stressed state of mind, where he/she is then unable to cope with surface conditions. In many cases the LOA diver faced these difficulties alone, as his/her buddy who had more air, continued the dive oblivious to the deteriorating situation (see later). LOA situations should be avoidable by adequate dive planning, using

Detail from 16th century Islamic painting of Alexander the Great lowered in a glass diving bell.

a cylinder with ample capacity for the planned dive, and frequent observation of the contents gauge. A particularly dangerous technique was to intentionally use all the available air (breathing the tank dry). Then there is much less opportunity to cope with unexpected eventualities and greater likelihood of emergency ascent and salt water aspiration. The dive should always be completed with at least 50 ATA remaining.

In some cases the diver was using a smaller cylinder than a 2000 litre (72 cu.ft) tank. A 1400 litre (50 cu.ft) cylinder has much less endurance than a conventional cylinder, and allows fewer breaths once a LOA situation develops at a significant depth. Also, a diver using a smaller cylinder will usually run out of air sooner, encouraging separation from his group.

Buoyancy

In the ANZ survey, half the diving victims (52%) encountered buoyancy problems. Most of these were due to inadequate buoyancy, but some (8%) had excessive buoyancy. The DAN survey buoyancy problems were the commonest adverse event leading to death. The buoyancy changes peculiar to wet suits were a significant factor. The considerable buoyancy offered by a wet suit at the surface needs to be compensated by weights. An approximate formula for this is:

- 1kg for each 1mm thickness,
- 1kg for "long john" extensions and a hood,
- 1kg for an aluminium tank,
- ± 1–2kg for individual body variations in buoyancy.

Based on the above formula, 40% of divers who perished were found to be grossly overweighted at the surface. This factor would have been greater at depth. When weighted according to this formula, a diver should be neutrally buoyant at or near the surface. In this state, descent or ascent are equally easy. During descent, the wet suit becomes compressed, making the diver negatively buoyant. This is where the buoyancy compensator (BC) comes in. It is inflated just sufficiently to restore neutral buoyancy. This is why it is called a buoyancy compensator.

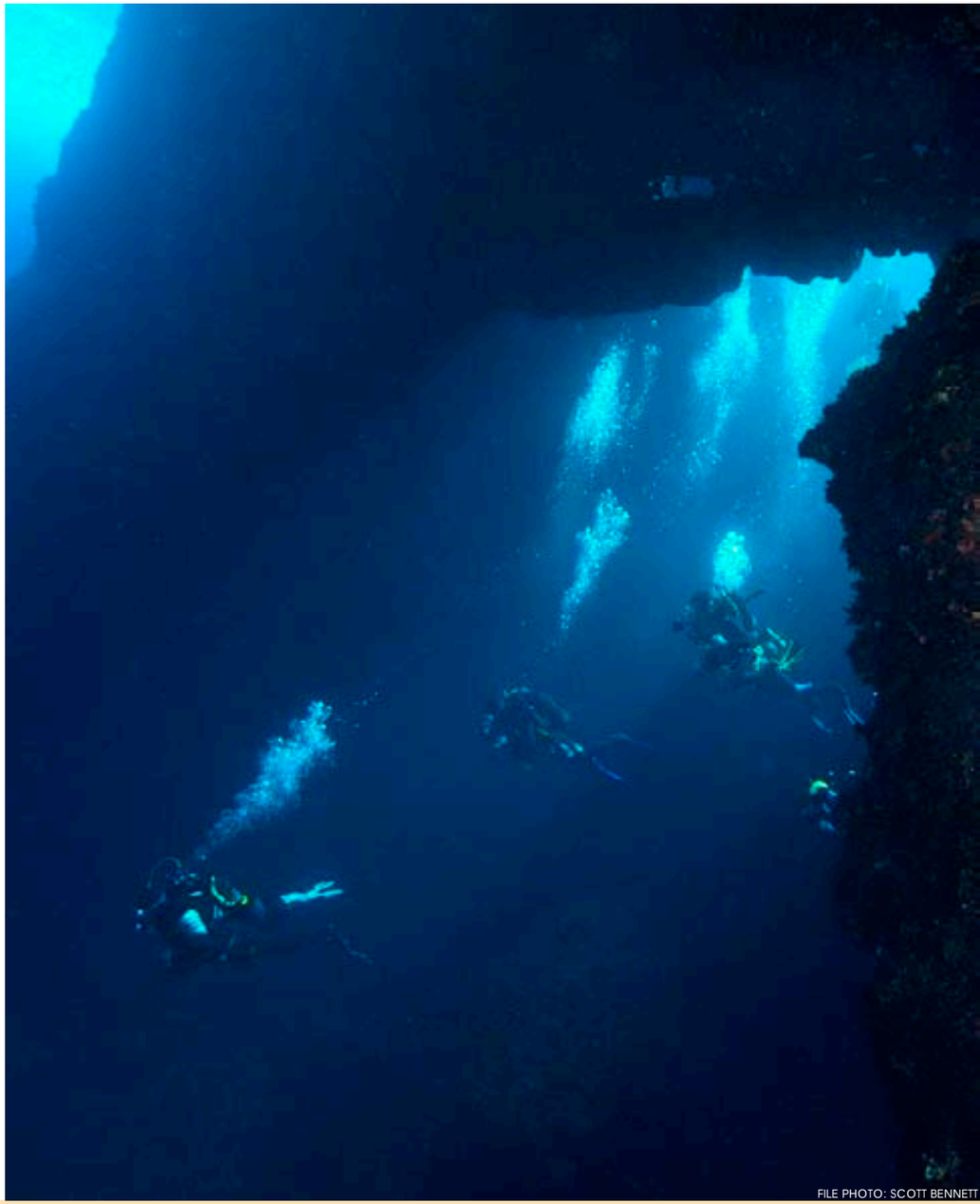
Evidently, some divers deliberately overweighted on the surface, using this excess weight to descend more easily and were then using the BC to maintain depth and then later to return to the surface. This places excessive reliance on the BC This dangerous practice is unfortunately promoted by some instructors. It has advantages from a commercial point of view, as it expedites training. Groups of divers can be quickly taught to descend with minimum skill. The technique is less advantageous in terms of longevity of the diver. In another fatality survey on buddied divers who ran into LOA/OOA situations, it was of interest that irrespective of who became OOA first, the overweighted diver was the one who died—at a 6:1 ratio, dealing with weights, buoyancy compensators, etc. In spite of being heavily reliant on their BC's, many divers then misused them. Examples of this include accidental inflation or over-inflation causing rocket like ascents ("Polaris missile effect"), confusion between the inflation and dump valves, and inadequate or slow inflation due to being deep or LOA. The drag induced by the inflated BC (needed in many cases to offset the non-discarded weight belt) was a factor contributing to exhaustion in divers attempting to swim to safety on the surface.

There are other unpleasant consequences of buoyancy problems. The American Academy of Underwater Sciences, in a symposium in 1989, reported that half the cases of decompression sickness were related to loss of buoyancy control. After acquiring the initial open-water certificate, possibly the best course to undertake would be on buoyancy control.

Ditching of weights

This was omitted by most victims (90%). Not ditching the weightbelt, compelled them to swim towards safety carrying many kilos of unnecessary weight, and made staying on the surface very difficult in these cases. This critical and avoidable factor should be easily remedied by restoring the traditional weight belt ditching drills.

Earlier diving instructors taught that the weight belt was the last item put on, the first taken off. It was to be removed and held at arm's length in the event of a potential problem. The diver then had the option of voluntarily dropping the belt if the situation deteriorated, or replacing it if the problem resolved. When problems did develop, the belt was dropped automatically! Some current diving students now question the validity of dropping these lead (? dead) belts—perhaps the high cost of replacement is worth more than their lives. "Lead poisoning" is a frequent contribution to fatalities. When ditched, the belt is held at arms length to avoid falling and fouling on other equipment. This entanglement occurred in some of the reported



FILE PHOTO: SCOTT BENNETT

FILE PHOTO: KATIE CLARK

kilograms of flotation are immediately available by simply discarding the weight belt. This action also results in a more consistent, controlled ascent than with an inflated BC.

Buddy Diving System

The value and desirability of the buddy system is universally accepted in the recreational diving community. Two maxims have arisen in diving folklore from this concept:

- "Dive alone—die alone"
- "Buddies who are not in constant and direct communication are not buddies, merely diving in the same ocean."

fatalities. In other cases, the belt could not be released because it was worn under other equipment (e.g. BC, backpack harness, scuba cylinder etc.), or the release buckle was inaccessible because a weight had slid over it, or it had rotated to the back of the body. In some cases the belt strap was too long to slide through the release buckle. Other fatalities have occurred where release mechanisms have failed, due to the use of knotted belts (which could not be untied), or lead balls contained within a backpack. In an emergency requiring either ascent or buoyancy, to keep the diver afloat on the surface, several

In spite of this, only 14% of divers who perished still had their buddy with them, and in the Hawaiian series, it was 19%. In 33% of the ANZ cases, the deceased diver either dived alone or voluntarily separated from his buddy beforehand, 25% left their buddy after a problem developed, and 20% became separated by the problem. Of those who started diving with a buddy in the DAN series, 57% were separated at the time of death.

A common cause of separation was one diver (the subsequent casualty) having inadequate air, OOA or LOA. In this case, the buddy often continued the dive alone, or accompanied the victim to the surface, before abandoning him and continuing the dive. There were many misapplications of the buddy system. In some cases, more than two divers 'buddied' together, leading to confusion as to who was responsible for whom. A particular variant of this is a training technique in which a group of inexperienced divers follows a dive leader. When one becomes LOA, he is paired with another (usually another inexperienced diver) in the same situation, and the two instructed to return to the surface together.

Often the heaviest air consumers are the least experienced and are overbreathing through anxiety. Two such inexperienced, anxious divers, both critically low on air, are then abandoned underwater by the dive leader and left to fend for themselves!

In others, the buddy was leading the victim and therefore not immediately aware of the problem. Generally, the more experienced diver took the lead, affording him the luxury of constant observation by his buddy, while he gave intermittent attention in return. In this situation, unless a "buddy line" is used, the following diver (upon developing a problem such as LOA or OOA) has to expend precious time and energy and air, catching his buddy to inform him of the difficulty. Often this was impossible, and the first indication the leading diver had of the problem was the absence of his buddy, who by this time was unconscious on the sea bed or well on the way to the surface.

A buddy line may be life saving. But not always.

Buddy rescue

In only a minority of cases was the buddy present at the time of death. Most divers ultimately died alone, usually because of poor compliance with the principles of buddy diving. In only 1% of cases did the buddy die attempting rescue, indicating that adherence to the buddy principle is reasonably safe for the would-be rescuer.

Buddy breathing

Four percent of fatalities were associated with failed buddy breathing. In a study of failed buddy breathing conducted by NUADC, more than half were attempted at depths greater than 20 metres. In 29% the victim's mask was displaced, and the catastrophe of air embolism occurred in 12.5% of cases. One in eight victims refused to return the demand valve, presumably to the righteous indignation of the donor. In one reported instance, knives were drawn to settle the dispute! Nevertheless, donating a regulator rarely results in the donor becoming the victim. The use of an octopus rig or (more sensibly) a complete separate emergency air supply (e.g. "Spare Air") would appear to be a more satisfactory alternative, having the added advantage of providing a spare regulator for the owner in the (not so rare) event of a failure of the primary air supply.

Human factors

(medical, psychological, physiological)

In at least 25% of cases, the diver had a pre-existing disease which should have excluded him from diving (compared to 8-10% in the potential diver trainee popu-

Ophelia by Paul Albert Steck, 1895

FILE PHOTO: SCOTT BENNETT

lation). The diseases either killed the diver or predisposed him to the diving accident. In assessing the cause of scuba fatalities, it is too easy to ignore the disorders which have no demonstrable pathology, such as panic and fatigue, but to do so results in less understanding of the incident. Drowning obscures many other pathologies and some, such as asthma or the sudden death syndrome, may not show up at autopsy.

Panic

Thirty-nine percent of deaths were associated with panic. Panic is a psychological stress reaction of extreme anxiety, characterised by frenzied and irrational behaviour. It is an unhelpful response that reduces the chance of survival. Evidence of panic was derived from witness accounts of the diver's behaviour, in the Australasian series. Other studies suggest a 40–60% incidence of panic. Panic was usually precipitated when the diver was confronted by unfamiliar or threatening circumstances such as LOA, OOA, poor visibility, turbulent water, unaccustomed depth, buoyancy problems (usually insufficient buoyancy), or separation from diving companions. After panicking, the diver frequently behaved inappropriately by actions such as failure to ditch weights or inflate the BC, rapid ascent, or abandoning essential equipment such as the mask, snorkel and regulator.

Fatigue

In 28% of cases, fatigue was a factor. Fatigue is a consequence of excessive exertion and limits the diver's capacity for survival. Physical unfitness aggravates it. Fatigue commonly arose from a variety of circumstances including attempting to remain on the surface while overweighted, long swims in adverse sea conditions or swimming with excessive drag from an inflated BC. The fatigue factor was not restricted to unfit divers—under special circumstances any diver will become fatigued. In some cases, the fatigue was associated with salt water aspiration syndrome, cardiac complications or asthma.

Salt water aspiration

This factor was present in 37% of cases. It refers to inhalation of small amounts of sea water by the conscious diver. In many cases this was the result of a leaking regulator, aspiration on the surface after removing the regulator and buddy breathing. In most cases, salt water aspiration was a preterminal event as the situation became critical. It frequently predisposed to the development of panic, fatigue, respiratory and other complications.

Pulmonary Barotrauma

Thirteen percent of deaths had autopsy evidence of pulmonary barotrauma (burst lung). In some cases, it was a complicating factor rather than the initial cause. Factors promoting the barotrauma were diverse including panic, rapid buoyant ascents, asthma and regulator failure. Half the cases had an identified cause for the illness. The other half were unexplained.

Diving & Risk

Cardiac (Sudden Death Syndrome)

In these cases, there was either gross cardiac pathology or a clinical indication of cardiac disease. In the DAN series, 26% of deaths were due to this. Of the cardiac deaths, 60% complained of chest pain, dyspnoea or feeling unwell before or during the dive. Victims tend to be older—cardiac causes explain 45% of the scuba deaths in those over 40 years. They tend to be more experienced divers, often with a history of known cardiac disease (arrhythmias or ischaemia) or high blood pressure—often under control with medication (especially beta blockers).

They usually die quietly, and the pathophysiology is probably a cardiac arrhythmia (ventricular fibrillation). Resuscitation is difficult or impossible under these environmental conditions. The trigger factors producing this very rapid ineffective heart beat include the following; exercise, drugs, hypoxia from salt water aspiration, respiratory abnormalities from breathing under dysbaric conditions through a regulator and with restrictive clothing and harness, cardio-pulmonary reflexes and cold exposure.

Asthma

In at least 9% of deaths the diver was asthmatic in the ANZ survey, and in at least 8% of cases asthma contributed to the death. In some other surveys (especially those with less data on each fatality, or those that do not specifically check the previous medical history), this data is not so obvious. Asthmatics should normally be excluded by a competent medical examination. Even so, surveys have shown that between 0.5 and 1% of divers are current asthmatics. When this figure is contrasted with the 9% of fatalities who have the condition, it implies that asthma is a significant risk factor.

There was often a series of adverse contributors to death in this group, including panic, fatigue and salt water aspiration. The ultimate pathology was usually drowning or pulmonary barotrauma. The risk of pulmonary barotrauma is

predictable, considering that asthma narrows and obstructs airways. Added to this is the possibility of an incapacitating asthmatic attack during the dive. A considerable number of divers in the survey died this way, some as they were returning to get their medication (aerosol inhalers). Others took it before the dive!

The diving environment can aggravate asthma in several ways:

Salt water aspiration
Respiratory physicians use nebulised salt water to provoke an asthmatic attack in cases of questionable asthma. Divers immerse themselves in such a solution and often breathe a fine mist of seawater through regulators.

Cold dry air
Breathing this air precipitates attacks in some asthmatics. Divers breathe this type of air continuously. It is carefully dried by the filling station before being used to fill scuba tanks, and cools as it expands in the regulator.

Exertion
This aggravates many attacks. Even the most routine dive can require unexpected and extreme exertion, due to adverse environmental factors such as rough water or currents.

FILE PHOTO: KATIE CLARK

Hyperventilation
The effects of anxiety cause hyperventilation and changes in respiratory gases. This will have little effect on normal lungs. It provokes asthma in those susceptible.

Breathing against a resistance
Many of the cases first notice problems at depth, where the air is more dense, or if there is increased resistance in the regulator—such as with a LOA or OOA situation. A study from Denver showed that although normal divers did not show any change in respiratory function with exercise or breathing through scuba regulators, asthmatics had decreases of 15% and 27% respectively.

Vomiting

Apart from the cases that vomited during resuscitation—and there were many—in 10% vomiting initiated or contributed to the accident. It was often produced by sea sickness or salt water aspiration, but ear problems and alcohol over-ingestion also contributed.

Nitrogen narcosis

This was an effect of depth, and contributed in 9%, but was never the sole cause of death in the ANZ series.

Respiratory Disease

A further 7% of casualties had chronic bronchitis, pleural adhesions, chest injury or other respiratory conditions. Because divers with these conditions are in a minority, they appear to be over represented in the deaths.

Drugs

Alcohol and cannabis (marijuana) are well known contributors to drowning. Cocaine is an established cause of sudden death in athletes. What surprised us was the apparent association between drugs taken for hypertension and the deaths from the sudden death syndrome. Antiasthma drugs seemed to have the same association.

Decompression sickness

The dread of DCS is prominent in the minds of most divers. Perhaps this is why there are no deaths due to this condition in the ANZ studies, and less than 1% in the NUADC. Hawaiians reached 4%, due to deep diving for black coral. The DAN survey has 2.5%, probably because of the inclusion of technical divers, who often dive deeper—the mean depth being 68 metres (226 ft) in that study. While DCS is an important cause of serious disability (such as paraplegia) in all divers, it is not a frequent cause of mortality in recreational divers. This is not, however, true for professionals. ■

Don't miss SCUBA diving: What are the risks, really? Part Two *in the next edition of* X-RAY MAG, *where we have a closer look at: Equipment factors (misuse, faults) and Environmental factors. Part two also includes a summary and some thoughts on how to prevent diving accidents.*

Dr Carl Edmonds, co-founder and director of the Diving Medical Centre in Australia from 1971-2001, served as a consultant in diving medicine to the Royal Australian Navy Submarine and Underwater Medicine Unit, HMAS Penguin, *for over 20 years. He was foundation president of the South Pacific Underwater Medicine Society from 1971-1975, and has authored or co-authored over 60 articles and books related to dive medicine. Two are sold by Dive Alert Network,* Diving & Subaquatic Medicine *(4th edition) and* Dangerous Marine Creatures. *For more information, visit: Diversalertnetwork.org.*

FILE PHOTO: KATIE CLARK

turtle tales

Edited by
Bonnie McKenna

DAVID BURTON / CREATIVE COMMONS

United States pushing for strong measures to protect sharks and sea turtles

The 17th meeting of the Interna-tional Commission for the Conser-vation of Atlantic Tunas (ICCAT) ended with successes in some areas and disappointments in others. One of the objectives of the United States this session was met: the adoption of measures to address the bycatch of endangered sea turtles, conser-vation measures for shortfin mako sharks, a recommendation on scien-tific observer programs and contin-ued progress toward a more robust compliance system. ■

Green sea turtle off the coast of Western Australia

International support needed to create marine sanctuaries in Western Australia

The public has a chance to support Australian conservationists in call-ing for marine sanctuaries in waters that are vulnerable to oil and gas drilling, overfishing and pollution.

Deep under the waters of the southwestern corner of Western Australia are hidden mountain ranges and dramatic canyons teeming with life. An array of marine species from blue whales to migrating leatherbacks, foraging green turtles and playful fur seals live here.

Ocean activists report that impor-tant decisions are being made now and that your help is needed to call for a strong network of marine sanctuaries in Western Australia. The seas off the coast of Western Australia are becoming a major frontier for oil and gas develop-ment.

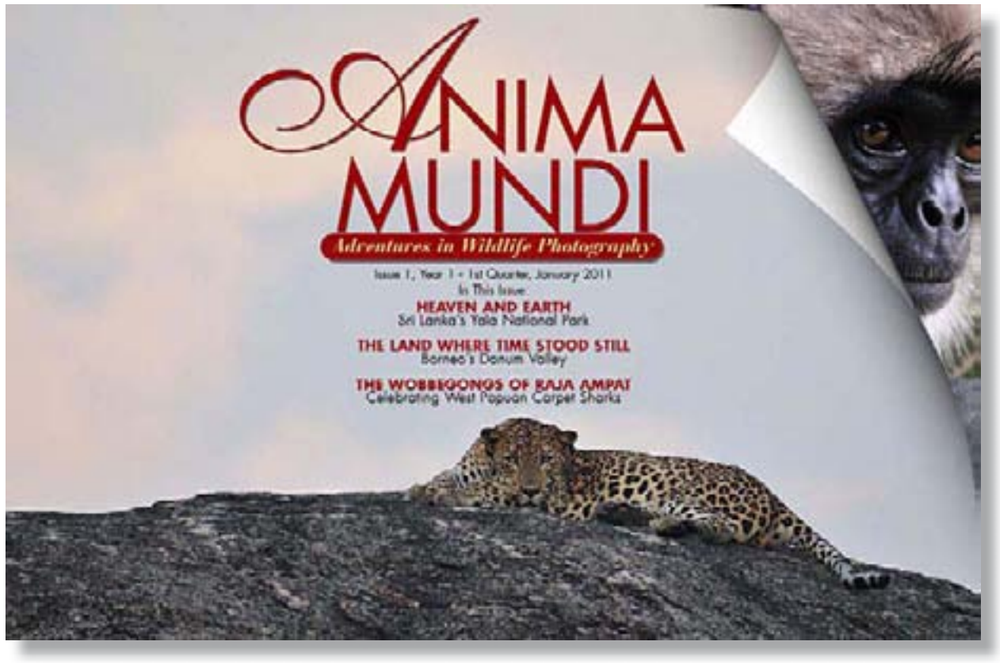
Australia's Environment Minister Tony Burk is on the verge of making a decision on the size and location of new marine sanctuaries. What makes this looming decision abso-lutely critical is that it will set the standard for marine sanctuaries for the rest of Australia for the next ten to 20 years.

Please join the action to protect Australia's marine environment by sending a message to Minister Tony Burke urging him to set aside signifi-cant areas of Western Australia.

Got to: **www.seaturtles.org** and click on the Action Alert link for the e-address of Australian Environment Minister Tony Burke. ■

Ferraris Go Online With New Wildlife Photography Magazine

Andrea and Antonella Ferrari - authors of the best selling guidebooks A Diver's Guide to Underwater Malaysia Macrolife, A Diver's Guide to Reef Life and A Diver's Guide to the Art of Underwater Photography and X-Ray Magazine , Wetpixel and DivePhotoGuide contributors - have now gone fully digital with the publication of their new free online magazine ANIMA MUNDI - Adventures in Wildlife Photography.



Anima Mundi is a quarterly, 110+ page, fully interactive, fully illustrated, high-quality online maga-zine available as a pdf for free downloading from their websites **animamundimag.com** and **reef-wonders.net**. Issues are available for downloading in three different resolution formats, even if the High Resolution version is the recommended one:

Each issue of the magazine - which is published in January, April, July and October - features a minimum of three extensively illustrated trip articles plus book and equipment reviews, photogra-pher's portfolios, field technique tips and fully interactive videos. While ANIMA MUNDI - Adventures in Wildlife Photography is mainly focused on topside wildlife and nature shooting, each issue of the magazine features at least one article or trip report centered on marine life or U/W photography. The Ferraris' new venture - a true work of love - is the result of a long-planned joint venture which is hosted and supported by X-Ray Magazine .

The first issue of ANIMA MUNDI - Adventures in Wildlife Photography
can now be downloaded for free at:
AnimaMundiMag.com