PETER SYMES

Risk Management for

Solo Divers

Some people dive solo and actually have no idea they are doing so.

Text by Steve Lewis

Diving is risky business. Just how risky depends on a whole shopping list of factors and influences, but let's agree that there are more risks involved with diving than, say, sitting in your basement watching Olympic curling on TV.

Now if we were to apply similar logic and argument, we could go further and make the point that solo diving carries an additional level of risk over and above the "run of the mill" stuff associated with regular diving. There are a few subtle points that need to be clarified if we are to fully understand that last statement, but we'll get to it in a few paragraphs. Let's simply agree that solo diving carries a few risks that are unique to… well… diving solo.

Yet, it is done every day. Indeed, some people dive solo and actually have no idea they are doing so… but more about that later.

Notwithstanding that at least two scuba training agencies teach courses intended to train independent or solos divers, you can find a whole bunch of people within the diving community who do not believe the additional risks associated with solo diving can be managed at all. These folks will give anyone admitting that they dive alone or who are even thinking about diving alone, the sage advice that they are crazy. "You are risking certain death, because solo diving is nuts," is the usual line.

These folks mean well. The circumstances that inform their opinion usually centers around being told—perhaps in an open-water training session—that diving alone is dangerous and not recommended. And bless 'em, they cannot see further than that.

Shake up

In 1999 (or thereabouts), what was then a brand-new training agency—called Scuba Diving International (SDI)—took the old-school recreational diving market by the scruff of its neck and gave it a good shake. They did it by launching a unique specialty course called Solo Diver—a program that taught recreational sport divers what tools and techniques would help them stay safe when diving on their own. And this was something no other agency had dared do before.

The logic behind the launch was that as risky as solo diving might be, divers were doing it anyway—many unaware they were effectively diving alone. The thinking behind the launch was that at least with a structured and sanctioned training program in place,

people could at least approach solo diving with the right mindset and correct equipment to do it with the proper controls in place.

When the folks at a training agency come up with a brand new idea like, "Hey, let's teach people to dive solo," taking that concept from a doodle on the back of a paper napkin to a full-blown program with instructor guides, student materials, and standards underwritten by a reputable insurance company, involves a great number of steps that follow a pretty well-defined pathway. Anyone who's been involved in the task will tell you it's not an easy process.

Solo diving was defined as self-sufficient diving

The first step is to define what it is you intend to teach and to whom. Solo diving was defined as self-sufficient diving. To define the program's target market, was not as straightforward. The circumstances where someone might find themselves diving solo had to be a little broader than simply diving without a buddy and being in the water with nobody else around.

Definitions

For instance, solo could also be defined as someone diving with a buddy who is way less experienced and upon whom they would rather not rely in the case of an emergency. After all, logic dictates that if you are diving with someone whose help can't be guaranteed if the Rottweilers hit the fan, you're effectively diving solo. By the same token, solo diving might also be someone who dives with other folks in the water, but who is doing "their own things," which is a diplomatic way to describe the buddy skills of most underwater photographers!

Insta-buddy experience

It may also describe a travelling diver who finds themselves on a dive boat coupled with an "insta-buddy" whose experience, abilities and dive habits are a total mystery. And solo diver fully describes every instructor who takes students into the water in a class setting. In an emergency, that instructor MUST be capable of "self-rescue," because it would be unfair and perhaps unrealistic to rely on a student to help.

Having defined what solo diving is, the next steps are to understand and define just how risky each of those situations is, and if those risks are manageable. In reviewing its solo diver program, SDI's training advisory panel looking really closely at the previously common blanket statement, "You are risking certain death, because solo diving is nuts," to see if it is indeed true or simply blinkered thinking.

In the world of diving, risk management always begins with a risk identification stage: what risks does the activity—in this case solo diving—carry with it and what is its potential outcome? The next stage is to assess each of the identified risks on a scale that stretches from Very Likely to Extremely Unlikely. And the third stage is to come up with a tactical plan that avoids or mitigates ALL the very likely and likely risks, as well as dealing comfortably with the risks that have only a small chance of happening.

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Solo Diving

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Perhaps the most commonly cited "additional" risk associated with solo diving is running out of something to breathe. To the classically trained old-school open-water dive instructor—and graduates from his courses—flipping your buddy the OOA sign and breathing from one of his regulators is the tried and true solution in this scenario. In reality this option is not always available.

Where's your buddy?

For example, what if your buddy isn't around? What if her gas supply is also down to seeds and stems? What if you really should do a safety stop and your buddy isn't in the mood to hang around at six metres for a few minutes before surfacing? Obviously, if you are diving without a buddy, there is nobody with whom to share gas, and all this becomes academic. Clearly, these situations present a challenge.

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To someone with a background in technical diving, the concept of running out of gas and relying on a buddy to get you back to the surface, is a bit of an anathema. Most technical divers regard running out of gas careless at best. Technical divers spend a lot of time and effort, and money, planning things so they do not run low on gas.

A far most constructive and robust solution is to NOT run out of air, and this can easily be accomplished by using a real gas management plan.

A properly trained solo diver knows their personal gas consumption rate. They know how many litres of cubic feet of gas they have at the start of their dive and they budget their time and depth, not just on the time that their PDC (personal dive computer) will allow them before decompression, but more importantly the time and depth that their STARTING GAS VOLUME will allow them while keeping a sensible amount back for contingencies. There is nothing difficult or revolutionary about teaching proper gas management to sport divers; however, it is often neglected. For a solo diver it is a required and an important skill to master if one wishes to dive with any margin of safety.

Equipment failure

There is of course, another side to the running out of gas scenario: equipment failure. While the practice is common among sport divers, diving with a single regulator first stage and no redundant gas supply is extremely risky... buddy or no buddy. With only one "life-support system," a diver—any diver—is totally done for if in the case of total equipment failure or even a minor inconvenience such as a missing mouthpiece.

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Once again the "normal" solution is to rely on your buddy to help. For someone committed to self-sufficiency and diving alone, the better solution is to carry a back-up. A properly equipped solo diver carries a small volume cylinder of gas fitted with a regulator and SPG. In the parlance of technical diving, this extra cylinder is often called a stage bottle, but in the language of solo divers, it becomes a buddy bottle. Effectively, it supplies enough gas to get the diver from their maximum depth back to the surface at the prescribed ascent rate including a safety stop, with a margin of contingency gas... just in case.

Another risk that is presented who pooh-pooh the idea of diving without a buddy is getting lost or entangled. The thinking is that with a buddy in tow, they will offer assistance. They will help if you are confused about the location of the exit, lose your mask, or are attacked by a strand of kelp or discarded fishing line. Once again, this shifts an awful lot of responsibility for one's own well-being off your own shoulders and onto someone else's. There is another way.

Surface marker bouys

Solo divers are taught to carry and use a delayed surface marker buoy and a spool or reel so that it can be deployed from depth. This effectively becomes the diver's personal ascent line and alleviates one issue. Carrying and being able to deploy a back-up mask deals with another. Entanglement is a more sticky issue. Solo divers are taught to avoid areas where entanglement is a real threat, but just in case carry more than one cutting device (and train how to extricate themselves from an entanglement using one of those tools and or common sense).

Avoid panic

In all three of these issues, one of the key guidelines is to avoid panic. "Stop, breathe, think, act" are the watchwords and as such perhaps more valid for a solo diver than for any other.

The ability to control panic when things go pear-shaped at depth is a function in part of experience. For example, the prerequisites for SDI's Solo Diver are for the diver to have logged at least 100 dives. I guess the agency believes that although logging that many dives offers no guarantees, it's a workable benchmark.

There is one other risk that's quoted as unique for those without a buddy to keep them in check. When diving alone, it is possible to drift beyond one's comfort zone and into the land of panic. A buddy, in the best-case scenario, provides a sober second opinion and will help prevent you from pushing beyond the limits of your training and experience.

Solo divers are also encouraged to share and discuss their dive plans with a friend or family member BEFORE putting the plan into action and going for a dive.

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Once again, well-trained solo divers follow a personal dive plan that takes this "shortcoming" into account. They are taught to draw up a plan that outlines goals, way-points, contingencies and LIMITS. Those limits include ones that take into account the limits of their equipment, their training and their experience. They are also trained to "self-assess" their personal stress levels before a dive and to call off any dive that seems too much for them on that particular day. One of the responsibilities accepted by a solo diver is to plan all their solo dives well within those limits.

Solo divers are also encouraged to share and discuss their dive plans with a friend or family member BEFORE putting the plan into action and going for a dive.

Accepting risk

Finally, there are some risks that simply have to be accepted. For example, having a medical emergency underwater while diving alone has a very small chance of happening, but the magnitude of the potential outcome is the most serious possible. A good risk management plan may have suggestions to mitigate the health—maintain a healthy lifestyle and work to stay fit for example—but that can never be totally avoided. If your personal state of health is at question, never dive alone.

When solo diving was brought to center stage and had the spotlight shone on it, many old-school instructors and divers were upset. They argued that solo diving is wrong and nothing would change their minds. However, I believe a growing number of instructors and divers believe that self-sufficiency begins with good training and part of that training is realistic and detailed risk analysis, self-assessment, and equipment choices.

Fact is that I believe in SDI's solo diver program, and those from other agencies teaching the same skills, have helped to produce a cadre of better divers, and ironically, a lot of really good potential dive buddies! □

Steve Lewis is a diver, instructor, dive industry consultant and author. He teaches and lectures at home and abroad. His main focus is to dive safety and to make each of us aware of the things that will make us better divers than we are now. His latest book, Staying Alive: Risk Management Techniques for Advanced Scuba Diving, *is available through Amazon. For more information, visit* ***www.techdivertraining.org*** *or* ***www.ccrcave.training****. Steve will be one of more than 30 speakers at EuroTek 2014 being held in Birmingham, United Kingdom, September 20-21.*

Author and photographer Kurt Amsler freediving with underwater camera

Apnea Pix

Freediving for underwater photographers

ANDRAS GRUBER

Text and photos by Kurt Amsler
Translation by Peter Symes

Taking pictures while freediving can be a real physical challenge, but in some cases, it may be the only option to get the subject in front of your lens.

Freediving in order to take underwater photographs is not the norm, but there are many freedivers who do just that—for example, the freediving icon Fred Buyle. It is also a good technique to use for practical reasons; Without noisy bubbles, it becomes possible to get closer to shy creatures. But the main advantage is that it's easier to keep up with fast moving animals, such as marine mammals and sharks, when you do not have to propel bulky scuba apparatus through the water, too.

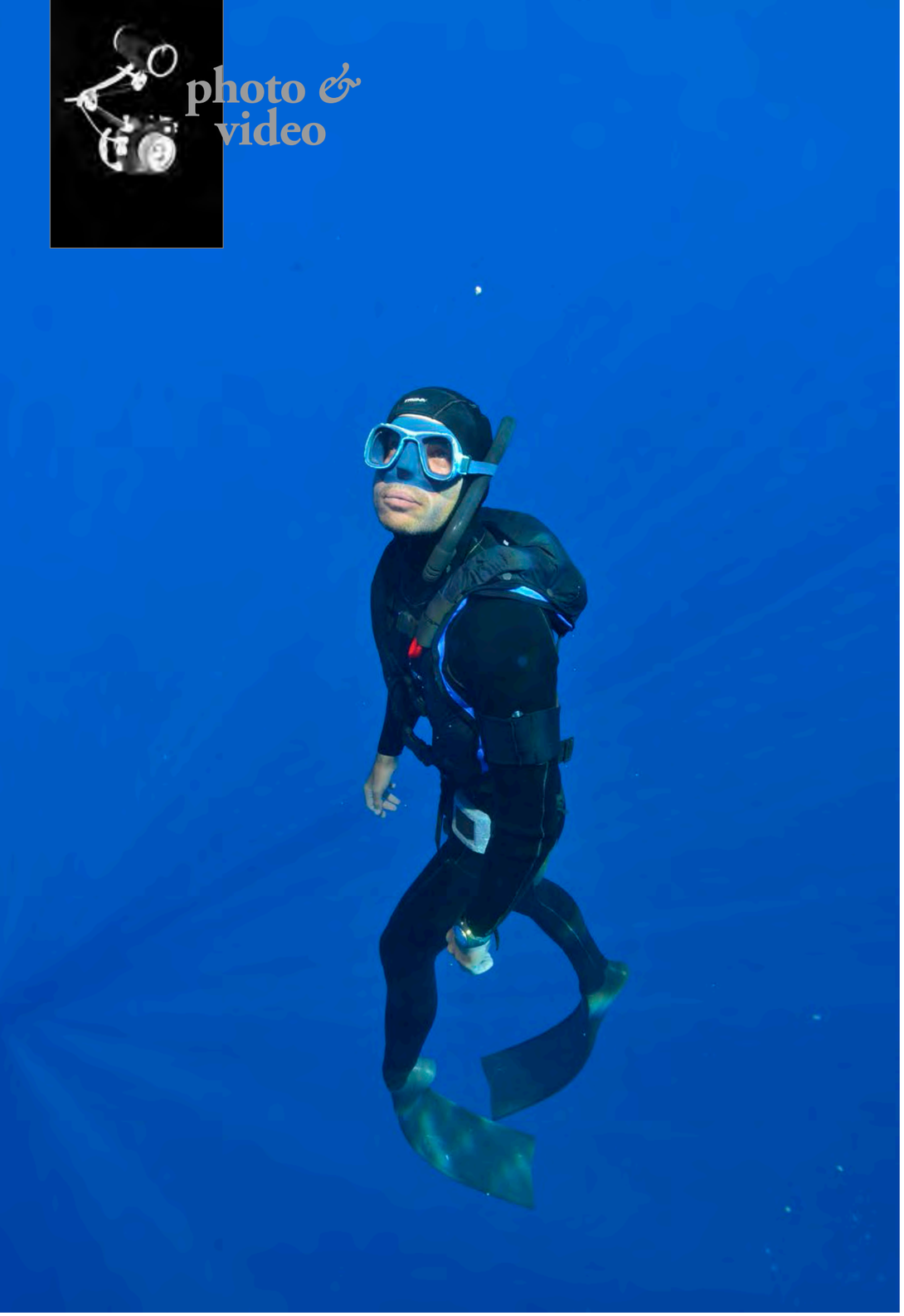
The kit

Compared to the scuba laden shooter, the freediving photographer tends to swim further and faster, so camera rig and equipment need to be optimised for these circumstances. The choice of diving equipment is also important, which will be discussed in further detail below.

The goal is to keep the camera as hydrodynamic and compact as possible. While artificial light is needed, only one flash unit should be mounted. A double-flash configuration would produce substantial drag and appear too large to an animal, scaring it off. In general, the classic apnea subjects—such as whales, dolphins, sharks, manta rays and other pelagic marine animals—live in the surface layers of the sea where ambient light is sufficient.

But even without a flash, the housing should have as little resistance as possible. Big dome ports, from 18cm of diameter and up, produce significant drag, so if you plan to pursue freediving photography more actively, you should consider getting a smaller dome. However, there are a few points to be observed.

The smaller the diameter of the dome



Freediving icon Fred Buyle

Freediver Recovery Vest (FRV) electronics and two 38-gram CO_2 cartridges, which provide sufficient lift from depths of up to 45 meters

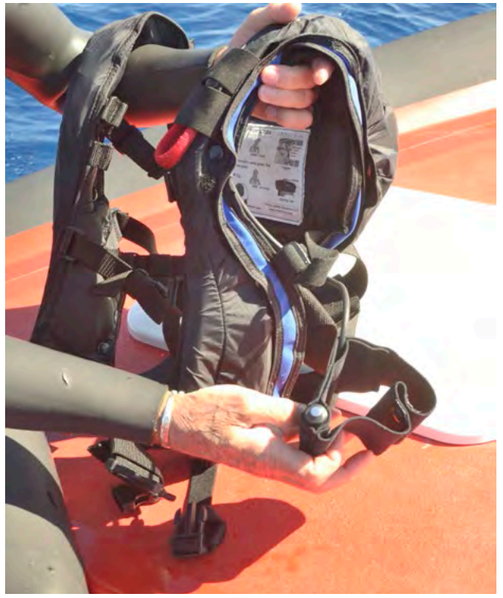
port, the less depth of field we get for a given aperture. This is related to the imaginary image the dome as a spherical lens projects in front of it. Using a 22cm dome, you may still achieve a full depth of field with an aperture of f:2.8, whereas with a 18cm, you will lose about a third of that. To compensate, the aperture needs to be stepped down to 5.8 or 8 in order to achieve a complete depth of field. For even smaller ports, the effect is even greater.

Back in the film (or analog) era, using ASA/ISO 100 using apertures from 2.8 to 4.5 were the order of the day, which is why the super dome ports were required to achieve full depth of field. Today, with modern cameras, where 400 to 600 ASA / ISO can be used without loss of quality, such large apertures are no longer relevant. Even under the most difficult lighting situations, it is rarely necessary to open up the aperture further than 5.6.

Exposure

When working with flash, everything is the same as before, and classic flash techniques come into play, depending on whether wide-angle, standard focal length or a macro lens is used. The flash takes priority and is controlled by the aperture after which the capture of ambient light from the background is dictated by the shutter speed.

When working only with natural light, these rules no longer apply. Where a flash is not used to freeze the motion of fast moving animals, one depends



Freediver Recovery Vest (FRV)

Freediving underwater photographer with pod of dolphins

on shutter speed. This must always be set faster than the relative movement between the subject and photographer, which of course depends on the situation. For example, when you approach a floating sperm whale, the shutter speed must be at least 1/350 seconds to ensure no motion blur occurs.

Ensuring correct exposure is then controlled via the aperture setting. In daylight photography, the camera can be used in automatic mode. With the camera set on "Shutter Priority", we do not have to care about anything, even if the lighting conditions vary. Only in situations where there is strong sunlight coming in from the side, or in front of the camera, which should be avoided anyway, the +/- exposure correction can be set at approximately 2/3 stop of overexposure. It is, of course, also possible to use the camera in "manual" mode and use the built in light meter as a guide, but I generally recommend using an automatic mode in order to save time. Once again it should be emphasized that shutter speed takes priority, and aperture and exposure is less important.

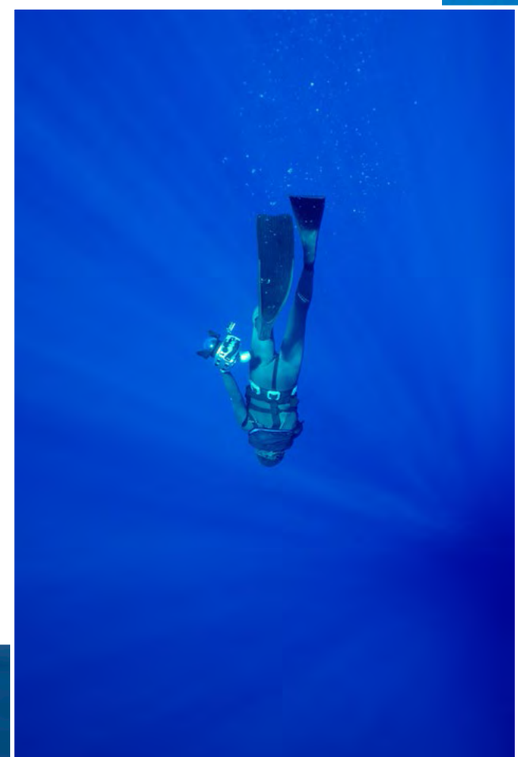
Should the aperture, in the case of too little ambient light, start to go below a value of 8 or 5.6, increase the ISO value rather than reducing the shutter speed!

Getting the shot

The difference between shooting while freediving and shooting while scuba diving is that the photographer usually has virtually no time to get the subject in front of the lens, let alone to mess about with camera settings. In other words, all important settings must be made prior to the dive. Already at the surface, the photographer can see the subject, assess the situation and decide from which side it is best approached, and then adjust the

Freediver Fred Buyle in shark encounter

Underwater photographers freediving with whale shark (right); The proper streamlined silhouette of a freediving photographer with streamlined camera gear (below)



camera settings accordingly.

A proven trick when capturing marine mammals, sharks and schools of fish is to preset the focus, so that the autofocus will not go hunting among several moving subjects. For example, while holding your legs out straight, focus your camera on the tip of your fins. Then flip the AF / M switch from Aufofocus to Manual focus, which will then leave the focus setting where it is. Since we usually work with the aforementioned subjects with super-wide angle or even fisheye lenses anyway, a f: 8 aperture will produce a depth of field from about 80cm to almost infinity. To benefit from this old trick, the underwater housing must, of course, have such an AF/M switch.

When working with natural light, the subject should appear fully lit, which means that you should approach the subject with the sun at your back. With the sun coming in from the side or even from the front, the subject tends to appear too dark against the background and the water can appear cloudy and dull, too. Exceptions are, of course, deliberate creative choices or backlit scenes.

Freediver with inflated FRV, or Freediver Recovery Vest

Diving technique

It is not just the camera gear that needs to be streamlined, so does the dive equipment. Consequently, freedivers equip themselves accordingly—with tightfitting, smooth suits, long fins, masks with small volumes and short simple snorkels.

Breathing technique, pressure equalization methods, etc, remain the same for the most part, but may be adjusted according to the shooting situation. It is, for example, impossible to calmly prepare for a dive while swimming alongside a whale shark.

It is important, whether diving with or without a camera, to get the weighting correct so positive bouyancy will be set in at around six meters of depth.

Equally important is to not exceed dive times beyond training levels and to be mindful of safety. It is only too easy to become fascinated with a particular subject in the viewfinder and ignore or suppress the respiratory stimulus and hunger for air for too long, increasing the risk of hypoxia or shallow water blackout just below the surface.

To this effect, multiple U.S. champion, Terry Mass, developed the freediving lifejacket. The "FRV" (Freediver Recovery Vest) is equipped with a timer and depth gauge, which can be individually programmed to suit personal needs. The vest

The Magic Filter restores many of the colors that are lost underwater due to absorption, from six to 15 meters approximately

is automatically activated depending on the programming, or by hand. The FRV consists of two bladders, which fit very snugly, and a small neck part, which houses the electronics. It does not prevent any freedom of movement and has little water resistance. The volume of the bladder is 16 liters and is equipped with two 38-gram CO_2 cartridges, which will provide sufficient lift from depths of up to 45 meters.

Color correction filter

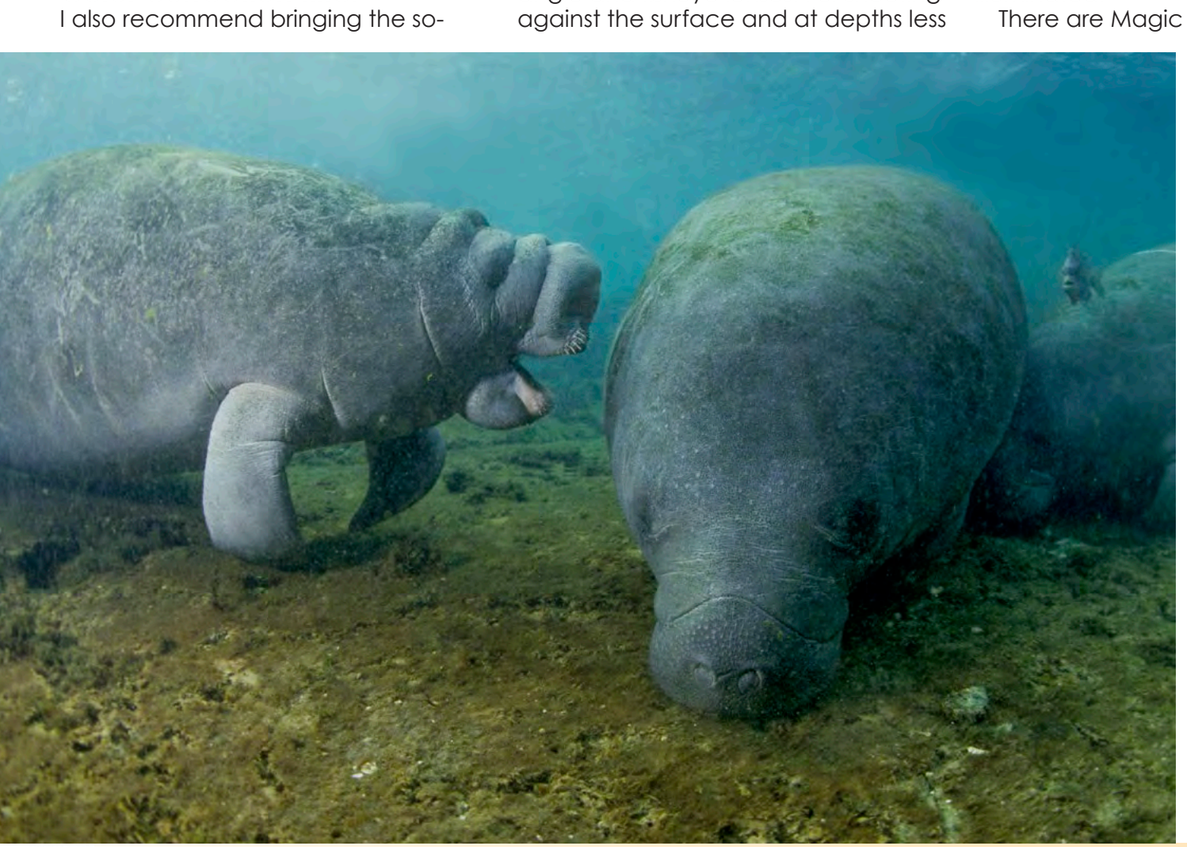
I also recommend bringing the so-called "Magic Filter", which, at depths from about six meters to about 15 meters, depending on water clarity and sunlight, will restore a large part of the colors that are otherwise lost by absorption.

The principle is based on the conversion of color temperature and color balance. This unique invention takes advantage of the technology that comes with modern digital cameras and is primarily designed for wide angle and fisheye lenses. For shooting against the surface and at depths less than six meters, it is not well suited as the ambient light will appear lacking magenta.

Using Magic Filters where no artificial light may be used is a no-brainer, but for greater depths and sunless days, it is best to do without it. The filter only works optimally in bright sunlight and clear water. And the colors are the most beautiful when the subject is fully illuminated.

There are Magic Filters for the most popular and super-wide fisheye lenses. Recently, they have also been produced for compact cameras. For more information about sizes and compatibility, please visit www.magic-filters.com. □

For more information about Kurt Amsler and his underwater photography courses, please visit his website at: ***Photosub.com***



Manatees feeding

photo & video

Edited by Don Silcock

PRODUCT SHOTS COURTESY OF THE MANUFACTURERS

Gates Arri Alexa Housing

Gates Underwater Products has announced it will be releasing two new housings for the Arri Alexa cinema cameras. One of the new housings will be for the Arri EV and XT camera models and the other will be for the Arri XT Plus. Both housings will feature Gates Precision Port and support over 70 PL mount lenses. Gates is advising that both housings will be available in the fourth quarter of this year and prices will be confirmed prior to release.

Sea&Sea RX100-III Housing

Sea&Sea has also announced the new housing for the Sony RX100-III compact camera. The MDX RX100-III housing is made from black galvanized, corrosion resistant, aluminum. Sea&Sea states that the design allows the camera's internal flash to be activated and used to trigger external strobes via fiber optic connections. The housing's design also allows the camera's LCD to be set at a ten degree angle, making it easier to use when composing images underwater. Access to the RX100's front and rear control dials, which are critical for using the camera in manual mode for underwater photography, are built in to the new housing. The MDX RX100-III will be available in early September at a U.S. retail price of $996.

Subal ND4S Angler Housing

Respected Austrian housing manufacturer Subal has announced its new housing for the Nikon D4s SLR camera. Subal is calling the new ND4S housing the "Angler" and states it is the first of a new series of next generation housings the company will be releasing. The housing provides access to all the important camera controls on the D4s and is compatible with the preceding Nikon D4 camera. The ND4S Angler is available now at a U.S. retail price of $6,500.

Recsea RX100 III Housing

The Japanese housing manufacturer Recsea has announced its new housing for the Sony RX100 III compact camera. The WHS-RX100 III housing is CNC machined from anodized aluminum and provides access to the front and rear command dials on the camera, both of which are critical for using the camera in manual mode for underwater photography. The rear command dial also has a push button function for accessing the center button.

Edited by
Don Silcock

Sony PXW-X70 Camcorder

Sony has announced the upcoming release of a pro XDCAM camcorder which will be upgradeable to 4K before the end of 2014. The PXW-X70 camcorder features a 1-inch type Exmor® R CMOS sensor together with a Zeiss Varion Sonnar T lens and Wi-Fi control. The camera will be available in fall 2014.

Ikelite RX100 III Housing

Ikelite has also released its housing for the new Sony RX100-III. Importantly, the housing provides access to the RX100's front and rear control dials, with a rotating gear wheel on the front of the housing to provide easy access for front control dial. Both these control rings are critical for using the camera in manual mode for underwater photography. The housing also features dual fiber optic ports for strobe triggering.

Nauticam GH4 Housing

Nauticam has announced their NA-GH4 housing for the very highly regarded Panasonic Lumix DMC-GH4 camera. The NA-GH4 is configured to maximize the excellent video potential of the Panasonic GH4 camera and features a thumb operated button for ISO adjustment, a lever for white balance and access to both control dials. Nauticam also announced the availability of an inexpensive upgrade kit for owners of the earlier NA-GH3 housing who wish to use it with the GH4. The NA-GH4 is available at U.S. retail price of $2,250.

Jason deCaires Taylor

P O R T F O L I O

Detail of *The Silent Evolution* (2012), depth 8m, MUSA Collection, Cancun/Isla Mujeres, Mexico

Inertia (2011) above and a detail of *The Bankers* (2012) on the previous page at 5-6m depth, MUSA Collection, Cancun/Isla Mujeres, Mexico

British artist Jason deCaires Taylor has created unique underwater sculptures and installations in locations all over the world. We first interviewed him in 2007 when he finished a photo-documentary of one of his earliest works in Grenada. Now a well-known artist and celebrity with international media coverage, Taylor is much sought after by many centers of tourism wishing to draw divers to their waters or rejuvenate sandy sea areas with renewed reef and marine life that thrive on his creations.

Text edited by Gunild Symes
Photos and all sculptures
by Jason deCaires Taylor

X-RAY MAG: How has your purpose or approach to underwater sculpture evolved and developed since the first sculptures you created in Grenada?

JDT: I am always interested in trying out new ideas, experimenting with different concepts and advancing techniques to create the pieces but I am now more focused on trying to highlight the grave threats to our marine ecosystems and the controversial subjects surrounding oceans and climate change.

Now that I am better known, I have more free rein on the design front and able to explore more divisive subjects. One of the sculptures in Mexico, for example, is of a politician with his head buried in the sand. It was not the first thing the tourist board or local government wanted to highlight. Likewise, the sculpture of the guy on the sofa called "Inertia," it's about our relationship with the natural world and tourism… how people just see these locations as sunny places to go and consume when in fact their interactions directly affect the environments they are going to.

X-RAY MAG: Are you trying to raise awareness in divers about these conservation issues?

JDT: It's not so much to influence the diving community, but more the general public. Most divers are fairly aware,

—maybe not in Cancun, where there are still a lot of novices or first time divers with poor buoyancy skills and are still touching the corals. I still see snorkeler's standing on reefs in some places. However, in most areas, divers are fairly respectful. It's more about

Stages in the creative process from local participant to life cast sculpture in reef-friendly cement to coral colonization, *The Silent Evolution*, Mexico; Algae, sponges and hydrozoans on *Viccisitudes Girl*, Grenada, West Indies (left)

trying to connect to a wider audience and bring a piece of our magnificent oceans into their living rooms.

X-RAY MAG: How have people responded to your message over the years?

JDT: It is difficult to gauge the response, but I must say, overall, in direct feedback and on social media, it has been very positive. I invest a lot of time and energy into good documentation of my pieces and the growth on them in order to help people experience the works. I have been told by many people it reminds them of a line from *The Tempest* [by Shakespeare]:

"Full fathom five thy father lies;
Of his bones are coral made;
Those are pearls that were his eyes;
Nothing of him that doth fade,
But doth suffer a sea-change
Into something rich and strange."

X-RAY MAG: What about your artistic methods, has this changed over time?

JDT: I am always working harder to improve ways in which the sculptures become habitats. I have used a lot of traditional sculpting methods in the past, but at the moment, I am designing a project for the Bahamas using 3D digital technology and CNC cutting machinery. It is going to be 100 tons in weight and six metres high. The piece will assemble in sections underwater like a layered jigsaw.

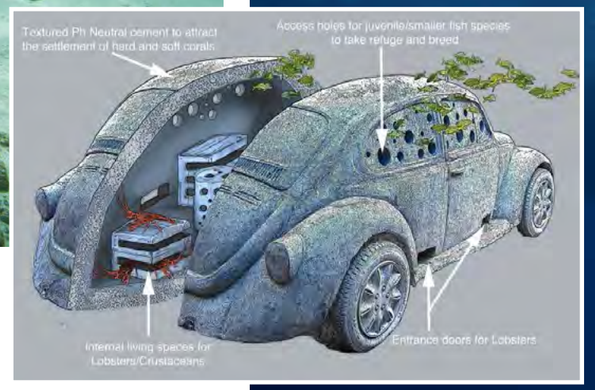
X-RAY MAG: Who helps you? How do you coordinate your team of helpers, assisting divers, in the production of your works?

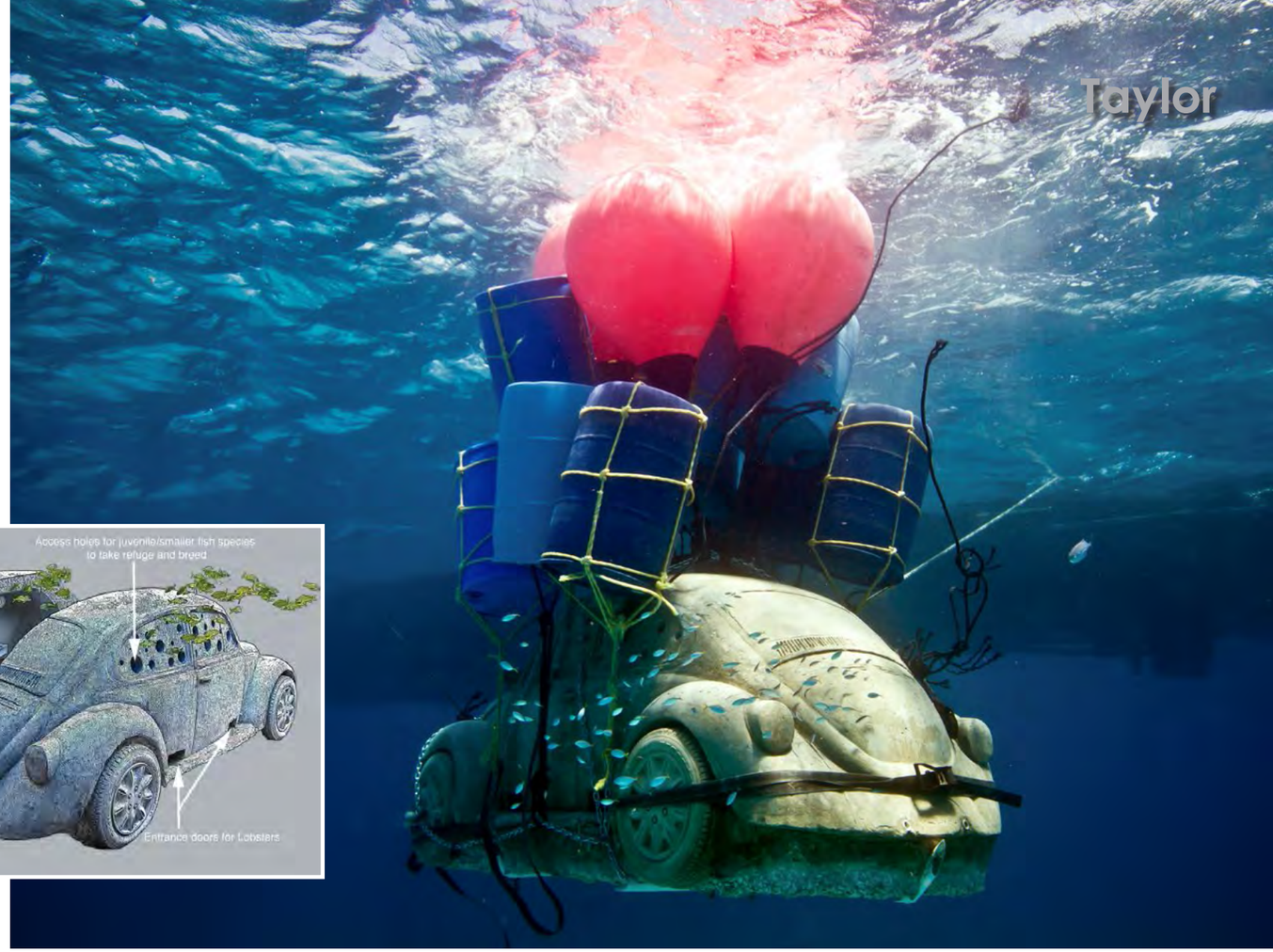
JDT: Various people at different points. The techniques I use require many work hours—i.e. life casting, mould making—so I have a lot of help in the studio, then a different team who work with the installation: marine engineers and dive technicians.

X-RAY MAG: Are they all volunteers or are they paid?

JDT: It depends on the project budget. I certainly prefer experienced staff. Sometimes it's difficult to find sculpting skills in remote places but I always, if possible, hire from the local commu-

Traditional life casting process, with artist Jason deCaires Taylor on the right





Anthropocene (2011), depth 8m, MUSA Collection, Cancun/Isla Mujeres, Mexico; Illustration (right inset) shows access holes and retreats for lobsters inside sculpture; Since the sculpture weighed more than a crane could handle, floats were used to lower it (far right)

nity. Divers can sometimes be hard to get hold of because I only need them for key events when I am installing the pieces. This usually coincides with peak season when the weather is calm and most dive professionals are busy.

X-RAY MAG: Are they technical or commercial divers, advanced in training and skill?

JDT: Sometimes I use commercial divers, which is great because it's quite hazardous work and requires good experience. But often I use instructors or dive masters from local centres. Having a good boat crew is equally as important. As with most diving, the weather generally dictates how smoothly everything goes. Hopefully in the future, when I expand my operations, I will have a dedicated installation crew.

X-RAY MAG: Have you had to postpone the installation of a sculpture due to weather? What are the challenges?

JDT: Yes, there have been lots of delays due to weather. In Mexico it was quite open sea, so winds had a huge influence on activities. We've had our fair share of problems along the way—the 8-ton VW beetle, for example. It exceeded the weight capacity of the crane on the boat so we had to tow it over a 7km on floats. Due to the repeated wave action, it cut the ropes to the floats and it sank in the middle of the bay on a patch of sand. So we had to lift it again, which took so much time it began to get dark and we had to suspend all operations until the weather improved. Eventually, we managed to place it in the right spot.

X-RAY MAG: How has it been working with governments and agencies involved with some of your projects? Any insights?

JDT: It's a constant challenge, applying for permits, fund raising, contracts, etc. Sometimes the overall objective gets lost. I always try to maintain work in the studio and share the visual documentation so everyone can see the reality of the project and what we are heading towards. Learning to adapt to the working practices of the region has been paramount and listening to local advice.

X-RAY MAG: Do you spend time visiting the location and meeting government agents before the project begins?

JDT: Yes, there's always a scouting trip—collecting field data, finding out the objectives and the scope of the project, taking on board artistic considerations and getting a feel for the local environment.

X-RAY MAG: What has been your favourite part of the process or the production?

JDT: The photography is the part I really enjoy—I love watching how the sculptures visually change. The photography is sometimes so important it can, at times, actually dictate the making and deployment of the statue. I often make sure the best photographic angle is facing the sun or include intricate details, which I know will be lost in days but will make a great shot.

Diver at work installing sculpture

CLOCKWISE FROM LEFT: Sea turtle swims over sculptures at night; Algae and coral growth on figures of *The Silent Evolution*; Gray angelfish over installation; and Southern stingray at *The Silent Evolution*, MUSA Collection, Cancun/Isla Mujeres, Mexico

X-RAY MAG: What camera and video equipment do you use to document your work?

JDT: I have a Canon SLR with Sigma lenses and video capability in a Sea&Sea housing. I used to have two cameras, but now they are combined into one. I also invested heavily in an underwater lighting system with underwater tripods and time-lapse equipment, placing small cameras on the sculptures to record time lapses or deployments. I have a series of different lenses—but mainly macro and wide angle.

X-RAY MAG: How have you learned how to use this equipment? Did you take courses or learn on your own?

JDT: I am self-taught. Sigma sponsors my lenses and also provides technical support. Learning how to use the equipment has mostly been through talking with colleagues and the camera crews who I have worked on projects with over the years.

But I am still not happy. I am a perfectionist. I want to get a new multi-panorama system, which is being developed in Spain and Germany. I am in talks with the developers, but the system costs around 40,000 Euros, so it needs carefully researching.

There is also a permanent underwater time-lapse camera, which can be installed near the sculptures and also provides a live webcam feed. It cleans itself every minute to prevent algal deposits.

I recently collaborated with Google Maps. Their survey, the Catlin Seaview Survey, mapped the sculptures in Mexico, so now people can move in and through the sculptures virtually.

X-RAY MAG: How do you find out how divers, people, kids in the different parts of the world where your creations are displayed react to your art works?

JDT: Sometimes I go on tourist boats as a tourist diver to listen to what people say about the pieces and to see their reactions. What I find funny is how the dive guides invent their own stories behind the meanings of the sculptures. You can see how so many myths come from the sea.

X-RAY MAG: What kind of fish and other marine life have interacted with your work?

JDT: Oh, it's another great pleasure to see what actually is colonizing the pieces—all sorts of bizarre things. In Mexico, there are very few gray angelfish. You'll see an odd pair here and there. But as soon as the sculptures were installed, very quickly a couple of gray angelfish came to swim on top of the sculptures. Then two months later—the viz was not so good—but I turned around and saw almost 100 huge gray angelfish, all full-sized adults. Other local divers said they never saw that many angelfish over the past 30 years.

Reclamation (2012) and *Resurrection* (2013) of the MUSA Collection in Cancun incorporate rescued fan corals ripped off reefs by storms (top left, center); Sea urchins clean the sculptures each night (above, lower left)

Then there are the crustaceans. We were really pleased that after a year there were 100 spiny lobsters on the "The Silent Evolution". It was great! But the next day, every single one was gone. A fisherman had been there and pulled all of them out. That's why we put the VW there with the habitat retreat for the lobsters. It's made with doors and curves that prevent the fisherman's barb from pulling them out. A year went by and no spiny visitors. I thought it had failed, but then, just three months before I left, there were between 50 to 60 lobsters inside, and fishermen couldn't get them out.

I have seen some really beautiful sponges and tunicates, mainly on the high areas where there's current and the filter feeders can find nutrients. There are lots of polyps. It's great to see the growth from a tiny polyp to a full

size colony of corals.

X-RAY MAG: Your "Reclamation" sculpture, the angel with wings made of sea fans... How did you devise that piece?

JDT: I wanted to create a kinetic element to the works as the gray cement finish can seem quite static. Sometimes after storms, sea fans are ripped off the reef and are either left on the sea bed or washed up on the beach. They eventually die. I developed a system whereby the fans could be rescued and clamped onto the body of the figure.

I have learned so much along the way. Algae for example—good algae and bad algae—it's really interesting. Divers always want to see the big pelagics, but all the hard work on the reef is done by herbivorous fish and urchins that keep check of the algal invasions.

My favourite time to dive is at night because then you can see everything out working, in all its colour. You can really focus in on what is going on.

I found out that the sea urchins clean the sculptures every night, which is very convenient. So some of the newer designs include living spaces for urchins, which need protective spaces to retreat to during the day. The pieces that are cleaned by urchins have the best coral growth because the invasive algae is held back. Urchins do not walk on sand very well, so we also sculpted bridges to assist them.

Each sculpture dictates the design for the following sculpture.

X-RAY MAG: Many of the sculptures are meant to support coral growth. How has it developed on your sculptures in the various locations?

JDT: Most of the sculptures are

Seahorse on figure, Moliniere Bay, Grenada

The Dream Collector (2009), Depth 8m, MUSA Collection, Cancun/Isla Mujeres, Mexico

THIS PAGE: Fish feeding and schooling around figures of *The Silent Evolution*, MUSA Collection, Cancun/Isla Mujeres, Mexico; Algae and coral growth on night photo of figure, Grenada (right)

designed to support marine life and provide a platform for corals. However, on a select few, I have actually propagated hard corals onto the surface from underwater nurseries and these seemed to have faired fairly well, but after a particularly hot summer in Mexico, I did see a lot of bleaching.

The most dynamic transformation has been in Grenada where great water quality and nutrient-rich current have resulted in some spectacular sponge growth.

The marine life is of course very endemic to the location. Techniques that work in one place may not work in another place. I am currently working on a project in the Canary Islands where the water is much colder. The plan is to make an underwater botanical garden with architectural features, walls, archways and trees. The colonisation is different—it won't be inundated with organic material, not like in the Caribbean where algal growth is faster. It's a lot slower in development, and indigenous species of sea urchin are being threatened by a newer invasive species.

In the past, I replicated sculptures, because I knew that the marine life would quickly colonize and change pieces. But here, there will be many more one-off pieces.

X-RAY MAG: I am sure you will be curious how it all will look after 5-10 years.

JDT: I will be curious after six months! There are so many works in so many places now it's a fulltime job just documenting the work. I would love to retire at 50 and just travel around photographing the pieces.

Solar Man in Brazil has solar panels and solar lights and goes up and down with the tides

The Silent Evolution (2012) above, with 450 figurative pieces, and *The Gardener* (2009) at right, with staghorn coral growth, are part of the MUSA Collection in Cancun/Isla Mujeres, Mexico

X-RAY MAG: Did you have any idea it would get so big when you started all those years ago back in Grenada?

JDT: No, definitely not. It was actually the first time in my life that I did not have a long-term plan. I got to a point in my life where I did not want to worry about the future anymore and just decided to focus on what I was best at and enjoyed.

X-RAY MAG: You have said that you want people to come away from your sculptures with a feeling of seeing the world in a different way, perceiving the tiny part we are in the grand evolutionary scheme of things… What do you want to wake up or inspire in the minds of the humans who partake of your work?

JDT: I have been diving and travelling for over 20 years now. Over that time, I have seen habitats disappearing, getting worse across the board in numerous destinations. I talk to fishermen, locals and divers, and they all say the same thing, "You should have seen this place 30 years ago. It was paradise."

We inhabit this is incredibly beautiful planet and are slowly ruining it, but we still have an opportunity to safeguard its future, and that's the message that I try to convey.

X-RAY MAG: You've had some extensive international media coverage of your work and projects. Has this helped or hindered your mission or message?

JDT: Mainly, it's helped. Obviously, I am working in areas where tourism is a major part of the economy, in places desperate to be noticed in a very competitive market, so it has helped me in that respect. It also helps to change the identity of place. In Cancun, for example, we wanted to alter how it was perceived as just a party town. Art, culture and environment were not words you heard often in association with Cancun, but that has now started to change. The world needs more sustainable tourism. □

For more information, visit the artist's website at: ***Underwatersculpture.com***