



Rebreathers

Text & photos
by Peter Symes

What is it like?

Diving Rebreathers

Why bother?

Rebreathers look cool, glitzy, technical and heralded as the future of diving, right? We read a lot about their impressive performances concerning duration of dives, gas economy, extended no deco limits and what not. But isn't it a bit like watching Jeremy Clarkson from BBC's car program, *Top Gear*, whiz around in fancy Ferraris and Aston Martins with a goofy, happy grin on his face and reeling off a string of excited superlatives? Yes, they look fabulous and sound fabulous, but you're still not sure what all the fuss is all about and what's in it for you... and whether you could actually afford one.

Rebreathers aren't exactly an impulse buy, but they don't quite require the same deep pockets as a super car. So, you could actually own one if you put your mind and piggy bank pennies into it.

They do come with the same sort of built-in bragging rights and can still gather a crowd on a beach. However, the glitz factor shouldn't be the only reason for getting one—there are easier routes to impressing members of the opposite sex.

Diving experience

The reason to go with a rebreather should be their performance in the water, and that

they provide for a much different and richer diving experience, which, in the first place, is why we go in the water ourselves rather than watching dive movies on *Animal Planet* from the comfort of our reclining chair at home. However, as we all know, there is no such thing as a free lunch in diving either. There is a trade-off, and you will have to consider if it is still worth your while despite this.

It is not merely a matter of comparing technical matters, performance and parameters when pitting rebreathers against the open circuits (regulators and tanks). It is easy to be blinded by dazzling numbers and facts on how much longer you can stay under water with no deco-obligation and so on, but consideration should also be given to the sensation and experience of diving rebreathers.

I think these subjective matters have been grossly overlooked in textbooks and articles. Yet, how can we put words to them?

Why?

Wine connoisseurs have a whole weird vocabulary to describe all the flavours of wines, but describing diving the rebreather experience to an open circuit diver still feels somewhat like trying to describe a sunset to a blind person: "It's... *erh...* just really cool and... *uhm...*"

Any piece of equipment is just a means to an end and not the end itself. It is a means of transporting you down into



Dräger Ray semiclosed rebreather. Behind, an open Inspiration fully closed rebreather

the underwater realm so you can have an enriching experience by witnessing, first hand, this magic realm. So, as far as I am concerned, if someone invented human gills and a thin hide to cover and keep me warm, my twin-set would surely be left to rust in the attic for good.

I just want to see fish and other underwater life. I want to get as close as possible without disturbing the creatures, and for me, this is exactly



Black goby, Baltic sea

Aaah! Silence at last—and the *Unbearable Lightness of Being* starts to sink in



Up close and personal. This squirrelfish almost sat on my mask

what all the fuss and hype is about with these gizmos.

I am a photographer, so aside from the better personal experience, I can also get better pictures when I don't blow or scare all the critters away.

For me, the longer no-deco times that these units give me are great but not a prime concern.

Although, I have on more than one occasion, appreciated the fact that I could just stay down there at depth to get my shot far longer than an open system would have permitted me.

Other CCR divers may have other uses and other subjective reasons for liking their units. For instance, rebreathers have also become quite popular among some wreck enthusiasts, technical divers and cave divers.

Hearing

Another major reason why I have a richer diving experience on my rebreather is that I can hear better—and so, can more keenly sense what is going on around me, even when I do see it directly. I have a much more acute sense of the three dimensional space around me and what is in it. But let me get back to that later.

On a rebreather, I often get the sense that I can hear what is going on behind me

Comparison

Let's go on a dive and compare how open and closed circuits perform. In the following, I will use a fully closed system for comparison rather than the more widespread and more economically accessible semi-closed system since the fully closed systems are the thoroughbred of rebreathers, and because I am better acquainted with this type of system.

Before we even get to the water, there is the matter of transportation. If you are going to the beach in your own van, there is not much difference in hassle when it comes to transporting a scuba set with tanks and regulators or a rebreather.

But if you have to travel by air, we are talking about a completely different ball game. Going by plane, the open circuit diver can bring along his or her regulator and BCD, or the diver can opt to hire everything at the destination. The diver doesn't have to worry about carrying tanks either, so there is not too much excess baggage.

Rebreathers are different story.

The check-in challenge

It isn't quite the same for the poor rebreather diver who might have to schlep quite a bit more hardware onto the plane. It is not an issue to be taken lightly these days when airlines are less and less tolerant of passengers who do not head weight limits and bring along overweight bags.

The rebreather diver must rely on the destination dive centre to fill his or her oxygen tank, and if the diver is lucky, the dive centre can also supply CO₂-scrubber and rental tanks. If not, well... let's hope that overweight charges aren't an issue for you.

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Rebreather-friendly dive centres & locations

Do check the list of so-called rebreather-friendly dive centres before you go. It could save you quite some hassle and money. You can find these dive centres on various lists, ie. online bulletin boards and web sites. For example, you could use this one at the Ambient Pressure web site: www.ambientpressurediving.com/ccrbint.htm

So far, it seems that open circuit systems lead closed circuit systems 4-0 in the why-bother score due to the hassle factor.

Before the dive

OK, we are now at the waterfront with all our gear spread out, rigging up. Mr. Open Circuit mounts his BCD on a tank, regulator on top, opens the air and he is ready to dive in a minute or so, save the odd popping o-ring experience. No complications here.

Ms. Re Breather, on the other hand, has a lot more equipment assembly to do, some testing on top of this, and then some "pre-flight procedures" to undertake.

After assembling the unit, we first have to do a *negative pressure test*, where we, under eye-popping strain, suck all the air out of the unit, close the mouthpiece and watch it to see whether the counter-lungs remain deflated and squashed like vacuum-packed coffee.

After that, we then do a *positive pressure test* where we inflate the unit fully and make it look like an over-blown tire to see if it holds pressure



and remains stretched like a drum-skin. If not, we have to go over all the seals and joints once more.

The open system now leads the score 5-0.

Next, comes the fire-up sequence where the rebreather diver stares very intently upon the unit's handsets (the controllers). *Do not distract her at this time!*

The electronics on the handset are taking the diver through a "pre-flight" sequence of actions and tests, and she must respond to these accurately and observe closely that the rebreather responds correctly. By *pre-breathing* the unit, the diver makes sure that it operates properly before entering the water.

During the start-up sequence, the breathing loop is filled with 100% oxygen to calibrate the sensors, so we have to





Weight can become a real issue when travelling with your rebreather. If possible, sort it out beforehand. Sometimes you can negotiate a fair price on overweight before you go - or buy some extra allowance.

observe that the oxygen partial pressure drops down from 1 bar to stabilise at 0.70 bar partial pressure, which we have chosen as our *low set point*.

This is the oxygen level with which we start the dive. Any wrong or erratic behaviour of the oxygen sensors will show in the readings or produce an outright error-message, of which you must strive to find the cause and correct before you can dive.

Finally, we can hit the water. Upon entry, or slightly into the descent, it may be our habit to clean our masks. We let

a little water into our masks, and then clear it by an exhalation through the nose. On open systems, this is just something you do, and many divers exhale through their nose on a regular basis. On a rebreather, this is a big no-no, as it means venting precious gas out into the environment.

On rebreathers, you clear masks very carefully and sometimes in a cross-eyed manner as you try to watch exactly how much air is required to just push that last drop of water out of the mask without losing any air.

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As you descend, the increasing ambient water pressure also starts to squash your counterlungs flat. They have about the same volume as a BCD, but need a constant volume in order for you to have something to inhale.

Unless you add some more air (or *diluent*, which can also be some other breathable gas) on your way down—either by manual injection where you do a series of small bursts, not unlike what you do with your drysuit, or by the means of an ADV (Automatic Diluent Valve)—you will soon enough find yourself sucking very hard for no air... not so comfortable, so you only do that once.

Some 5-6 meters down, or if you are at the bottom of a somewhat shallow coral reef, you pause and look up for the tell-tale streams of bubbles that might indicate a leak. You can also ask your buddy to look around for you.

If everything's fine, you may proceed and switch to the higher set point, where your oxygen level is kept at 1.3 bar partial pressure. Only below 3 meters at which time the ambient pres-



The Megalodon is another popular CCR-rebreather on the US market

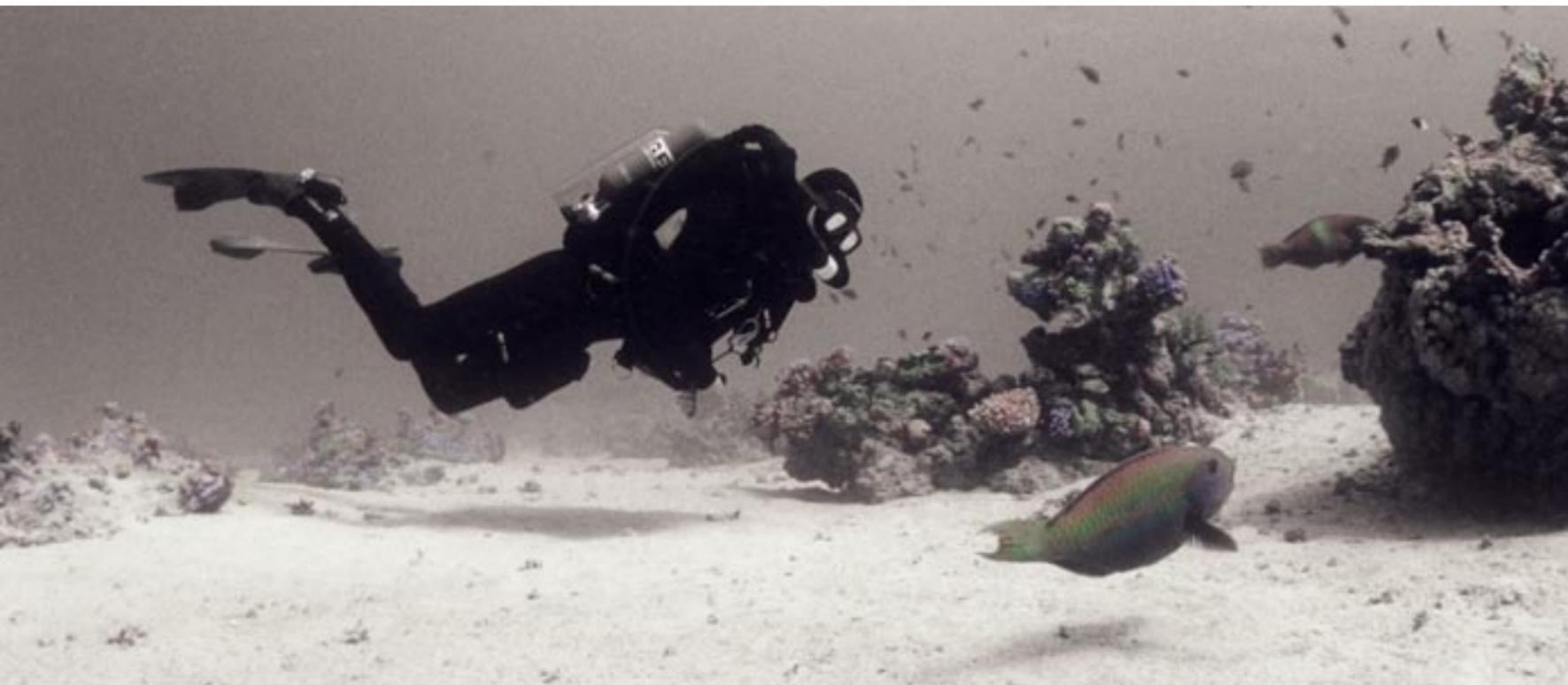


Prism CCR from Steam Machines as it was presented at DEMA 2003

The ADV (Automatic Diluent Valve) on a Inspiration CCR, makes sure that more air gets automatically added into the breathing loop upon descent



Hovering becomes a delicate skill when diving rebreathers. You need to be far more accurate in regards to how much air you have in your wing or dysuit. But once you get it right, you will lie completely still—even while breathing in and out



A couple of worthwhile rebreather resources:

www.therebreathersite.nl
www.rebreatherworld.com

Some manufacturers:
www.steammachines.com
www.customrebreathers.com
www.ambientpressurediving.com
www.ccrb.co.uk

(Above list is not exhaustive)

STEFAN BESIER, WITH PERMISSION FROM STEAM MACHINES

sure is at least 1.3 bar, can the system maintain a 1.3 bar partial pressure of oxygen, hence, the need for a lower set point at the surface. (On newer rebreathers, like the Evolution, this set point switching can be set on automatic.)

It is, after all, this bother that permits the rebreather to flourish and deliver its promises. This is where it picks up on all the points leading to an enhanced diving experience.

First of all, there is this amazing tranquility—you can't hear a sound except, maybe, noises from your buddy's equipment. And this is what I treasure most on the rebreather: you regain the practical use and sense of hearing. You are not cocooned any more in cascades of bubbles and heaving, wheezing, whining valves.

You'd be amazed how much noise open circuits actually make, but it is hard to fully appreciate this before you try and experience the alternative yourself.

I haven't seen this change of noise

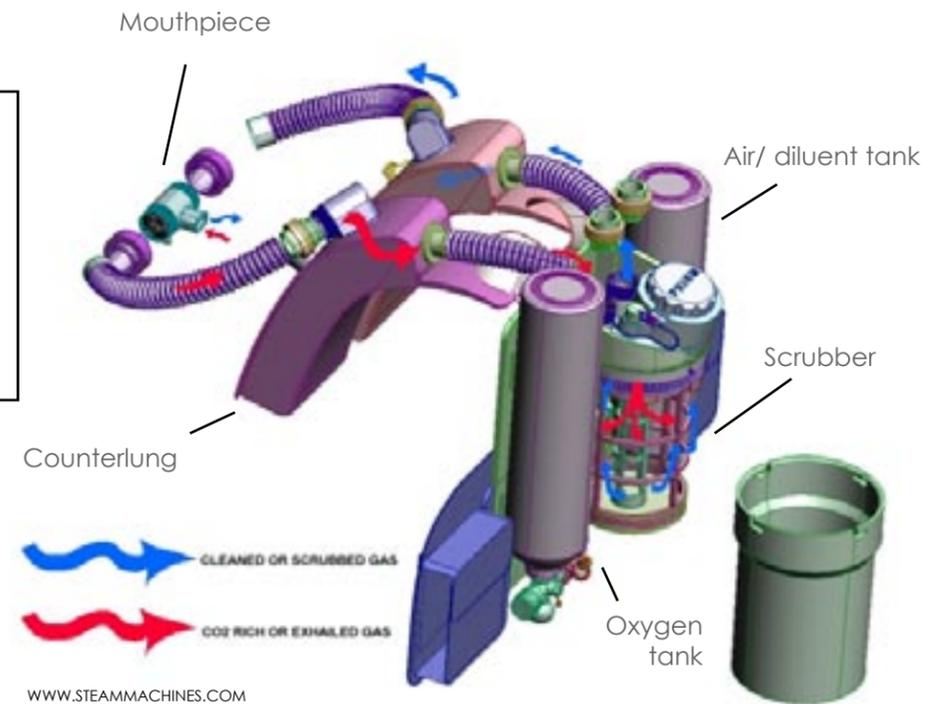
level given much mention in various text books. This feature allows you, all of sudden, to hear or sense what goes on behind you. It provides you with a 360° awareness that is not so unlike what you have on land. On land, you can usually hear when somebody enters an area you occupy even if you are reading a book and facing another direction.

Buoyancy issues

Continuing on our journey, we swim, down a slope. As I sink, I compensate for lost buoyancy with squirts of air into my wing, and then, to halt my descent completely, I take the traditional deep inhalation, which would, if I were on an open circuit, have halted me just above the bottom. Not so on a rebreather.

This time, I most ignominiously plough straight into the muddy bottom flat on my face. The reason? My lungs and the counterlungs on the rebreather maintain a constant total volume, so when I inhale, I just empty the counterlungs with

Flow-diagram and main components of a Prism Topaz CCR-regulator. The diver's lungs and the CCR's counterlungs, scrubber and hoses has a constant total volume



no effect on overall volume and buoyancy.

Boy, does it make you feel stupid when you bite the dust this way.

Buoyancy on a rebreather is a more delicate thing. Because you can't use your lungs to fine tune your hovering, nor will your breathing disturb your position, you won't bob up and down with each breathing cycle, which is really great once you have nailed it and want to lie completely still with a pygmy seahorse in the cross hairs of your camera viewfinder.

For the very same reason, a rebreather diver will prefer to swim *around* an object rather than over or under it. Ascending means venting gas, which you lose for good.

At depth, I have several other advantages over my open circuit buddy: I won't run out of gas any time soon.

My on board gas supply will last me 10-12 hours, although the CO₂-scrubber shouldn't be used more than 3 hours. And with lots of non-deco time to go around at medium depths, it also gives me peace of mind and no stress.

It is the Zen of diving. Should a school of hammerheads parade by 45 minutes into the dive when my buddy's open circuit system would be down to 40 bar,

I can still just hang around to make the most of my roll of film.

But unlike my open system buddy, I do have to watch my handsets, my controllers, at regular intervals to make sure that I am still getting the right Nitrox blends. On a closed circuit rebreather, I always have to know which gas mix I am breathing and that it can sustain life at a given depth.

On open systems, once you have the regulator in your mouth, you only have to breathe it and you are set. Not necessarily so on a (CCR) rebreather, which is a mobile nitrox mixing unit. As such—if anything goes awry, God forbid—it can serve you a gas mix too lean or too rich in oxygen for your own good.

Too little oxygen leads to hypoxia, and you will faint. Too much, and you run the gauntlet of oxygen toxicity, which brings along with it uncontrollable cramps. In either case, drowning is imminent. This is why knowing at any given time what you are breathing is one of the golden rules of CCR-diving.

If I am ever in doubt, I may first perform a strangely looking exercise called a "diluent flush", where I flush

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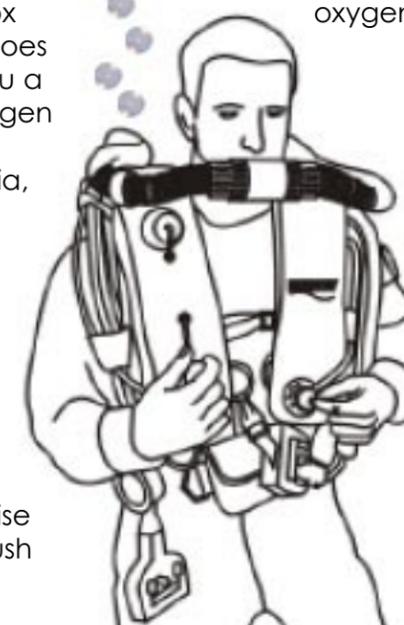
the whole breathing loop with air from my air (diluent) tank. With one hand, I keep pressing the inflator button down injecting air, while I pull the cord to keep open the over-pressure valve that is venting air. I do this for say, 10-15 seconds, after which the entire atmosphere in the breathing loop should be exchanged with air, which I know I can always breathe. Needless to say, this procedure is quite wasteful of your relatively small gas supplies.

If I am still in doubt for some reason, the golden rule is to "bail out". That means switching to open systems, which is either a regulator connected to the rebreather's air (diluent) tank, or a completely separate system, ie. stage tanks.

If I switch, it is paramount that I remember to close the mouthpiece, otherwise water will enter the breathing loop and replace the air resulting in a very considerable loss of buoyancy.

So, what should you know and be able to do? What should your buddy, on an open system, be able to do to assist you in case you run into trouble?

A CCR rebreather diver can become unwell for all the same reasons that an open circuit diver can, plus a couple more things can happen including hypoxia, hyperoxia and hypercapnia. (too little oxygen, too much oxygen and too much CO₂).



Diluent flush manoeuvre. Illustration adapted from Inspiration manual (Ambient Pressure Diving) Simultaneously pressing the diluent feeder and pulling the over-pressure valve chord allows air (diluent) to replace whatever gas was in the breathing loop before

"Artist's impression" of the 360° awareness sensation





This little green knob is the valve to the O₂-tank. Buddies should know how to check and open it

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maintenance and cleaning of the unit. Rebreathers need to be disinfected at regular intervals because the unit has recycled air that has been in and out of your lungs numerous times.

The verdict?

It seems that you will have to endure a bit more bother and complexity when diving rebreathers. Which brings us back to the main question: Is it worth it?

Yes, it is. Rebreathers are certainly not for everyone. The ease and uncomplicated aspects of the open systems will still make open circuits a better option for many as well as a certainly more economical and accessible one, ie. when you bring your family along on a trip.

But for those who are willing to go those extra nine yards to fully appreciate what it is like being down there soundless, bubble-free, the way nature intended, the rebreather is the thing that will get you hooked for good. (Don't say I didn't warn you)

I have already mentioned the soothing silence, but the ability to be in the water and have a sense that you are truly part of the environment rather than being the noisy intruder, is the priceless part. The wildlife acts differently—your presence is somewhat accepted. I wouldn't go so far as to say that marine life acts indifferently, but the rebreather certainly lets you get far closer, and the critter behaviour seems far more natural and less apprehensive.

I have had blennies sitting right on my mask. This is the closest I have gotten to feeling like a human fish. It gives you the same sort of Zen experience as when you freedive, yet it gives you the time duration of open systems and then some.

Footing the bill

OK, now we come to the serious question: What is this going to cost me?

The Semi-closed rebreather Dräger Ray comes—at the time of this writing—at a suggested retail price of around US\$ 2,000, making it just a little bit more expensive than a complete scuba set for open circuit diving, that is, regulator, BCD and tanks.

The fully closed rebreathers are more expensive and will, as a rough guide, come in the US\$ 5,000-10,000 range for the most popular consumer models. This is, admittedly, not exactly pocket change for the average blue collar worker, but not totally out of reach either, if you really want one.

It all comes down to a matter of priorities. Do you want to have the kitchen refurbished, or one of these great machines? Well, that is a matter for you and your partner to sort out. Safe diving! ■

The Ourosboro rebreather by Kevin Gurr is one of the newest CCRs on the market. See the New Equipment section for more information



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Text and photos by Dan Beecham

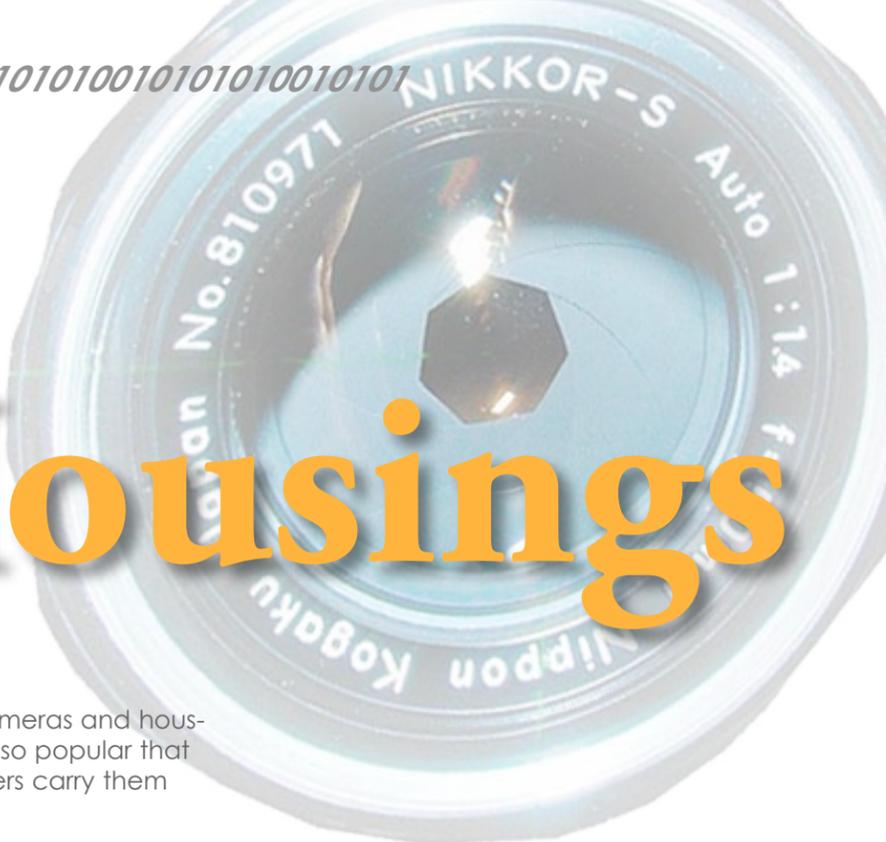
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Digital Underwater Photography:

Cameras And Housings



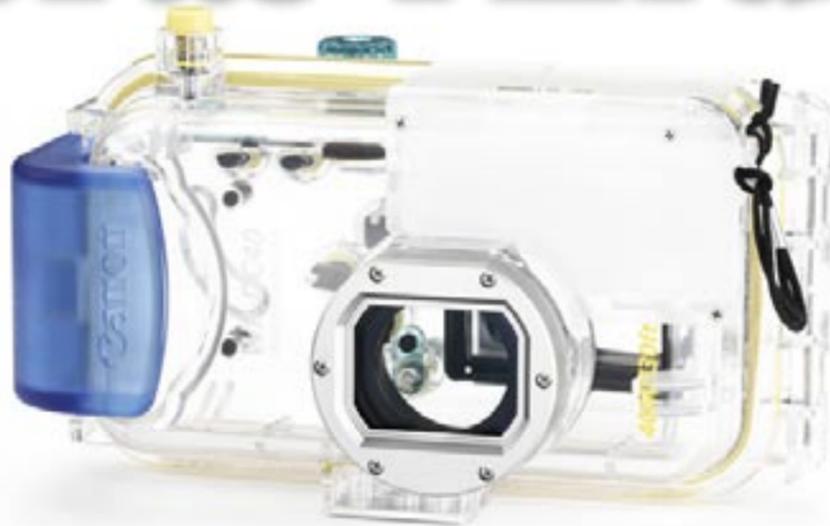
In the last issue we looked at the advantages and disadvantages of digital underwater photography compared to traditional film systems. Now we're going to look at what kind cameras and housings are available on the market today, the costs involved, and which one is right for you.

To help simplify matters, we're going to group cameras into four different categories, these are;

- Compact Cameras and Housings
- Digital Underwater cameras
- Entry Level DSLR's and Housings
- Professional Level DSLR's and Housings

Compact Cameras and Housings:

The production of cheap poly carbonate housings for consumer level cameras such as the Olympus C7070 and Canon S70, has made it inexpensive for the first time to submerge camera's which offer features which in the past were only available on more expensive SLR's. Housings for compact cameras are produced by the cameras own manufacturer, and also appeal to the outdoors market, making them much cheaper than if they were just being used by divers.



WP-DC40
Compact cameras and housings are now so popular that nearly all divers carry them

Because compact's offer so much flexibility at a fraction of the cost, they occupy a large part of the market, and nowadays nearly all divers have a camera and housing, often small enough to fit into a BCD pocket.

Using a compact camera and housing means you can use the same camera that you use on land, whilst diving. This saves costs, and means you only have to travel with one camera. There's also a huge range of accessories available for compact's, including filters, external flash units, and supplementary wet-lenses that can be removed and replaced underwater to suit your subject. Another great thing about compacts is that the LCD screen can be used for composition, not just



reviewing images and navigating menus like an SLR.

Compact cameras are easy to travel with; we hear more and more about divers in disputes with airlines over fares for excess baggage, and underwater pho-

tographers are often caught out whilst struggling to get their heavy equipment to and from their destination. A complete compact camera system can weigh as little as three or four kilos, which means it is easily transported in a rucksack.

There are many cameras and housings on the market at the moment, but most people agree that Olympus are the most versatile systems available. Filter threads are



D70 housing with 70-180mm macro zoom lens

D70 housing with fisheye As you can see with a camera and housing you can use a wide range of 'ports' to accommodate a range of lenses, from a 10.5mm fisheye lens for photographing large subjects such as wrecks or scenic's, right through to a 70-180mm macro zoom lens for photographing small shy subjects from a distance.



photography



a standard feature on the Olympus range, which leaves you much more choice in the range of accessories that you can attach in the future. This also stops you having to use adapters to add accessories, which can be expensive and often introduce many more parts into the system.

Whichever system you choose to go for, check that the camera offers you aperture and shutter priority modes; the majority of compact cameras only have fully automatic exposure systems, which do not offer enough flexibility for use underwater. Also check that the housing will accept any accessories you may need to use in the future. For example, if you plan on photographing very small critters such as nudibranchs or pygmy seahorses, then you'll need to make sure the system you're looking at will accept a close-up or macro lens, otherwise it will not be appropriate for you.

Disadvantage

The main disadvantage of a compact camera is shutter lag. This is a small delay between pressing the shutter release button, and the camera actually taking the picture. When you first use a camera with shutter lag it can be very distracting, especially if you're used to the instant shutter release on an SLR. If the camera is very slow it can stop you getting the picture you wanted. If you plan on photographing fast moving subjects, a compact may not be the best route to take.

Compact's suit most peoples needs, they can be carried on every dive for a quick snapshot if the opportunity presents itself, or they can be kited out as a complete system for more serious photography.

One of the hot cameras at the moment is the Olympus C-7070. A 7 megapixel compact which offers you plenty of control, excellent image quality, and a housing which will accept a range of accessories. The camera and housing together should cost you around £500 (US\$875).

Digital Underwater Cameras

Also known as amphibious cameras, these are systems which are designed specifically with underwater photography in mind. Cameras such as the newly released Sea and Sea DX8000G, offer an 'all in one' solution to an underwater camera, and often include handy features such as built in colour corrective filters.

Amphibious cameras generally offer the same sort of functionality as a camera in a housing, in fact that's exactly what an amphibious camera is, a normal digital camera built into an underwater housing. There's nothing special about the camera which makes it more suited to underwater photography.

Compact cameras and amphibious cameras share many of the same advantages and disadvantages, they both suffer shutter lag, yet they both offer you the versatility of being able to change lenses underwater.



The Nikonos V is probably the best known amphibious camera and the model which many famous photographers started. It went out of production 4 years ago but left a lasting legacy



Sea & Seas newly released DX8000G



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Which brand? The Canon versus Nikon debate is stronger than ever at the moment.

DSLR's and Housings

Modern DSLR (Digital Single Lens Reflex) cameras such as the Nikon D70s and the Canon EOS 350D are now so cheap on the high street that more and more photography enthusiasts are using them on land, unfortunately the cost of getting one underwater is very high. For this reason DSLR's generally appeal to very enthusiastic photographers who want to utilise the unique features that a DSLR offers the user over an amphibious or housed compact camera

Beside costs there are some other major differences between SLR's and compacts, as well as differences in the housings. As previously discussed, housings for compact cameras are produced for the mass market, and as a result are very cheap. SLR housings are a completely different ball game. Some housings are so specialised and appeal to such a small market that they are made in batches of 20 or less, hence the cost.

Unlike a compact, when using an SLR you must select which lens you plan on using before you begin the dive. When working with an SLR you travel with a range of 'ports', these accommodate different lenses. You use flat ports for macro lenses, (for shooting small sub-



Glove housings fits the camera very snugly



Enlarger for a view finder



jects) and dome ports for wide angle lenses (for shooting large subjects). The lens quality and final image quality on an SLR is generally much better than that of other systems. Depending on where and how you use your pictures, this may make an SLR more suitable for you.

Some high end housings also offer the option of a viewfinder magnifier. These can be especially useful with modern DSLR's that generally have very small viewfinders, which appear to be even smaller when viewed from inside a housing and from behind a dive mask. Magnifiers significantly increase the cost of a housing, but also massively increase functionality. Many professional underwater photographers simply will not work with a housing which does not offer this feature.

There are many different housings available for DSLR's, ranging in price and functionality. There are two main types of SLR housing; these can be referred to as box, and glove housings. Brands tend to specialise in one or the other.

Glove Housings

When a new camera is released, a company such as Subal, Seacam, or Nexus will design a brand new housing from scratch. This means the body of the housing has a very snug fit around the camera, with very little dead air space inside.

When you pick up a glove housing all the controls fall in the same position on your hands as if you were using the camera on it's own. This offers you the highest level of functionality. Because the housing is designed from scratch, they are a lot more expensive. A housing body can cost more than £2000 (US\$3500), and a system fully kitted out with ports and flash units could easily cost more than double that.

Box Housings

As a general rule, box housings tend to be a lot larger and heavier than glove housings. This is because manufacturers use the same basic hull for many different cameras, and adjust the placement of controls for different models. This means there is a lot of wasted air space inside the housing, making it buoyant, and so additional weight must be added to get it under the water. This also means that the controls are not positioned very conveniently on the housing, and you can be distracted by your equipment

rather than being able to concentrate on getting the image you want.

Box housings tend to be available much sooner than glove housings, simply because they do not take as long to develop, if you're in a rush to get one of the



Seacam housing

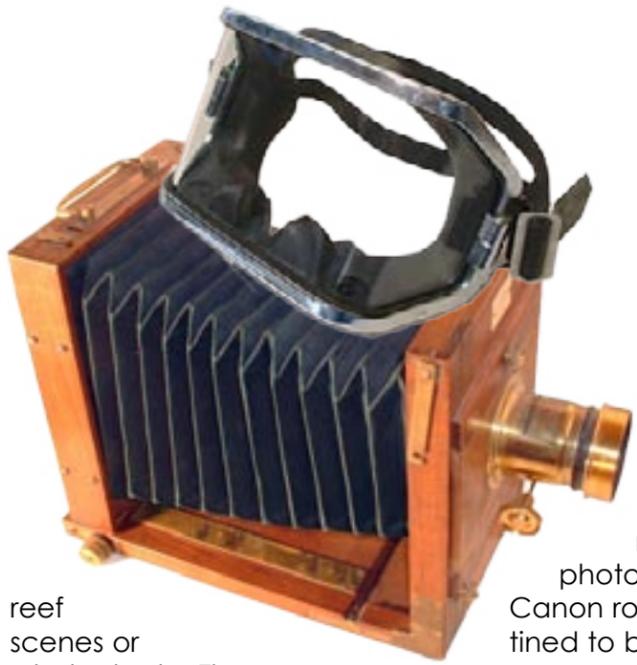
newer cameras under the water, a box housing may be a better choice for you.

Box housings are also great if you're working to a tight budget. You can normally get a system up and running with a range of lenses for less than half the cost of a top of the line housing. However do bear in mind that because the system will be heavier than a glove housing, there could be potential costs in transporting your equipment on a dive trip.

DSLR's offer excellent level's of flexibility, resolution, image quality and control, but this all comes at a price. There is no cheap way to get an SLR under the water, all housings are expensive (some a lot more than others), and you also have to invest a lot of time into the maintenance and preparation of your equipment.

The most popular cameras at the moment are the Nikon D70s and the Canon 20D. The D70s currently costs around £600 (US\$1050) and the 20D around £950 (US\$1650) (camera body only). Many divers are choosing to go with the Nikon, this is because there are two different wide angle lenses available, a 12-24 mm zoom lens and a 10.5mm full frame fisheye. This offers the user more flexibility when choosing which lenses to use underwater.

Fisheyes are very popular, allowing you to capture large subjects such as wrecks,



Underwater photography is nothing new. This is the Rolleiflex housing that the legendary Hans Hass used



reef scenes or whale sharks. The Canon 20D is a better camera in terms of resolution, speed and build quality, but at the moment there is no fisheye available.

Professional level DSLR's Cameras such as the Canon EOS IDS mk II, and the Nikon D2x are the tools of professionals, and carry price tags which are way outside most peoples budgets. With a system fully kitted out, a photographer could be entering the water with more than £10,000 (US\$17,500) worth of cameras equipment. Professional level DSLR's offer the handling, build quality, and speed that many were used to with top of the line film cameras, as well as resolution and image quality that meets the needs of professionals.

With regards to high end cameras, the Canon versus Nikon debate is stronger than ever at the moment, it seems that the majority of underwater photographers are taking the route of the Nikon D2x, a 12 megapixel camera which renders excellent image quality and carries a price which is very competitive to the top of the line Canon cameras. Many divers are taking this route because they owned Nikon's in

the past and so they have a lot of money invested in lenses, however most professional land photographers are taking the Canon route. The IDS Mk II is destined to become a cult camera, many people believe it was the first camera which allowed us to say that digital is actually better than film, and the results that it is producing underwater are truly stunning.

Most underwater photographers need not consider professional level DSLR's, lower end cameras such as the Nikon D70 offer more than enough in terms of control, flexibility and resolution. There are however a select few, mainly professional underwater photographers, who can justify the expense of getting these sys-

tems up and running. Hopefully we've now cleared up a few of the questions about the questions that you may have had about the pros and cons of some of the cameras which are available on the market today. ■

In the next issue:
Let there be Light

Remember all the stunning colours you've seen in countless underwater photograph's, and now wonder why it's not in yours? We'll look at how to get colour in your shots through the use of flashguns and filters.



Where the pros go, camera tables tend to get a little cluttered

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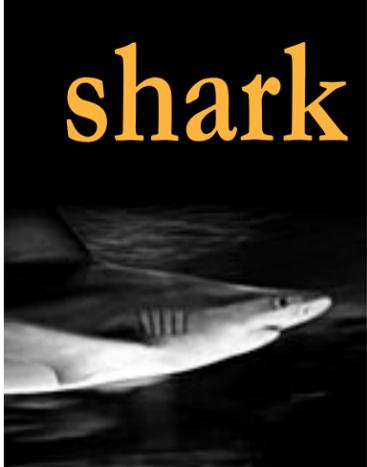
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Text by Edwin Marcow
Photo by Peter Symes

The time has come to repay the debt

A suggested new revolutionary dive levy

There have been three shark attacks in Florida recently; Armin Trojer, 19, was bitten in chest-deep water; Craig Hutto, 16, lost a limb while fishing in Cape San Blas; and Jamie Marie Daigle, a 14 year old girl, was killed as she swam on a boogie board.

Shark attacks happen, but they are rare events, and are usually due to mistaken identity. But it is always greatly regrettable when such terrible incidents do take place. One can hardly imagine the terrible pain and anguish of those poor families, especially for the family of Jamie Marie Daigle, the teenage girl whose life ended so abruptly.

The closer we come to the day when we have electronic barrier protection for bathers and swimmers, the closer we will come to having a human and a healthy shark population living side by side without tragedy.

Jaws

It was after human intervention in the

70's, particularly after the Jaws films, that all sharks were vilified as killers. Divers with a misguided sense of bravado went about decimating shark populations throughout the world. The problem today has become so great that the population projection for the gray nurse shark is quite depressing. The extinction of this magnificent animal in eastern Australian waters could be a reality 10 years from now.

Rare

Shark attacks are rare and loss of life worldwide only numbers a handful of people annually. More fatalities occur from elephant stampedes in India but without the same emotive and chilling headlines, or sense of panic.

We live in an ever-changing world, with our climate and the oceans on which we depend being in a state of flux. Sightings of basking sharks are up 65% off the Scottish coast since 2001, but are down 66% in south-western England, their natural habitat. The reason for this abrupt and dramatic change, with rising sea temperatures, is that the distribution of plankton has been severely changed from its usual pattern. The whale sharks are simply fol-

lowing their food source into new waters.

The impact of man on the natural world has had a far-reaching effect, for we have upset the natural balance and placed many animals, the gray nurse shark included, on the endangered list. It is now time to repay the debt!

Shark Tax

A revolutionary idea has taken shape in Australia. Primary Industries Minister Ian McDonald has championed the cause for 'pay as you dive'. In certain critical gray nurse shark locations a charge of 20 Australian dollars per diver, per day, would be levied. Divers would also be required to dive with only specially licensed commercial dive operators who would adhere to a code of conduct and various other practices.

Shark attacks happen, but they are rare events, and are usually due to mistaken identity

The money raised from this levy would be directly used for an artificial breeding program. Test tube sharks in fact. Embryos harvested from female sharks in the wild would be reared separately in artificial wombs to prevent "intrauterine cannibalism" (this takes place where embryonic sharks feed on one another within the womb), and to increase the odds for successful healthy births.

This would go a long way to help, as there are believed to be only about 460 gray nurse sharks remaining in eastern Australia, with a low birth rate of only two pups every two years. The mathematics speaks for itself. With so few gray nurse sharks remaining, and a low birth rate, most scientists believe the population cannot regenerate itself naturally.

With the population in such a criti-

cal stage of its fight of survival, and the regrettable and shameful past of divers indiscriminately killing sharks for sport, would not every one agree with this revolutionary idea? However, objections have come from – most surprisingly – Australian dive operators, the very people who should be more environmentally aware.

They fear that these extra charges would put people off diving. I believe, though, that in 10 years from now, if there are no more gray nurse sharks in eastern Australia, the diving industry will suffer even more than the recent 30% drop the industry has suffered in the last two years. Why? The answer is simple. Love them or hate them, most people, especially divers, are drawn to sharks, all sharks.

We need to be magnanimous, brave, visionary and, above all, live with a good conscience. Save our seas, and we will perhaps save our world. ■



File image of black tip reef shark from the Kattegat Aquarium in Grenaa, Denmark. www.kattegatcentret.com

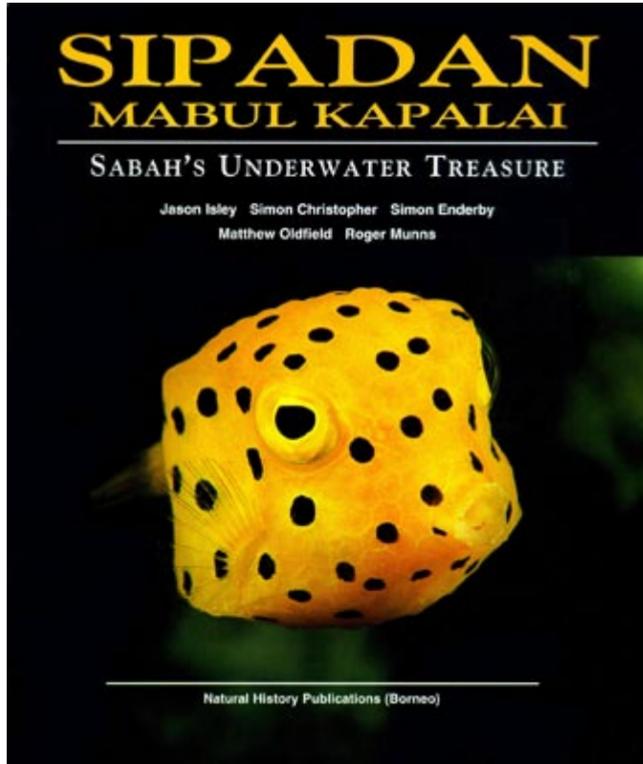
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ON BOLD LINKS



Sipadan Mabul Kapalai: Sabah's Underwater Treasure

by Isley, Jason; Simon Christopher, et al
Hardcover: 202 pages
Published: 2005, Malaysia, 1st Edition
ISBN: 9838120944
Price: US\$79.04 (\$132.00)

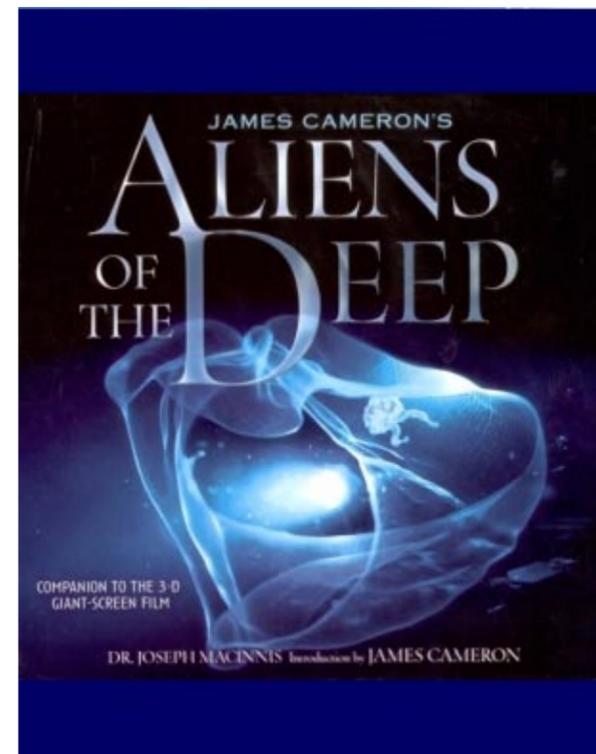
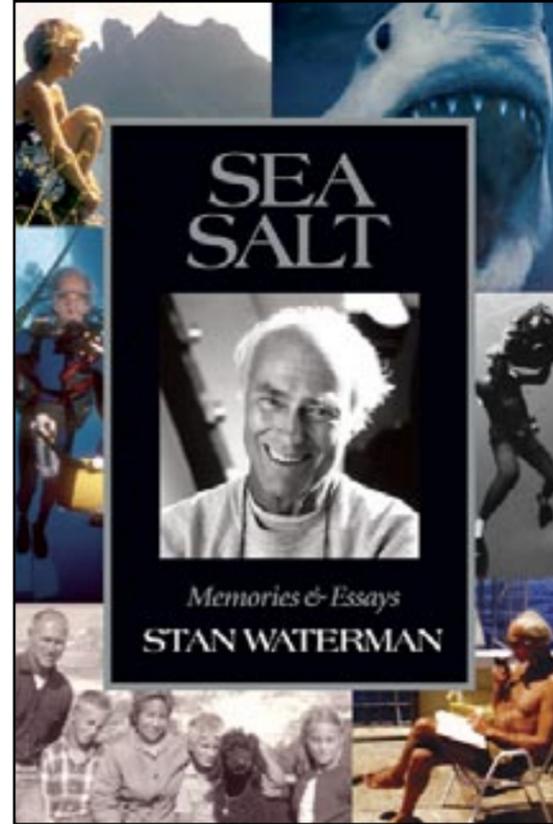
Ignored by the rest of the world until the 1980's, the three small Malaysian islands of Sipadan, Mabul and Kapalai, are home to one of the most diverse underwater ecosystems in the world. Five passionate divers who have spent the last seven years in and around these islands document this remarkable ecosystem in this book with superior images and text that provides insight into the day-to-day activities and behaviors of the flora and fauna of these islands. While the region is at risk for environmental impact from global climate change, the future holds that the island of Sipadan will soon be recognized as a World Heritage Site.

www.selectbooks.com

Sea Salt: Memories & Essays

by Stan Waterman
Hardcover: 320 pages
Publisher: New World Publications
Published: October 20, 2005
ISBN: 187834840X
Price: US\$30.00

This book holds a treasure chest of memories and stories by the author, famed filmmaker, adventurer and explorer, Stan Waterman, collected over his 50 years on, under and exploring the sea. Great tales of exciting adventures with Great White sharks and other magnificent creatures riddles the book with profound insights and poetic exposés of the natural underwater world and the author's experience with the amazing creatures of the ocean. www.amazon.com



Aliens of the Deep

by Joe MacInnis, Lisa Thomas (Editor),
James Cameron (Introduction)
Hardcover: 192 pages
Publisher: National Geographic
Published: February 1, 2005
ISBN: 0792293436
Price: GB£19.99

James Cameron, director of *The Titanic*, offers this companion volume to the new 3-D giant-screen film. The book follows a team of NASA scientists on their exploration of the deep ocean vents in the Atlantic and Pacific Oceans. Earth's most hostile and inaccessible environments are revealed as we catch a glimpse of the remarkable inhabitants that exist in these strange ecosystems.

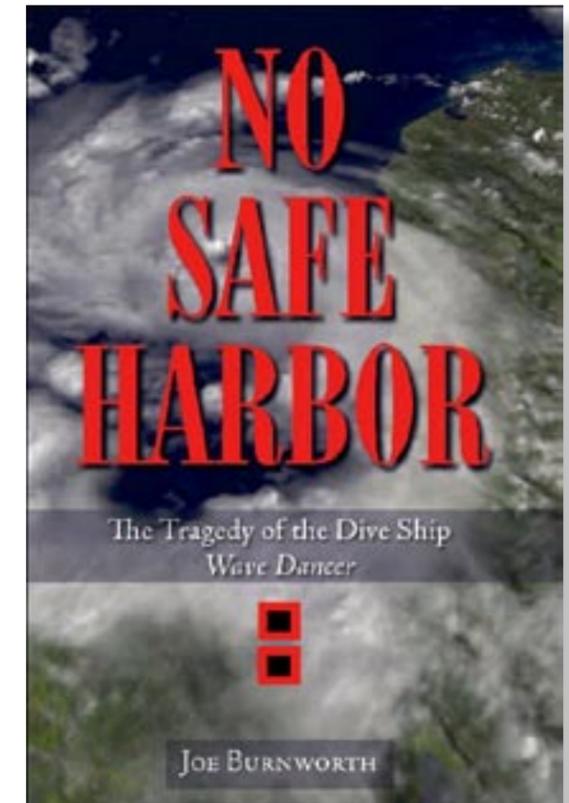
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No Safe Harbor: The Tragedy of the Dive Ship *Wave Dancer*

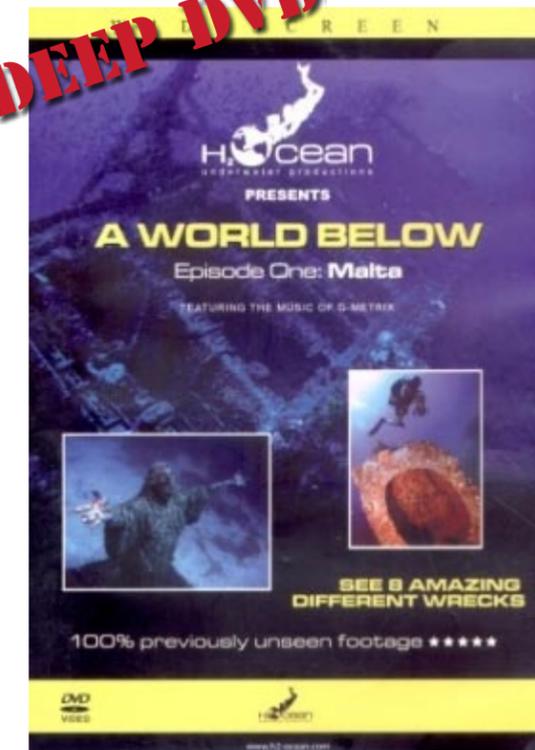
by Joe Burnworth
Hardcover: 254 pages
Publisher: Emmis Books
Published: June 20, 2005
ISBN: 157860219X
Price: US\$13.59

The author of this book, Joe Burnworth, has created a gripping page-turner focusing on the worst accident in sport scuba diving history. A true adventure book, *No Safe Harbor* provides a dramatic account of the events that turned a carefree scuba diving vacation in Belize into disaster and tragedy as Hurricane Iris captured a group of divers in her mighty path.

www.amazon.com



DEEP DVD



A World Below: Episode One Malta

DVD Published: April 2005
Price: GB£14.99

This DVD gives viewers the ultimate audio visual experience of shipwrecks through a fusion of spectacular underwater scenes and an amazing musical score. With essential information of each shipwreck provided in a unique format, this is the first part in the H2Ocean series that takes viewers to the Mediterranean island of Malta. The island's strategic location placed Malta in a pivotal role during WWII where several battles left the island's shores littered with an abundance of interesting wrecks.

www.aquapress.com

Often fished but rarely dived, Connemara loughs are bog diving territory at its best

RIGHT: Killary fjord, Connemara
BELOW: Tube worm feeding



Text and photos
by Jerome Hingrat

Sliding into brackish water riddled by a seasonal down-pour might not be everybody's idea of a week-end in the Wild West...but for the frustrated winter diver that I am, there is sometimes nothing like the peaty waters of Connemara.

The region of Connemara on the West coast of Ireland is famous for its scenery and fishing. It has inspired many artists and attracts tourists every year from all over



Ireland's Connemara





Connemara

the world, in particular the United States, Germany and France. The town of Clifden, in particular, is a popular place for fishing—sea and fresh water—golf, and hill walking. With a low density population, wild scenery and friendly people, it is one of those places where you can truly get away from it all.

Connemara loughs are like proverbial watering holes: there is no shortage of them. Water is not exactly a rare commodity around here, above and below, out of the heavens it comes in every colour, salted, fresh, not so fresh or with a seasonal Guinness tint. In late summer, a plankton bloom and peat water conspire to create visibility averaging chowder-like conditions, at best. To cap it all, clouds of jellyfish pulsating by don't help improve the visibility. What a contrast with the clear waters of the Atlantic nearby!

Fed with seawater and fresh water from nearby rivers, sea loughs can bring together an odd mixture of life resulting from the interchange with the sea. A slight current is noticeable with the tide and water clarity can improve. It is a great spot for watching passing shoals feeding by. Shoals of garfish and rainbow trout are not uncommon. Depending



on their relation to the sea, some loughs seem deprived of any visible life, others are just teeming with it. With sea loughs, a layer of brackish fresh water sits over the layer of salt water. In the summer, as the sun filters through the surface, the water takes on an eerie post nuclear glow. The surface halocline acts like a filter and blocks off daylight, soaking up whatever sunshine dares find its way over Connemara.

Mysterious Shallows

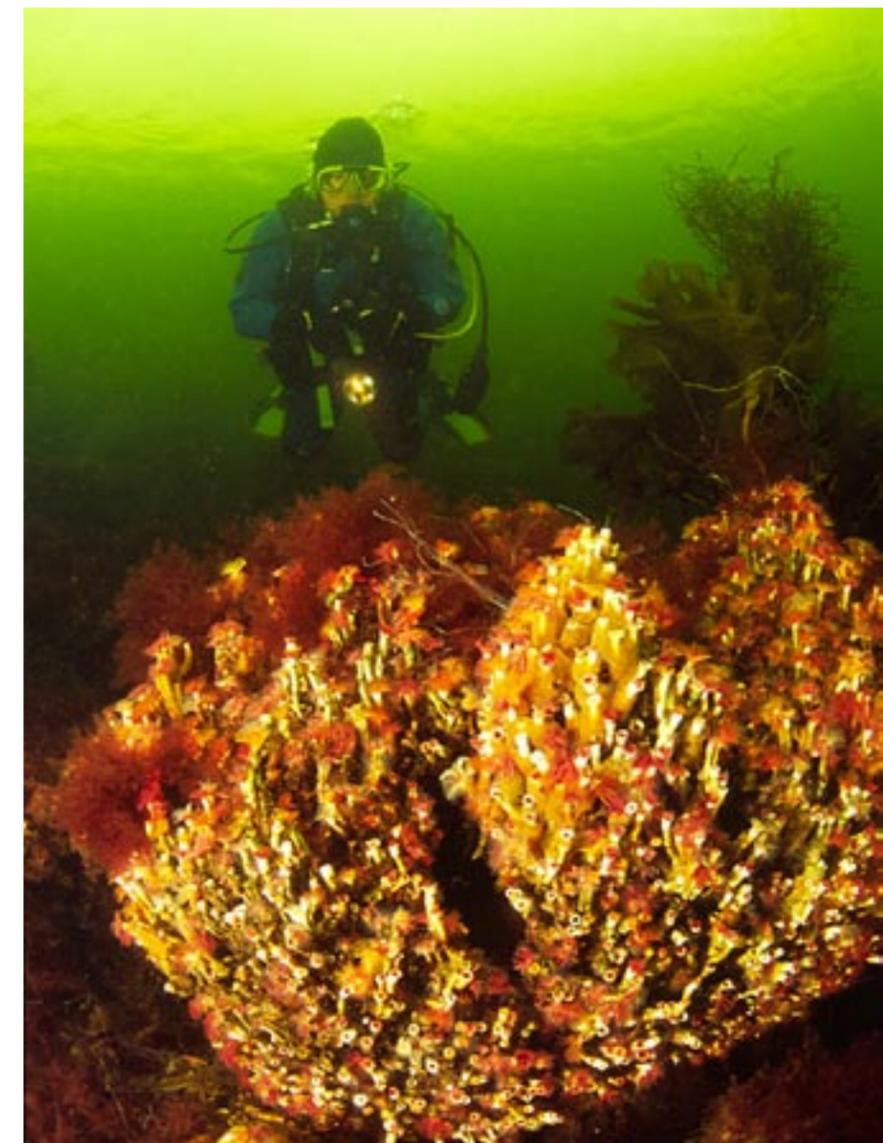
Moving along the shallows reveals a sandy bottom of broken shells and gravels. Not the typical mud plain. Beyond the shallows brings you into deeper waters, and in some areas the slope falls sharply into 20+metres. With limited visibility, many dwellers are camouflage experts and blend in with their environ-

ment, it takes a while to adjust and spot them. A lot of these mud hoppers are more curious than their sea counterparts, they will come out to gawk at the tourists, stare and hop out of reach.

In places, tubeworms have congregated in huge numbers and developed into full-grown reefs. Clumps of red, orange, yellow and white serpula (tube worms) are fanning themselves in a gentle current. This is the closest I've

seen to a live underwater Christmas tree. Sitting on a hard base of white tubes, they really stand out against the muddy lough bed. At feeding time, with the reefs in full bloom, the bottom suddenly comes alive.

These reefs are very much alive and support a variety of animals. The colonies of tubeworms act as a magnet for several species and diversity is the order of the day. Sleepy edible crabs are found



LEFT: Detail view of Tube worms
 CENTER: Blennie camouflaged in the shallows
 RIGHT: Diver over reefs of tube-worms (serpulids)

Connemara is a savage beauty.
—Oscar Wilde

nestled among clumps of tubeworms. Starfish and brittle star sit atop or in the centre of the reefs when they're not crawling their way across clumps of colourful umbrellas.

Further along, the reefs are covered with strings of sea squirts in the shape of



LEFT: Starfish in bog water
TOP INSET: Nudibranch
BOTTOM INSET: Curious blennie
UPPER RIGHT: Clifden, Connemara

Connemara



light bulbs. In places, various weeds and sponges appear to smother the colonies of serpulids, each species competing for space. It seems that the tubeworm colonies have been themselves colonised.

Fish

Fish are not lacking either. Blennies and dragonets are hopping along the muddy bottom, rock cook and wrasse hover around feeding. Blennies are not used to divers and faced with less predators than in the sea. In any case, they show real curiosity, attracted by the whirr of the auto focus - a few oblige by posing. May coincides with nest building for wrasses and the reefs are a busy hive of activity where wrasse can be seen carrying along seaweed twigs. Further along, the reefs have eyes. Scallops are glued to the reefs. Some are

attached to glowing pieces of orange sponge or wedged in a crack. Smaller scallops and mussels are buried in many places. They can be hard to spot and it's only after getting close that you'll make out their tiny eyes. Another striking residents are nudibranchs sliming their way across the reefs.

Further along, three lobsters have found a home at the base of a large clump of tubeworms. One of them pops out of its den wielding a pair of claws like garden shears. But they're not all the stay-at-home variety. We turn around to face an even bigger specimen trampling the muck. Amazingly, the wily old beast keeps a steady course. I have to make way as he retreats into a hole hindered by two oversized claws. Eat your heart out Popeye! If the size of these animals is an indication of the nutrients available, then

the grub here is five-star.

Macro life

In June, nudibranchs and sea hares enlaced in amorous embrace have colonised the reefs. They are obviously thriving in this environment. It is difficult to imagine all these animals surviving on the muddy lough bed. The reefs provide a habitat for these species that would probably not be found here otherwise. Watching these animals will test your buoyancy and breathing control. Serpulids are extremely sensitive to any light, noise or vibrations. The slightest disturbance and the colorful beasts retreat in a wink. Unlike critters that dart away and never reappear, the serpulid worms are soon out again. They cannot leave the reefs, they are the reefs, and I must have aged taking photographs of them.

feature

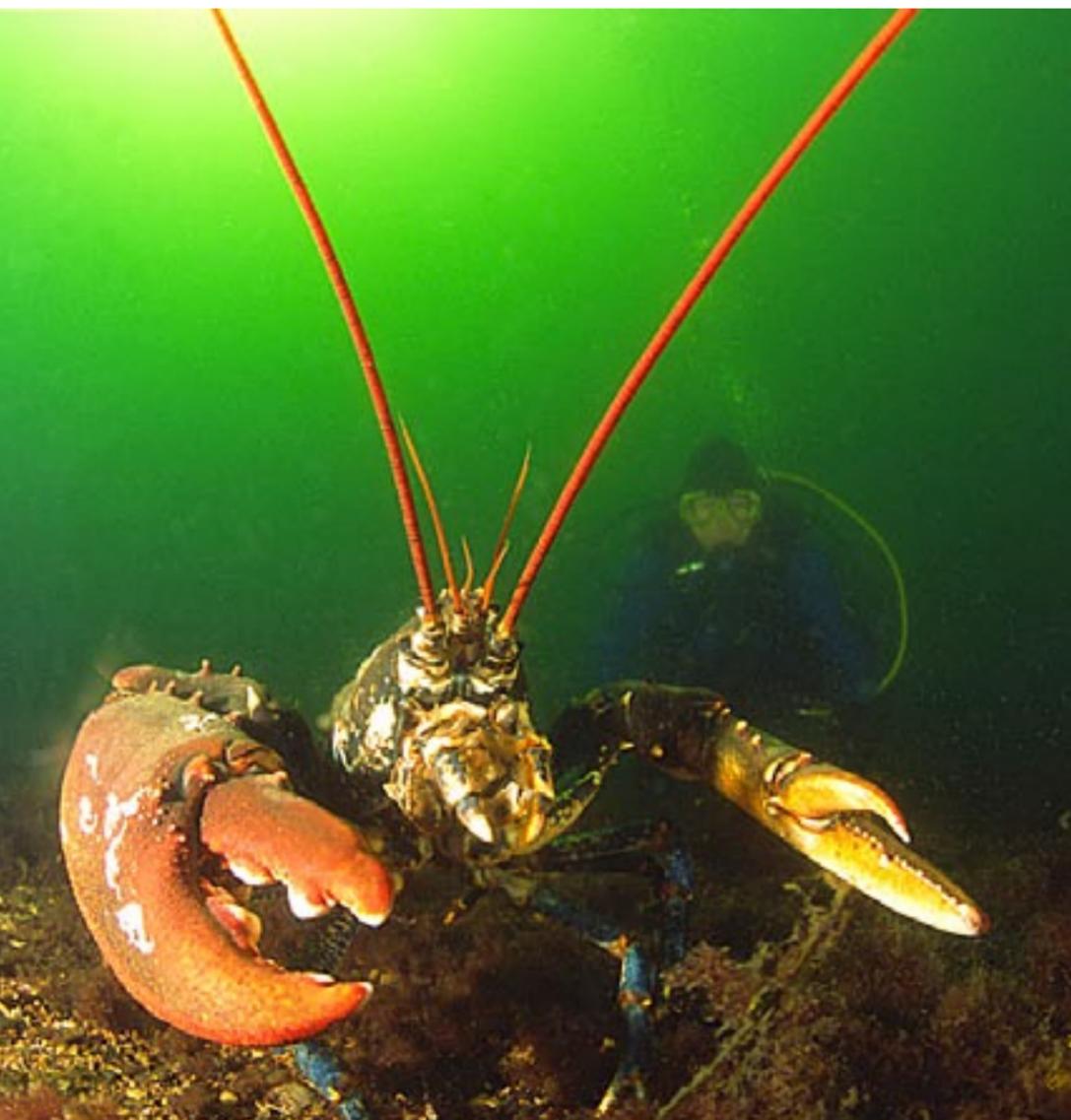
Deeper, the atmosphere can be downright spooky. Light penetration is minimal and on cloudier days, almost non-existent. Past 20 m, we might as well be diving in a tunnel. A halogen torch cuts through the first meters of water shrouded by plankton and particles. Looking up, the surface is a faint glow. On a sunny afternoon, we hit 25 m of complete darkness in the centre of the lough. I had never been on a night dive in the middle of the afternoon before. Definitely one for the logbook.

In contrast with the colourful reefs seen only a few minutes earlier, the

RIGHT: Split view of bridge and shallows
BELOW: Portrait of a lobster with diver

bottom is a plain of mud. The lightest fin kick raises a cloud of soot-like dust. The kind of particles that stay in mid-water and take all summer to come down.

Back to the shallows, sun rays passing through the surface weeds create ghostly silhouettes. After persistent rain, water droplets float on the surface trapped in an oily film. Run off from the land give the surface a milky appearance. Within the last five meters, the separation line between the layers of sea and fresh water becomes visible. A horizon line runs below the surface. Looking up from 10 metres,



the surface seems to have doubled up into two layers. Crossing the layers is like going through an optical illusion. I wonder if I haven't gone cross-eyed. A bit like looking through a magnifying glass that won't focus...After heavy rain, the halocline can be seen up to 5 metres deep.

Dive Center

The nearest dive centre to Clidfen is Scuba Dive West on the Renvyle Peninsula in County Galway. It is a family run PADI five star dive centre established for many years. It is located on the banks of Ireland's

only fjord, Killary. It is an ideal base to dive and discover the islands of Clare, Inisboffin, Inisturk, and the many wonders of Connemara.

www.scubadivewest.com

Jerome Hingrat is a professional underwater photo-journalist from Brittany. His photographs and articles have appeared in a wide range of publications, including SportDiver (UK), Océans (France), Subsea

Connemara

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(Ireland) among many others. His work focuses on destinations and subjects ranging from the Amazon to the Indo-pacific to underwater Ireland. www.jeromehingrat.com





fact file

Connemara, Ireland



Map of Ireland designating Connemara region

History Connemara's history stretches back thousands of years. Local archeologists have found Bann spearheads in Streamstown that are 7,000 years old. The spearheads are evidence that the people of that era were nomadic hunter gatherers. A change from the nomadic lifestyle to that of farming communities is shown in artifacts dated later.

Celtic tribes arrived on the island of Ireland between 600-150 B.C. Norsemen began to invade the area in the late 8th century. The invasions were finally ended when King Brian BORU defeated the Danes in 1014. In the 17th century, English invasions began and started more than seven centuries of Anglo-Irish struggle of fierce rebellions and harsh repressions. Guerilla warfare was sparked by a failed 1916 Easter Monday Rebellion. In 1921, it resulted in independence of Ireland from the UK for 26 southern counties while six northern (Ulster) counties remained part of the United Kingdom. Ireland withdrew from the British Commonwealth in 1948. In 1973, it joined the European Community. Since then, Irish governments have sought the peaceful unification of Ireland and have worked with Britain to halt terrorist groups. A peace settlement for Northern Ireland was approved in 1998. Its

implementation has met some difficulties in recent times.

Government Republic

Geography The country is located in Western Europe, west of Great Britain. It occupies five-sixths of the island of Ireland in the North Atlantic Ocean. Terrain: mainly level to rolling interior plains surrounded by low mountains and rugged hills as well as sea cliffs on the west coast. Coastline: 1,448 km; Elevation: lowest point - Atlantic Ocean 0 m, highest point - Carrauntoohil 1,041 m; Natural resources: natural gas, peat, copper, lead, zinc, silver, barite, gypsum, limestone, dolomite; Environmental issues: water pollution from agricultural runoff, especially of lakes.

Capital Dublin

Economy With growth averaging a robust 7% in 1995-2004, Ireland is a small, modern, trade-dependent economy. Once the most important sector, agriculture is now dwarfed by services and industry. Industry accounts for 46% of GDP, about 80% of exports, and 29% of the labor force. Exports remain the primary engine for Ireland's growth, however, the economy also benefits from a rise in consumer spending, construction,

and business investment. GDP is 10% above that of the four big European economies per capita and the second highest in the EU behind Luxembourg. The Irish Government has implemented a series of national economic programs over the past decade designed to curb price and wage inflation as well as reduce government spending, increase labor force skills and promote foreign investment. On 1 January 2002, Ireland joined in circulating the euro along with 11 other EU nations. Agriculture: turnips, barley, potatoes, sugar beets, wheat; beef, dairy products; Industry: steel, lead, zinc, silver, aluminum, barite, and gypsum mining processing; food products, brewing, textiles, clothing; chemicals, pharmaceuticals; machinery, rail transportation equipment, passenger and commercial vehicles, ship construction and refurbishment; glass and crystal; software, tourism; Exports: machinery and equipment, computers, chemicals, pharmaceuticals; live animals, animal products

Climate Temperate maritime modified by the North Atlantic Current. Ireland has mild winters, cool summers, constant humidity and is overcast about half the time

Population 4,015,676; Ethnic

groups: Celtic, English; Religion: Roman Catholic 88.4%, Church of Ireland 3%, other Christian religions 1.6%, other religions 1.5%

Currency Euro
Exchange rate: EUR 1 = USD 1.21

Language English is the official language generally used. Gaelic or Gaeilge is spoken mostly in areas located along the western seaboard

Web sites

The Killary Centre
k2@killary.com
Maol Reidh Hotel
www.maolreidhhotel.com

Dive Operators

Scubadive West
www.scubadivewest.com

Deco Chamber

Galway Chamber
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Lobster on the run. Photo by Jerome Hingrat



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