The wide angle zoom lens: friend or foe?

By Alex Mustard and Peter Scoones

Flexible friend. These two shots were taken on the same dive. A wide angle view of the reef, and a fist sized frogfish hiding in soft corals. Nikon F100 + 17-35mm. Subal Housing. YS 120 + YS30 on TTL. Ektachrome extracolour 100.

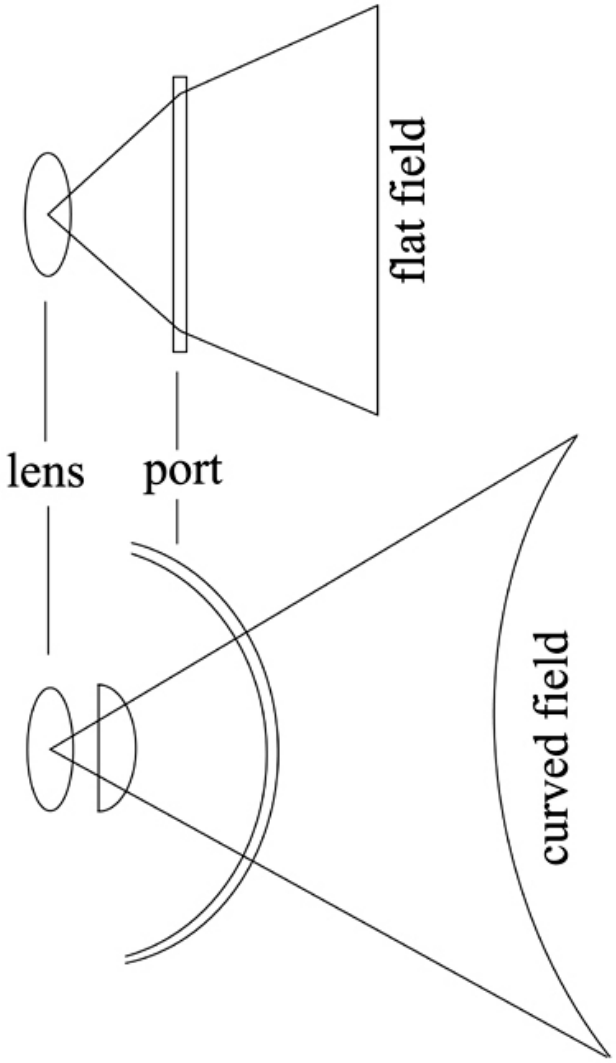
The world of technology, these days, is a very different place compared with a decade ago. For example and with apologies to the editor, we are writing this article for a magazine that does not exist, well not in the traditional sense! The pace of progress is remarkable.

The humble zoom lens has also benefited from the technology revolution, and a modern zoom lens is very different beneath the skin than a lens from even the early 1990s. Established wisdom states that zoom lens should be avoided by serious photographers because to work over a range of focal lengths their optics are compromised compared with a prime, fixed focus, lens. In other words, by attaching a zoom lens to our camera we are going to take pictures that are not as sharp or as saturated with colour as we would with a good quality prime lens. But technology has changed things. Computer aided design has provided solutions for the complex optical requirements of zooms, and has closed the performance gap with prime lenses. This is most true of the wide angle zooms, that are particularly applicable to underwater photography. So is now the time for underwater photographers to embrace the zoom lens?

There are many reasons why zoom lenses should be a favourite with underwater photographers. First, and with fear of stating the obvious, it is not possible for us to change the lens of a SLR camera underwater! Which is a pity, because most of the time UW shooting conditions are far from predictable. Good subject matter is an important ingredient in any photo. But part of the problem, and indeed part of the pleasure, of any dive is that we are never completely sure what we will encounter. A zoom lens affords us photographic flexibility.

Zooms have other benefits too; one of the basic rules of underwater photography is to keep the amount of water between the camera and subject to a minimum. This is because photographing through too much water reduces contrast, sharpness and colour saturation of a

Flat port. Although still an acceptable image, this shot taken through a flat port lacks colour and contrast compared with the first two shots, which were taken on the same dive site on the same day. Nikon F100 + 28-70mm. Flat port. Subal Housing. YS 120 + YS30 on TTL. Ektachrome extracolour 100.



The refraction of light through a flat and dome port

subject.

A wide angle zoom lens allows us to fill the frame with a subject from as close as possible. The slight loss associated with the optics of a zoom is meaningless if we can reduce the amount of water we are shooting through compared with a prime lens. The recent designs of wide angle zooms are a great benefit here, because many have a much smaller minimum focus distance than the older models.

Zoom lenses are also ideal for capturing the behaviour of underwater subjects. By controlling the focal length of the lens we can frame activity as required, while finding a working distance that does not disturb the subject. Zooms also allow us to try several creative techniques such as zoom blur and even to make effective multiple exposures without rewinding the film. And for trips abroad a zoom can replace at least a couple of other lenses, saving precious kilos of baggage allowance. Now you must be interested!

Not all zoom lenses are suitable for underwater use. A zoom with a really large range of focal lengths is impractical to house, and in addition most telephoto lenses have minimum focus distances which are too large to be useful underwater. The zoom lenses suitable for UWP fall into three categories: the macro (80-170 mm), the standard (28/35-70/80 mm) and the subject of this article, the wide angle zooms (15/17/18/20-35 mm).

Housing a wide angle zoom requires a bit of thought because lenses wider than about 28mm cannot be used behind a flat glass port without suffering considerable degradation of image quality. The main problems are chromatic aberration at the edges of the image, pincushion distortion and a reduction of the angle of view. To overcome these problems we use these lenses behind a dome port.

Domes are not free from optical problems and a most serious consequence of using a dome port underwater is curvature of the field.

This manifests itself as the plane of focus being much closer at the centre of the frame than at the edge, and the wider the field of view the more exaggerated the effect. Put simply this is great if we are

Best behaviour. Zooms are excellent tools for capturing the behaviour of reef life, such as this parrot fish grazing. Nikon F100 + 17-35mm. Subal Housing. YS 120 + YS30 on TTL, f6.7 1/60th. Ektachrome extracolour 100.

photographing footballs but useless for caves! The larger the dome diameter the less field curvature occurs. Small diameter domes suffer the "Buzz Lightyear effect" and can be particularly problematic and field curvature can result in detail at the frame edges being "beyond infinity" even at the lens's minimum focus.

There are custom made ports available for some older zoom lenses, but to make use of some of the most recently designed lenses we may have to come up with our own combination of dome and port extension rings.

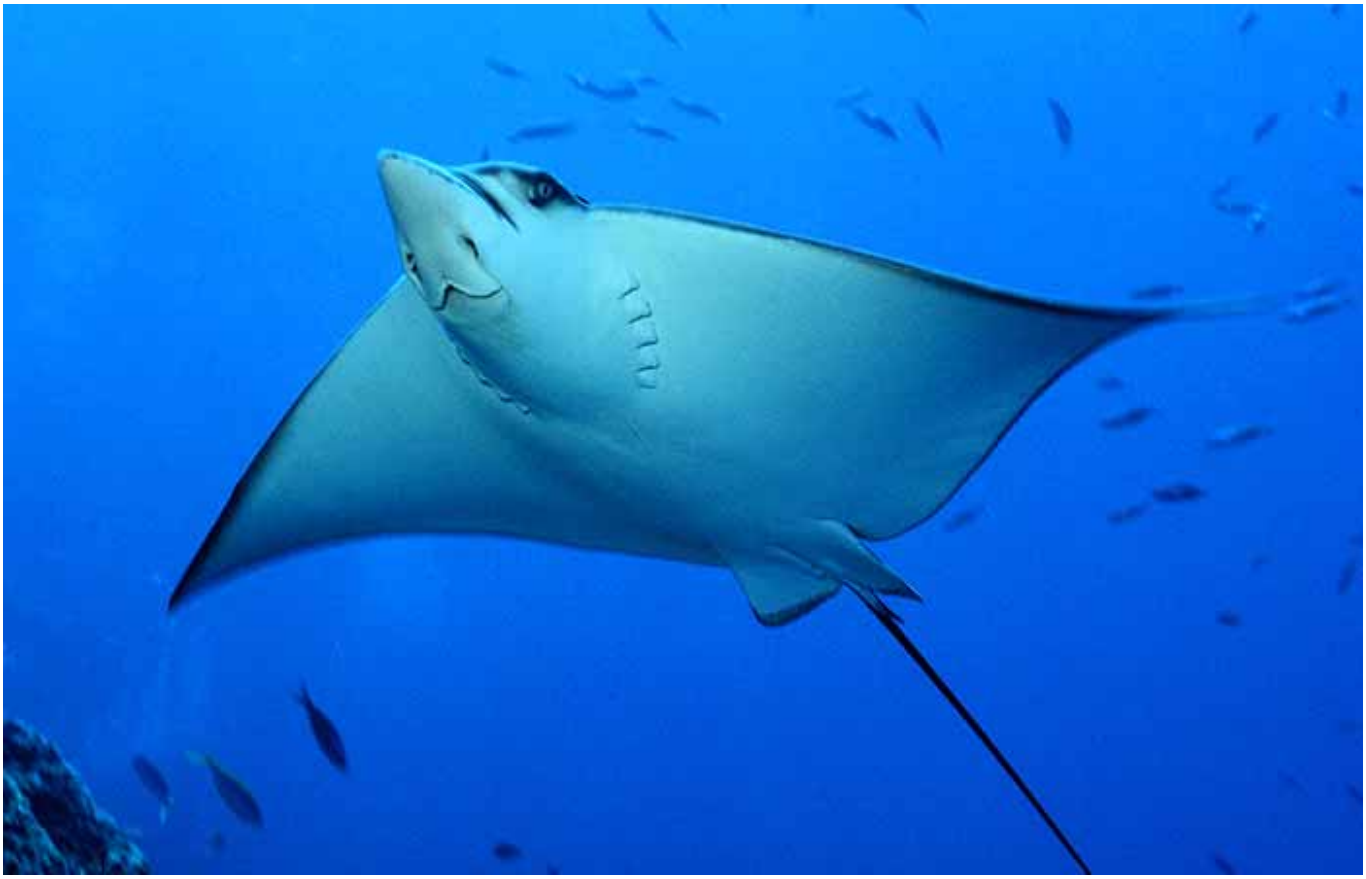
Therefore it is important to understand a little bit about the theory of dome ports and the specific requirements of zoom lenses to be able to make informed decisions about the port configurations we choose.

In the water, a dome port reduces the problems of a flat port, but also acts as a negative lens. To correct this, a dome port is used in conjunction with a supplementary positive dioptre, fixed to the front of the lens. The correct dioptre strength required for a dome port depends primarily on the internal diameter of the sphere prescribed by the dome; dioptre strength is simply calculated as 1000 divided by twice the internal spherical diameter, in mm, (e.g. a dome with a diameter of 200mm needs a +2.5 dioptre for compensation, sited 100mm from the internal surface of the dome). The required strength of the dioptre is independent of the focal length of the lens, and a single dioptre will work throughout the range of the zoom.

The position of the lens within the dome also influences the correction, and a practical approximation is that the dioptre should be as close as possible to the centre of the sphere of the dome. This is why it is important to use the correct length of port extension ring. A stronger dioptre is required the further forward into the dome the front of the lens is protrudes.

Lens positioning is a potential problem with zoom lenses because the barrel length of many lenses changes significantly during zooming.

Certainly, lenses which have large to and fro' changes in barrel length should be avoided because these may also see the sides of the port at their shortest focal lengths. Changes in barrel length, and thus the dioptre position relative to the dome, mean that the field will not remain focussed as the lens is zoomed. However, the typical movement of a lens is not that problematic for stills, because the lens can always be re-focussed. A more serious consequence is that the optical correction will not be exact at all focal lengths. For this reason it may be worth upping the strength of the dioptre a little because minimum focus may be



Big shots. Wide angle zooms are also great for large animals, especially when we cannot be sure how close we will be able to approach. Nikonos RS + 20-35mm. YS 120 + YS30 on TTL. Ektachrome 100.

more useful that infinity underwater. But if this is overdone the background will always be out of focus. The answer is to experiment. For those with deep pockets these problems can be avoided by using a lens with an internal zoom mechanism, that is the lens barrel does not change length.

Another consideration is that the large diameter dioptres required for wide angle zooms can cause internal reflections within the dome.

An efficient lens hood, such as a smaller port that is only a section of the hemisphere, can be used to shade the lens from unwanted light, so long as it does not cut off part of the image! Such a solution is also advantageous because the larger the dome of the port (even if we use only a section of it) the less field curvature occurs.

In the real world, it is not always possible to produce the perfect optical port configuration for practical reasons, such as the equipment available. For example, I (ATM) have not had any problems with reflections using a 77mm wide dioptre behind a Subal Fisheye port. But I made this port choice because I cannot afford (in hard currency or baggage allowance) a second, more suitable dome port! In the end a port/dioptre/lens configuration will be judged on its results, and such judgements will of course be subjective and personal.

To summarise, we hope these tips help to guide your choices:

1) select a zoom with the minimal front to and fro' movement, both in zoom and focus;

2) use the largest dome curvature that is practical;

3) use the smallest dome section that does not cut into the image;

4) select the correct dioptre;

5) set up the dome to dioptre distance accurately, using a port extension ring.

Traditionally zoom lenses have been thought of as compromised optics, but the results from high quality modern zoom lenses are hard to pick apart from prime lenses when used underwater - where so many other factors influence image quality. Zooms are not suitable for everything: prime lenses should remain our first choice when a shot can be planned in detail before getting into the water, and photographic equipment (film, flashes and lenses) can be optimised for that shot. But when we cannot control the variables, which is so often the case underwater, a modern zoom lens is a most valuable ally.

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