DIGITAL PHOTOGRAPHY

What it is and how it stacks up against film

LIKE NEVER BEFORE, DIVERS ARE TAKING MORE PHOTOGRAPHS OF THEIR UNDERSEA ADVENTURES. SO WHY IS PHOTOGRAPHY SO POPULAR NOW AND HOW DO THE NEW DIGITAL CAMERAS COMPARE TO THE 'OLD' FILM CAMERAS?

For divers the more important influencing factors in taking up underwater photography are:

1 A huge range of cheap cameras and housings. Not so long ago there were half a dozen housings on the market, mostly for 'high end' SLR cameras. A serious investment of $5-8000 got you a basic housing and camera, but no strobes or other essentials such as strobe arms and different lens ports. Now there's a flood of cheap plastic and metal housings on the market for a wide range of cameras.

2 Instant feedback. You can pause on your dive to see what you have 'in the can'. You can show your buddy, or take more shots if the first try was 'success challenged'.

3 No scanning, no printing. A picture can be downloaded to your computer or your phone and sent instantly anywhere in the world. Most photographs taken on digital cameras are not printed so there is no waiting to see if it 'came out'.

4 Digital cameras are more forgiving, producing a good results with less effort.

So if you are new to photography the latest technology has all sorts of advantages. Price is just the start. While a good digital camera can be two or three times the price of a film camera, the cost of film and processing can soon overtake and far exceed the original savings, especially if you get serious and start blasting away. The only extra expense with a digital camera (assuming that you already have a computer purchased for other purposes) are a few blank CD or DVD discs to copy and archive your gold medal images. You can go on a dive, shoot off 200 images and the expense is almost zero.

But if you are already the owner of a film camera, there are a few things to consider before you dump all that expensive gear and rush out in a lather of 'upgrade therapy'. Lets have a look at how film and digital compare.

FILM Without getting all technical, film comes in a variety of flavours which can be broken into two groups. Slide or transparency film providing a positive image and print film, giving a negative or reversed image. Each is designed for a particular purpose with slides used for projection and for use in magazines, books and other forms of printed material and print film for producing colour photographic prints.

What film does have is a reasonably wide 'dynamic range' – the ability to record detail in very bright and dark areas at the same time. A transparency can hold about 5 f-stops in brightness range (from blacks to whites with readable detail) which is close to the 4 f-stop limit of the average printing press. Negative film has a wider dynamic range, able to reproduce in a colour print a lot more detail in the dark and light areas. Some negative film, such as that used in the movie industry, can hold twice that range. So, if you are shooting a reef scene with film you can produce an image which shows the sun at the surface with detail in the bright sunball as well as some detail in a darker areas of the reef. Some films, such as the now sadly abandoned Kodachrome, could do this very well.

The business end of a digital camera is the camera sensor made up of tiny light sensors and covered with a protective clear sheet. You may never have to spot a scan again but if dust rests on the sensor it will leave a dark blob in your image file, usually more noticeable in even toned areas such as sky or water.

DIGITAL CAPTURE Digital falls flat on it's face when it comes to dynamic range. Given the same photographic situation, it is unable to cope with anything above an overcast day. The sun ball blows out to a white hole 2-3 times the size of the film's highlight. You can compensate to some degree with more strobe fill to the foreground and underexposing the surface but that is not always an ideal situation. There are other fixes as well such as filters and shooting in RAW format, which we will go into in one of the following articles in this series.

On the positive side what digital files can give you is low ongoing costs, no scanning (along with all that cleaning up and spotting of dust, hair, scratches, fingerprints, etc) and instant feedback so that you know when you have that special shot 'in the can'. It also has the ability to compensate for the green/blue/cyan/yellow colour cast (depending on the colour of the water in which you are wallowing) that is the inevitable result of shooting in the ocean. Shooting without a strobe in shallow water, or with a warming filter (such as the UR Pro filters) at greater depths, now provides very acceptable results with little effort.

GRAIN AND PIXELS Put simply, photographic film is made up of light sensitive silver halide particles which, when exposed to light, undergo a chemical change forming a latent image. When the film is developed these silver grains are removed and replaced with coloured dyes. The higher the film's sensitivity to light, the larger the silver grains and resultant dye clusters, therefore the more 'grainy' the film appears.

In comparison digital files are made up of pixels which are tiny squares of colour. If you enlarge a digital file enough, you can see those small squares on your computer screen. Each pixel represents a single colour and is recorded on your computer as a number or line of computer code.

A slide that is reproduced in a magazine or turned into a photographic print has to be scanned to be converted from a complex, multilayered chemical object into a digital file. (Most photo labs now scan photos prior to printing and many picture-takers print out their images at home on colour printers.) In the process, a scanner divides up your slide into pixels. The digital file will record all sorts of imperfections in the film surface along with anything else that has stuck to the static-friendly film. Factors affecting the quality of the scan are the flatness of the film during the scan, flatness of the film during the original exposure, thickness of the film, number of dye

Digital camera sensors cannot handle contrast, as evident from the blown-out sunball.

A digital image file, whether made from a scan off film or a file from a digital camera, is made up of pixels, small squares of a single colour.

layers, quality of the lens in the scanner, the software interpreting the information and the scanner operator. A flatbed scanner that you got 'free' with your virus ridden Windows PC will obviously provide a less quality digital file than a $2 million drum scanner using custom colour software running on a slick Mac system.

If the scan is designed to be printed out at, say A4 size which is the size of the page you are reading now, but is then enlarged to double that size, the computer program has to guess or 'interpolate' the information in the original scan, doubling all those imperfections as well. The result is a file with no extra detail covering a larger area giving a less sharp image.

Digital files have no grain and are only one non optical step away from the original capture of photographic information. (All cameras record photographs in a format unique to the brand and, usually, camera model, generically called a RAW format. This needs to be converted into a different format, usually jpg or tiff, before it can be used.) Therefore digital files can be enlarged with less drama. If a camera were to produce an A4 sized file, it can be easily enlarged to double or triple that with almost no noticeable effects.

While digital cameras usually have a means to increase the 'speed' or ISO of the capture, this is just a hangover from film cameras with their different film speeds. In reality all the camera is doing is amplifying the original image information. As with high speed film which has increased grain, a digital file taken at a higher 'speed' has undesirable effects from the amplification called 'noise' which is evident as speckles of colour, usually more evident in dark areas of the photo. As with film, the lower the speed the better the result. That said, digital files from a quality camera will produce excellent files amplified up to 400 ISO.

RESOLUTION The word 'resolution' has multiple meanings. For our purposes it can mean:

1 The ability to show detail.

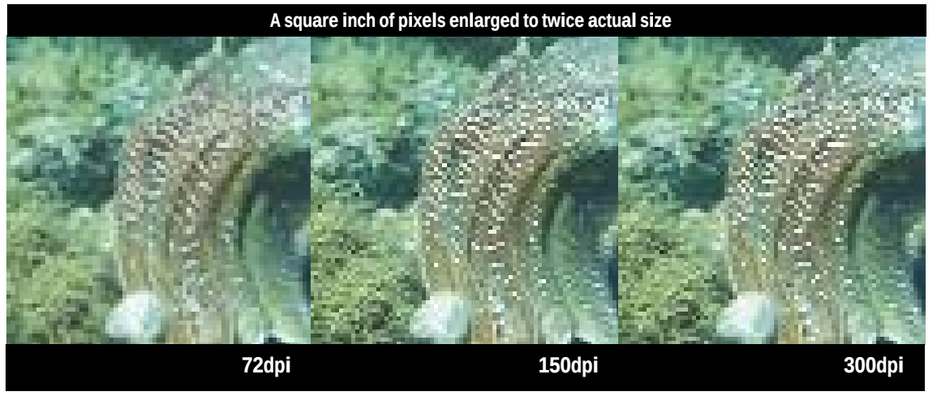
2 The number of pixels in a given area of a digital file or the number of dots on a photographic print or magazine page in a given area. In the photographic world the area is referred to in inches such as '300 pixels per inch (ppi)' or '300 dots per inch (dpi)'.

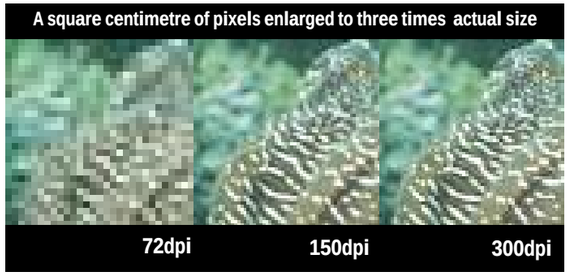
On the first point above, the resolution of film, it's ability to resolve or show texture and detail, is limited by the grain in the emulsion. The smaller the grain the more detail and texture it can show before the grain interferes. Other factors such as lens quality, water clarity, how clean your lens is, etc, also come into play but those factors affect both film and digital equally so lets put them aside for the moment.

Digital files are similar. The more light sensitive pixel recorders in the camera sensor the more information is recorded, therefore more resolution of detail. So a camera with a large sensor with a dense array of pixel recorders will produce a file with more texture and detail.

Next, let's look at the second point above. Imagine a small tray, about half the size of one page of this magazine, packed full of small red and white beads. There are 10,000 beads in the tray. You can push them around and arrange them into an image such as the Coca Cola logo. The beads are all snug and tightly squashed together so that the logo looks relatively clear and distinctive. Lets say that in one square inch there are 300 beads. Now pour them out and distribute them across your kitchen table in the same pattern. They now cover a huge area but there are still only 10,000 beads and now there are only, say, 50 beads per square inch. The logo image is still there, just less distinct.

So one could say that the first tight arrangement is a 'high resolution' image file. There are lots of beads in a given area producing a clear image. The 'low resolution' image on the kitchen table has fewer beads in a given area making the image harder to visually comprehend, possibly being easier to to see when viewed from a greater distance. And yet there are the same number of beads in both situations.





A digital file is similar to this. A 3 megapixel camera will make a file that is about 9 megabytes in size. If you pack the pixels into an area where there are 300 pixels in a square inch (300 pixels per inch or 300 ppi) then you will have a 'high resolution' image of about 178 x 127 mm. The exact same file can be 'spread out' by making it 72 ppi with an area of 740 x 530 mm. This has fewer pixels in a square inch so is considered a 'low resolution' image file. One will cover a much larger area than the other yet both will be the same 9 megabytes. So a 'high resolution' image file and a 'low resolution' image file may be the same size in megabytes but very different in area covered and resolution.

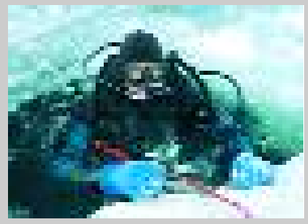
I often have people ask me to supply them with a 'high resolution' file. That's like asking for a long piece of string. How long is a 'long' piece of string? How 'high' is a high resolution image? A printer which makes large billboards prints at anywhere between 50-150 dpi. So a 200 dpi image could be considered a high resolution image file. But the same file printed in a magazine would be considered a low resolution image.

A 3-4 megapixel camera will produce a clear image up to around half a magazine page. After that the original pixels will be more spread out. However your file will not have gaps between the pixels like the beads on your kitchen table. The computer program used to enlarge the file will create pixels to fill the gaps, guessing or interpolating what colour to make these new pixels. The result is an image that is not as sharp as the same size file taken with a camera with a higher megapixel rating.

The upside of this is that a large photographic print is usually viewed from a greater distance, making the computer 'fudging' less obvious. However, if the image is reproduced in a magazine the viewing distance will be the same for a small image as it is for a large full page or double page spread, making the image appear less sharp and detailed than one taken with a higher megapixel camera as the computer program can only copy pixels to match what is already there, not creating extra texture and detail.

So what does all this mean? Which camera you need depends on what you want to do with your files. If you just want to email them to friends and make the occasional print up to 10x8 inches, then a 3-4 megapixel camera will be more than enough. You may even be happy with the quality when enlarged up to A3 (a double page spread in this mag). For those of you who want to regularly make large prints or who are serious about having their work published, then a minimum of 6 megapixels are warranted, 8 or more megapixels is even better, especially when most photographs can be improved by some cropping, resulting in a smaller file size.

Our next article in the series will look at lenses, optics and the mechanics of the camera. We will also look at the different file formats, JPEG, TIFF and RAW, how they affect your results and what is best for your needs.



Kelvin Aitken is a Melbourne-based professional photographer and diver with passion for the big blue and all the big sea creatures to be found out there. He's dived from the Arctic to the extremes of the South Pacific and if there's a new marine dive adventure to be experienced or invented, he's always the first to put up his hand. He's also dived the southeastern Australian continental shelf and photographed shark species nobody knew would be found out there. Kelvin is a BBC Wildlife Photographer of the Year marine category winner and you can explore his unique work on www.marinethemes.com