

## UNDERSTANDING THE JPEG FORMAT

**I am not sure about you, but I think that if I were to see the Queen down at the local supermarket, well, I'm not sure what I would do. Ask her if she prefers the whiter and brighter washing powder or is she a liquid user? Or how about running into that pouty female Oscar winning actress at the local servo? We ordinary folk may aspire to the wealth and fame of those figure heads but the reality is that we must endure a far more mundane existence.**

In like manner, I do tend to bang on about saving all images in the original RAW format. There a myriad of reasons why you should do that. But in reality, most of you don't. Your camera can provide the 'rich and famous' RAW format, rich in information and detail, famous for the amount of information stored in those shadows and highlights, but we tend to set it to the more mundane JPEG, the shoe shine and garbo collecting format.

Lets look at why most casual photography buffs and weekend warriors leave their camera on 'save jpeg only' in the camera's menu.

First, that's how the camera came out of the box. If your manual has a 'quick start' section, that's about as far as we tend to look when first using a new camera. And changing saved formats is never in there. It will be buried deep into the manual, where your brain would have long ago given up trolling through all the complicated jargon associated with custom set-ups.

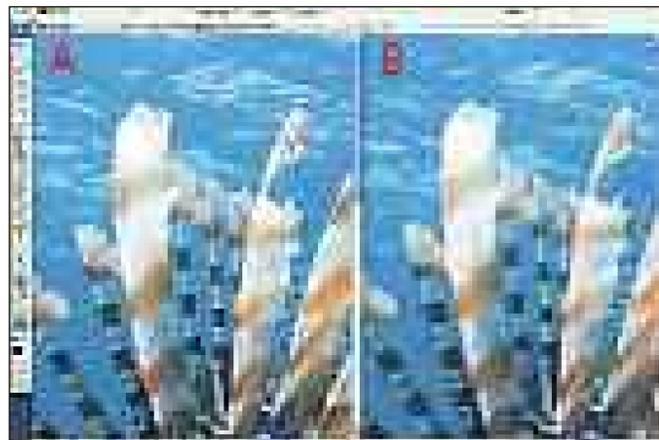
Second, for some reason, finding out that you can fit 5000 jpeg images on your camera's memory card, as opposed to only 100-300 RAW images, seems to be a much better deal. It's as if we think it's going to cost money to store the bigger file. Maybe this is a throwback from film days where more exposures meant more cost but with digital, hey! you can cheat the money monkey and squeeze in far more shots on your card if you use JPEG format. Or it may also be a throwback from the days when a 1gb hard drive was very expensive so you wanted files to be as small as possible. Or you may be a survivor of the Y2K fiasco, caused by programmers skimping on the date format to save space on their 10mb hard drives.

Third, most camera users have end requirements for their photographs that rarely require the 'rich and famous' RAW format. There's not much to inspire you to pull out extra detail in those blocky shadows or blown highlights if all you are going to do is squint at the image on your camera's LCD screen once you are back on board your dive boat. Or no point in getting that colour balance just perfect if you are just going to upload the pic onto your Facebook page. For starters, web browsers don't have colour management capability so any minor colour tweaking along with saving embedded colour profiles is going to be ignored and/or reinterpreted by the browser in some random fashion that will make all your work for naught.

So, assuming that many of you readers will stick to the Joe Bloggs

JPEG format and ignore the George Clooney RAW format, let's look at what the JPEG format does that is positive, negative, useful and annoying. At least that way you will have a better grasp on what best suits your photographic requirements.

JPEG or JPG is just one of many formats in which you can save a photo file. My old Photoshop 7 has 20 different formats in which I can save an 8 bit image file, a few of which are JPEG variations. JPEG is preferred for web use, including email, as the resulting conversion to JPEG format can impressively reduce the size of the file on your hard drive or any other storage device including backup DVD's. When your photo editing software opens a JPEG file it is transformed into exactly the same image size as it was before it was compressed. So, a saved file that is only, say, 800kb can, when opened, have an uncompressed file size of 20-30 or more megabytes. A file sized to A4, or full page in this magazine, at 300dpi (dots per inch or pixels per inch) will normally be 25mb in size. If you were to save it as a JPEG then it may be compressed down to a file that is only 100kb, a tiny fraction of the original size. Save it as a TIFF file without



**Zooming in on a lionfish photo saved as a level 10 JPEG, the image (A) is a typical JPEG file with not a lot of information in the highlights and a bit of the jaggies appearing on the edges of the fins. But, considering the zoom level, it is not too bad. However, exactly the same image saved at level 0-2 shows up a lot of the problems that lossy compression causes with the smooth background breaking up into squares of pixels and edge sharpness degenerating.**

compression and the same file stored on your hard drive will show up at the full 25mb.

As much as we may wish it otherwise, there is no free lunch. There is a price for such extreme compression. A JPEG file employs what is known as 'lossy compression'. That means that when you save an image you will lose information. Taken to extremes, a JPEG file can look like your dog's breakfast, as information is dumped by the compression process to reduce the file size of the image.

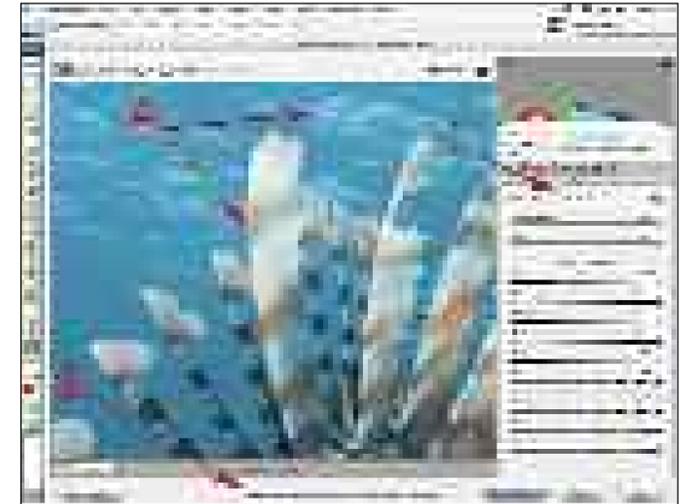
Down at the pixel level of your image, saving in JPEG format will give your photo a jagged and/or blocky appearance. This is particularly evident in areas where there is a sharp contrast change, such as a white strip on a black wetsuit. The transition area takes on a typical jagged appearance. What the process is doing is taking a certain number of pixels and changing their values. While not technically accurate, you can think of it as picking a blue pixel and making all the others around it the same colour and/or density value. So, if a single pixel is bordered by 8 pixels, instead of having 9 lines of code to describe each of the pixels, the whole section can now be described with one line of code. As I said, this is not technically correct as the process is much more complex than that, but in principle this is how the system works.

Now if you are just sending emails or posting images on a web page, this compression is not really an issue. In fact, if you were to post an uncompressed TIFF file next to a JPEG on a web page, you would not see any real difference. The same may be said of small colour prints, particularly if the original exposure was spot on and no major fiddling is required. However, let's look at some extremes to see what you can do to avoid the pitfalls of using JPEG as your working file format.

For starters, all JPEG files are not created equal. Open any image in your photo editing software. Make sure it is in 8 bit mode as 16 bit images cannot be saved as JPEG files. In Photoshop that would be under Image>Mode>8 bits/channel. Now save the file using 'Save As...' under the File menu. Give the file a new name then under the Format drop down menu, choose 'JPEG' (if it is not already chosen). If JPEG is not available it is always due to the above mentioned 8 bit vs 16 bit problem. Also, depending on your software, it may not be available if you have layers in your image.

You can also embed the colour profile of your choice at this stage, using the check box at the bottom, but, as mentioned above, if you are only using it on a web page the profile will be ignored by the browser.

You are now presented with the JPEG Options window, the most important part being the Quality setting. Drag the slider across to 10 or 12. Depending on your software version the maximum quality (meaning minimum compression) can vary with older



**A RAW file, in the process of being converted, does not have jagged JPEG compression artefacts, blocky pixel clumps or edge blurring (A). At this stage, a choice of colour profile, bit level (16 bits has been chosen) and resolution and dpi (B). A White Balance can also be specified (C) but I prefer to shoot on Auto White Balance and use Photoshop to tweak any colour shift.**

versions only going to 10. At the bottom of the window is an indication of the size of the saved file as well as how long, at a given speed, the file will take to be transmitted. The higher the quality, the larger the file, the less compression and the greater the time taken to transfer. For reproduction, I suggest 10 or more. For colour prints: 5-10, for web page and email (i.e. for viewing only, not printing or reproduction) you can use 2-5. I've even used 0 and the image looks just fine in an email. Obviously, these lower numbers represent the more extreme compression levels.

So, if the image looks OK in a highly compressed form, what's the big deal? The problems start when the image is re-saved. Not >

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and his unique work is on [www.marinethemes.com](http://www.marinethemes.com)

# digital photography



After selecting JPEG as my format of choice in the 'Save As...' dialogue box, along with selecting the check box to save it with the colour profile, my JPEG Options dialogue box that now pops up allows me to choose a level of compression. You can enter a number or select a level from the drop down menu (A). The size of the saved file will be displayed (B), the value being the size of the compressed file at the level of compression you choose. For web use I use a much lower level giving a much higher compression, say level 4 or 3. If I select the Baseline Optimized option (C) I will save a little more file size without changing the compression. The third option is rarely used as it is often annoying to have images reveal through a series of scans. This was used more often back when high speed meant a 56k modem.

re-save it, the image will lose more information. Then, let's say you open the changed file and create a new file for a wall print and save it, then open that file and make a smaller file for a party invite, you soon find that the image looks like a badly pixellated TV screen. Each time you saved the image, the compressed file had additional compression which removed more texture, detail and colour information. Each time you re-save a JPEG file you do more damage.

Another factor that comes into play is the amount of adjustments you make to an image. A photo that is correctly exposed with good colour balance will put up with a lot more abuse than a badly underexposed photo with electronic noise in the shadow areas. Since JPEG files are in 8 bit mode, they have already dumped a whole lot of information that could have been used during the correction process. This is particularly evident when you view the Levels window (Image>Adjustments>Levels...). A 16 bit file will have a smooth histogram while an 8 bit JPEG file with a lot of exposure and/or colour adjustments will show a gappy, jagged histogram where complete areas of colour and density are missing. In extreme cases this will show up as a form of mild posterisation or

copied, as in burning to a disc or making a duplicate. If you open a JPEG file, do nothing to it and then close it then no changes occur. But if you open a JPEG then re-save it (usually after doing something to the file), going through the saving process above, the previously compressed file has another compression algorithm applied. So if you have a photo of a diver, saved as a JPEG by the camera, then you open it in your photo editing software to make some changes and

lack of smoothness in transition areas between subtle colours. For example, a blue water background will begin to show banding or abrupt colour changes. Add some heavy compression when saving the file and you are going to end up with a rather sad result.

To add insult to injury, the default colour space for most cameras will be sRGB. This is a colour profile intended for web or internet use or for simple programs such as Powerpoint. A colour profile is a description of the colours used in an image. If the profile does not describe certain colours then they do not show up. A good example of this is the CMYK colour space used for printing this magazine. There are many CMYK colour profiles but they all have fewer colours available than the RGB profiles that you use. That is why, when compared to the original, magazine printed images are a lot less saturated, particularly the blues and cyans found in underwater images.

The sRGB profile has fewer colours available than wider profiles such as Adobe RGB (1998) or ProPhoto RGB. Again, with a perfectly exposed image this is normally not a major issue, but once you begin to add up all the factors (8 bit only, underexposed, lossy compression, re-compression artefacts, narrow colour profile, etc) you can see how your photos can quickly become less flexible or, at worse, useless. You can change the colour profile your camera applies to your JPEG files. Just check your manual to find out which menu item will do that for you. I would recommend the Adobe RGB (1998) profile.

Another factor to take into consideration is that you have to choose a colour balance. Your camera will probably come with a range of colour balances to be applied to all photos you take. Indoor lighting, flash or strobe lighting, fluorescent lighting, etc. To keep things simple I recommend you just set it to Auto. This will work in most situations. The last thing you need is to be fiddling around with colour balance when the two mating manta rays, with your buddy firmly attached, goes by. If you are shooting macro with only strobe light in your shots, then you might choose the Flash or Strobe setting, but generally the Auto will work just fine.

To summarise, the benefits of shooting in RAW are: 16 bit

instead of 8 bit for more colour and density information, particularly for pulling out shadow detail and/or clawing back texture in bright areas. No need for a colour profile or white balance, that is all done in the process of converting from the RAW file into a photograph. No compression so no loss of detail and texture. Once converted, a RAW file can be saved as a high quality TIFF file in 16 bits with all colour and density adjustments, easily converted to an 8 bit JPEG for web or other uses. Your 'rock star' RAW file can always be downgraded when necessary, like one hit wonders of the pop genre who now work in a car wash or restaurant kitchen.

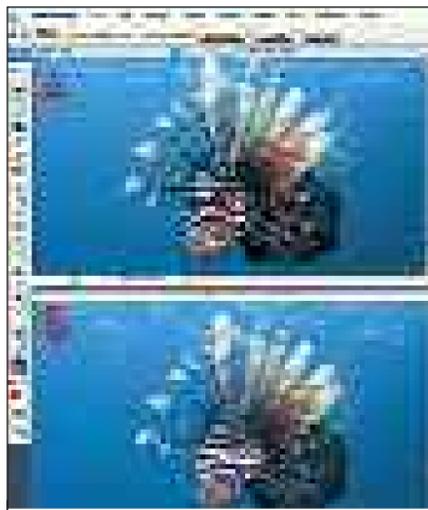
Negatives: you have to convert each file from RAW to an image file so there is a lot more work. This can be overcome to some degree with batch processing or by having your camera save both the RAW file and a JPEG copy. You can then use the RAW file to work on more difficult images while using the JPEG files for correct exposures.

Positives for JPEG are small size per image file and a wider range of uses (i.e. many print outlets demand JPEG format, web sites need JPEG for speed of loading, etc). Negatives: the lesser amount of colour and texture information in an 8 bit image file, compression of image will remove texture and colour information (and once it is gone, it is gone for ever), a colour profile and colour balance must be chosen prior to shooting, your Joe Bloggs format cannot be upgraded to 'rock star' status, it just does not have the wealth of information needed.

So while I always save the RAW format, I do understand why some prefer the default JPEG system. But for the sake of a few dollars and a larger memory card, why not save the RAW file as well? You never know when you may need a visit from Elvis.



After imitating a bad exposure by making the lionfish darker, then lightening it again, this 8 bit file is starting to strain under the load. The Levels dialogue box (Image > Adjustments > Levels) shows the histogram turning into the 'comb tooth' structure of an image which is missing pixels in most of the luminance range, particularly in the shadow to mid range area. An underexposed JPEG would most probably be much worse than this, especially if it is saved with additional compression.



After a few saves, our lionfish looks a little jagged and blocky (A) with the open water background starting to show banding and fine detail blurring or merging. Our file saved from RAW as a TIFF then saved as a JPEG (B) looks much better.