ISO SETTINGS & NOISE REDUCTION

From a photographic point of view, one of the most obvious problems with shooting underwater is a reduction in light. In pristine tropical water with the sun directly overhead, even a depth of half to one metre will see your light levels drop by one f-stop.

Go deeper or add a cloudy day and fairly quickly you'll find that you have to take steps to raise your ISO setting. While this isn't a difficult physical task (all you have to do is push a knob and make the adjustment) it will affect your results. One of the many advantages of shooting in digital format is that you can change your ISO mid-dive, even between shots; not something that you could do with film. And just as when shooting film a higher ISO meant more grain and less saturated colours, with digital the quality of your results will be affected. With film, a 'normal' ISO setting is ISO 100 to ISO 125. Anything below that (i.e. ISO 64 for Kodachrome or ISO 50 for Velvia) is considered a 'slow' film stock, while anything ISO 200 and above was considered a 'fast' film. The visual difference between ISO 100 and ISO 200 was quite evident, the faster film having a noticeable increase in grain, less detail and less colour saturation with the opposite result coming from slow films, namely finer grain with more detail and richer colour saturation.

In the digital world the same holds true, to some extent. The visual difference between ISO 100 and ISO 200 in a digital file is almost unnoticeable. ISO 400 begins to show evidence of electronic 'noise' in the shadow areas of a photograph but it's still quite acceptable for moderate enlargements. The noise will be evident as coloured specks or spots, maybe appearing as coloured texture where there should be just plain black or dark grey. ISO 800 and above begins to show electronic noise in mid tones and highlights as well, becoming worse the higher you push it. Some cameras enable you to set the ISO over 1600. Depending on the quality of the optics and sensor chip, the images will display a range

of electronic noise that may reduce the potential to print out to just small standard sized prints or make the file useless for quality prints or magazine reproduction.

In general, if you set your camera ISO to 200 it will give a great result while allowing you a higher shutter speed than the 'normal' ISO 100. Strangely enough, you won't gain a lot of quality by setting your ISO below 100. In fact with some

Using a high ISO has it's drawbacks. While you can freeze subject and/or camera movement due to the higher shutter speed, you'll get a 'grainy' look to the image plus an increasing amount of colour and luminance noise, particularly in the shadow areas. This image was shot at ISO800 due to low light levels very early in the morning.

The higher the ISO the more colour noise you'll encounter. It will manifest itself in shadow areas first, such as in the darker seabed. Colour noise will usually be either red or blue. The higher the ISO the more extreme it will become showing up as both colours and maybe green as well, making the removal of noise more difficult without affecting other areas of the image. Using selections and/or the history brush will help.

cameras you will slightly reduce the quality of the image if you need particularly long exposure times. In temperate waters and/or with lower visibility or late afternoon/early morning situations, using the ISO 400 setting will give you more leeway with your exposures while still providing you with technically useful image files.

But what if you end up with an image that had to be taken at a high ISO? Maybe you were on a shark dive on an overcast day or you have some fast-moving fish come in late in the afternoon. Raising the ISO was the only way you could get a decent shutter speed to freeze the motion but now you have a file that may look OK on your camera's LCD screen but on the computer or as a print it looks like you were shooting through a fine gauze curtain with lots of colourful backscatter tossed in for good measure. Your image looks decidedly 'grainy', even though digital files only have pixels, not film grain.

To start with, we have to acknowledge that sometimes the only solution to a photographic problem is to raise the ISO setting above the normally acceptable ISO 400. Unless you deliberately want to blur something, it's much better to have a 'grainy' digital file that's tack-sharp than a blurred subject with no electronic noise. While an ISO setting of 200 is remarkably superior in a digital file as opposed to a ISO 200 strip of film, there are always trade-offs.

With film, you can use a rule of thumb that your slowest shutter speed with a particular lens is equal to it's focal length. For example, if you're shooting with a 100mm lens, the slowest shutter speed you'd want to use is 1/100 second, with a much higher shutter speed preferred if you had enough light to support it. Sports photographers would use a minimum of 1/500 second with a hand held 300mm lens, maybe letting it sneak down to 1/250th if they had something to lean up against for support. This usually works down to a 50 mm lens or 20mm where 1/60th was the minimum or 1/30 if they had support and the subject was not bouncing around.

With a digital camera this does not work. You need to jump up one whole shutter speed setting. If you have a 100mm lens on a digital camera, you'd need to use 1/200th second to ensure that you had a sharp image for most of the time. Part of the reason for that is that with no grain to mask any motion blur, a digital file shows up any weakness in this area much more than film. Also, most digital cameras have sensors smaller than a 35mm frame, so with a lens of an equivalent focal length used at the same distance as a film camera you're effectively capturing a smaller area so any movement is more noticeable. An extreme example of this is watching the football at your local park. Use binoculars and suddenly you have to keep very still to stop vision of the players from jerking around.

In practice, the fact that you can use ISO 200 instead of ISO 100 as your standard setting, you gain back the extra shutter speed. For example, with a film camera you might use ISO 100 film on a sunny day and get f8 @ 1/250th second. With digital you need f5.6 @ 1/500th second to get a sharp image with the same lens. However,
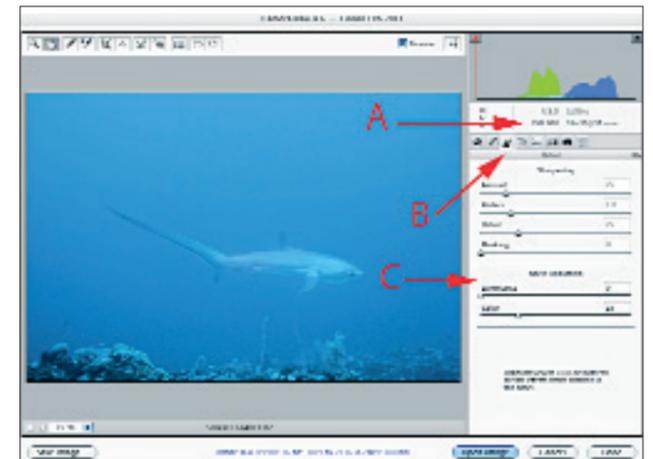
The RAW converter window in Photoshop allows you to work on noise before the RAW data is converted into a photographic file. A high ISO rating (A) was used because light levels were very low (in this case the image was shot at f3.5 @ 1/50th second, with a very steady hand and slight panning helping to keep the image sharp. ISO 1600 would have reduced the very real risk of losing the image due to movement.) Noise reduction is found in the third tab (B) but this option will vary depending on the software version used. Both Luminance and Colour (C) can be fiddled with.

because you are using an ISO which is one stop faster (ISO 200) you gain that one f-stop back so you have f8 @ 1/500th second.

So how does all of this apply to real world dive situations? Lets take a typical tropical reef scenario. It's after 4 pm, you're on a reef or sand flat and along comes a manta ray. It's too big and possibly too far away to light with a strobe.

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digital photography

Or your strobe may be used but because of the size and distance of the subject it isn't your primary light source. You fire off a couple of shots and check the LCD screen. Your histogram shows that you have a good exposure but when you check the numbers you see that the camera is firing off at 1/15th second. You know that with a large moving subject you're sure to have subject blur which is not what you want, especially if you intend to blow the image up for your office wall.

You're set at ISO 200, maybe you are on aperture priority exposure and your lens is almost wide open. The only way you can get a faster shutter speed is to crank up the ISO. You tweak the appropriate knobs and, bingo, you now have 1/125th second. All is good. The auto focus locks on, the camera fires and your manta is tack sharp. Your new office decor is in the bag.
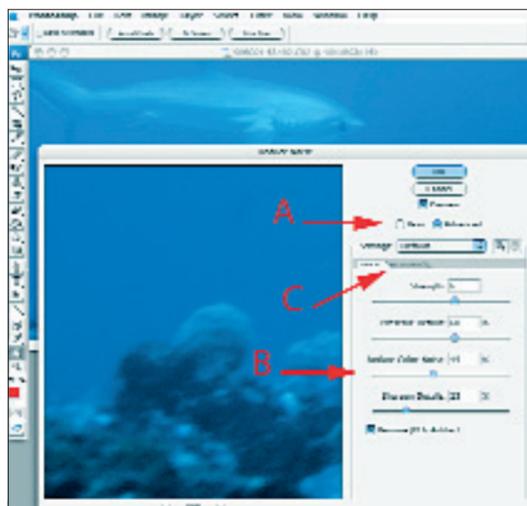
But then you get home, open up on your image on your computer, resize it to poster size and zoom in to 100% to check for any dust spots. What's this? In the shadows and in the plain blue water areas there are 'grainy' artefacts. In the shadows it looks speckled with red and blue pixels. Your ISO 1600 setting gave you a sharp image but also gave you a bad case of the 'noisies'. Just as photographic film has to use larger silver halide crystals to increase the ISO, your digital image has been amplified with a drop in visual quality due to the introduction of electronic noise.

If you were to visit a recording studio and listen to a music track on wide magnetic tape, you can play it back so loud that your ears bleed. There's so much information on a big fat master tape that you can amplify it without losing quality. But if you do the same with a compressed mpeg file on your iPod it sounds terrible. All the high notes and low notes are either distorted or missing. Fine audio details are gone or are covered by electronic hissing noise.

Sorry folks, the laws of physics keep us in check. A high ISO setting has consequences. But, as mentioned previously, a noisy image that's sharp is far better than a blurred image that has no noise evident. Fortunately technology can help us to cheat a little. In Photoshop and in most, if not all, camera brand RAW image file converters, there will be an area where you can tweak the amount of noise in an image. In Photoshop you find the item in the RAW image conversion window. The location of the noise reduction control varies between versions. In Photoshop 9 it's under the Detail tab. However, as usual, what the RAW converter window does is not as powerful as the main Photoshop application. If you fiddle around with the Colour Noise Reduction slider you may find that it fixes a small amount of noise. But for a more powerful tool open the RAW file and try a few of these processes in Photoshop.


When the image is opened in Photoshop, in this case without applying any noise adjustments in the RAW window, the Noise filter allows us to target Basic or Advanced modes with Basic allowing us to change colour noise (B). Advanced will give you another tab to target specific colour channels (C). Again, these options vary with the software version you are using.

Hue/Saturation
If the noise is primarily of one colour you can reduce the problem by choosing the appropriate colour from the Edit drop down list in the Hue/Saturation dialog box (Image>Adjustments>Hue/Saturation). Reducing the saturation will often remove or drastically reduce the problem. For example, if you find that your image has a lot of red noise artefacts, choose Red from the Edit drop down list then move the Saturation slider to the left. If this causes problems with other areas of your image, you can select the problem area before applying this process or you can use the History Brush tool to undo the saturation change in other parts of your image.

Using The Noise Reduction Filter
In Elements and Photoshop you have access to a noise reduction filter which has many more options that the RAW converter window. In Photoshop go to Filter>Noise>Reduce Noise. You'll see the changes you make with the sliders evident in the preview window. The Advanced option allows you to target specific colour channels. In Photoshop 10 you can also target luminance noise as well as or apart from colour noise.

Noise Reduction Plugins
Third party plugins can be purchased to help you tackle noise. Products such as Noise Ninja, Neat Image or other plugins have a few more controls and tweaks. Obviously it's cheaper to use just the powerful Photoshop controls but if you regularly have
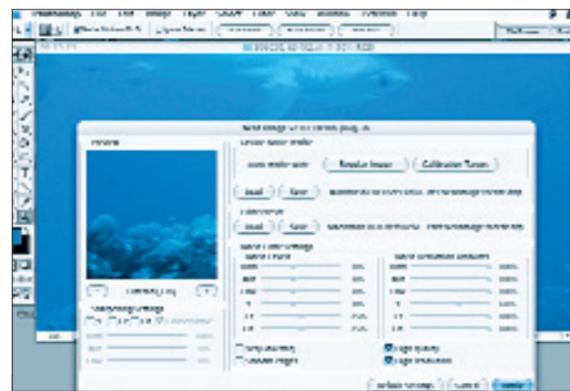
Neat Image is one of many plugins that can be added to Photoshop to target problem images. As you can see from this screen shot, Neat Image has many more options to target specific issues with image settings that produce noise. Noise Ninja, Imagenomic and Nik Dfine and others all offer noise control at a price.

problems with image noise you may find a plugin easier to operate.

Free Noise Reduction
It's the right price and does a far superior job. Obviously the best way to reduce noise is to keep your ISO as low as possible. Don't be lazy and set your ISO to 800 or above because it happens to be easier to get a result. If you must use a high ISO use it as sparingly as possible. You can pick up a couple of f-stops simply by getting lower on the reef and shooting up towards the surface a little more. Or if the subject is a reasonable distance away, such as our manta ray, use a wider aperture. Usually your lens will provide acceptably sharp resolution if it's closed down one stop from wide open. You may be using an ISO rating that could be lowered down to a much more acceptable ISO 400 or 200 just by opening up the aperture a stop or two.

Also, do not underexpose images. Remember that changing the ISO doesn't do anything physical to your sensor. It just means that your digital signal is being amplified which is where the noise artefacts come from. So if you're shooting in RAW format (and you are, right? Even if you opt for a jpg file as well as the RAW file to be saved.) don't think you can underexpose by a stop or two and rescue it later without any consequences. The final image will have noise and usually more than if you shot with an adjusted ISO setting. You cannot change the laws of physics, so keep your exposures spot-on to minimise the amount of noise produced.

If your image is primarily strobe lit, you'll be better off keeping a low ISO setting and using a longer exposure time to get the background light to register. Photographers have been shooting with long macro lenses with exposure times as low as 1/8th second or even less, pulling in background light to give a blue water or sunburst effect. The brief strobe exposure will freeze the subject and detail, while the long shutter speed will allow even low light levels to register. Keeping yourself propped solidly on the reef will allow you to get some great results using this technique. Practice makes perfect. Control your breathing, get nice and propped and fire away. Use your

The cheapest and best noise control comes from using normal ISO settings and holding the camera still. While not always an option, such as the shark image in the other illustrations, quite often all you need to do is steady your breath, prop yourself firmly, hold the camera steady and gently squeeze the shutter. This image was shot late in the afternoon on a dull, overcast winter's day. To get the background to register, I used a shutter speed of 1/8th second. This is where your histogram and LCD preview image are a huge asset in balancing strobes and background to give you the result you want.

exposure meter to get the required shutter speed by taking a reading off the background with the aperture set to your strobe exposure. So, if your subject to strobe distance with a 100mm macro lens gives you an f16 aperture, set the camera to manual on f16 and take a background reading, changing the shutter speed until you have a 'correct' exposure reading. Recompose, take an exposure then check your LCD image and histogram to make sure you're on target.

There are lots of other ways to reduce noise; alternative techniques or completely different methods. You may find the best results come from applying more than one method. See the list of links below for more techniques and tips.

> **LINKS**
www.layersmagazine.com/turn-down-the-noise-in-photoshop-cs3.html
http://graphicssoft.about.com/od/photoshop/ss/cs2reducenoise.htm
www.imagenomic.com/nwpg.aspx?gclid=CPnMlcqktpkCFVMwpAod0nuC7A
www.niksoftware.com/dfine/usa/entry.php
www.neatimage.com/index.html?gb2
http://help.adobe.com/en_US/Photoshop/11.0/WSB43BAF40-D3A6-4139-89F8-DCFCAF6F4F14.html
www.picturecode.com/