WILDLIFE PHOTOGRAPHY MASTERCLASS:

CAMERA SETTINGS

Everything you need to know
in a few easy steps

Mark Carwardine

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Written and photographed by Mark Carwardine

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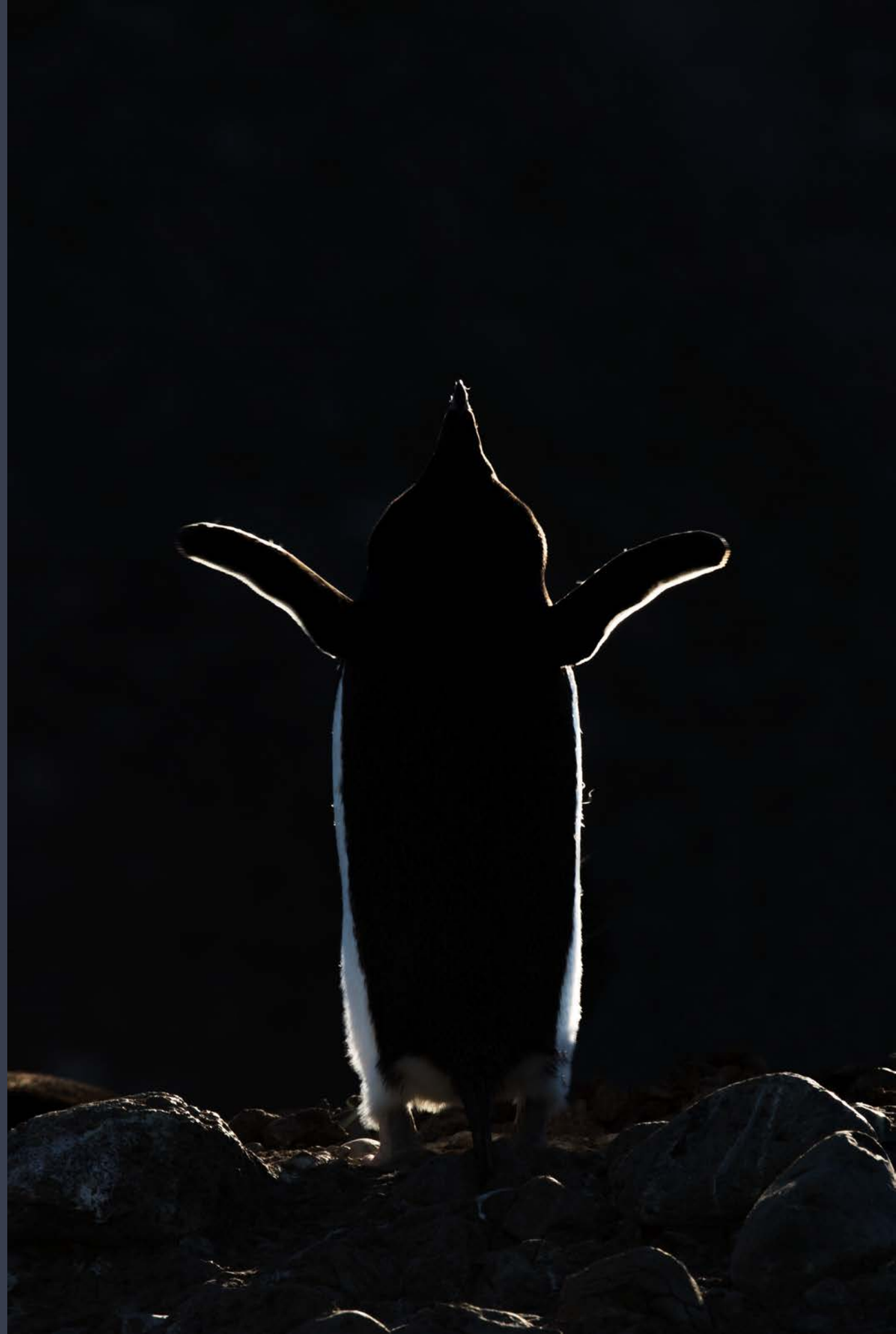

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INTRODUCTION

How many times have heard the immortal words "I love your photos – you must have a really good camera"? No one ever says to a writer "I love your books – you must have a really good word processor". Yet many people seem to think that the better the camera, the better the picture.

Admittedly, cameras that require a second mortgage to buy are usually better – and make it easier to capture certain images - but they can't choose where to point, how to compose the frame and when to release the shutter. Only we can do that. It really doesn't matter what camera you use, so long as you use it well. Indeed, I've seen some outstanding competition winners over the years, taken on the simplest equipment. And, of course, the digital revolution has brought surprisingly high-quality cameras within reach of almost anyone.

The reality is that, to take a great photograph, you need two things: a good knowledge of how your camera works (and how to make the most of it) and a good eye for composition. The aim of this ebook is to help with the first of those things (there will be another ebook, on composition, very soon).

It's possible to attend workshops on camera settings that last for days on end. But I'm going to keep it really simple. That doesn't mean glossing over the essentials – but it does mean making it manageable. You don't need to know everything, but it will help (a lot) if you know everything in this book. The fact that this is specifically for wildlife photographers helps, too - we can ignore the stuff that is only useful to wedding photographers, for example.

By steadily working your way through this book, and practicing, you will understand enough about your camera for it to be like an extension of your arms and hands. This is the trick - once you've mastered the technical side of wildlife photography, you are free to think about photography rather than menus and buttons. And there is no need to fret about white balance or f-stops, or whatever else you've been fretting about. If you can use your camera instinctively, your photography will improve in leaps and bounds. If, however, you still need to take your instruction book with you every time you leave the house, you'll struggle to take great pictures.

I should just add that this is how I do it. It's not the only way, of course, and everyone has their favourite settings and techniques. But it works very well indeed and, as you develop your own skills, you can adapt parts (or all!) of it to suit your own personal preferences and requirements.

HOW DOES YOUR DIGITAL CAMERA WORK?

We're going to be talking primarily about 'DSLRs' - Digital Single Lens Reflex cameras. 'Digital' (as opposed to 'film') is self-explanatory. 'SLR' identifies a type of camera that has two particular features:

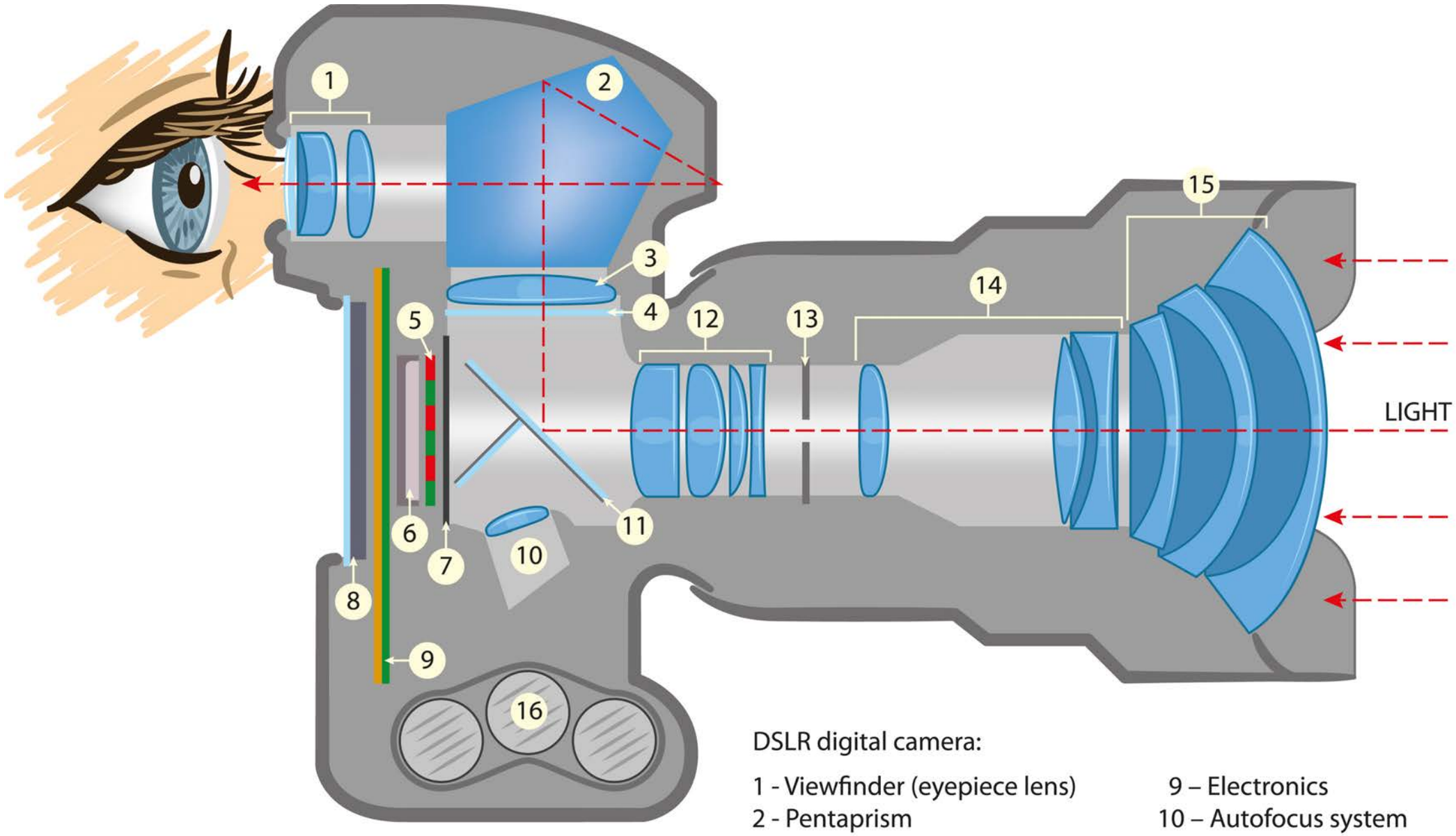
1. An interchangeable single lens that you look through and shoot through (rather than having one lens for shooting and another for looking).
2. A mirror (it's actually called a 'reflex mirror' because it moves) that flips up and out of the way (on a hinge) when you take a picture.

This is why DSLRs are so popular with wildlife photographers - one of their primary benefits is the ability to look through the camera's lens to see exactly what the sensor will be seeing when you take the picture. There are many variations on the theme and each camera manufacturer (Canon, Nikon, Olympus, Sony, Panasonic etc) has its own way of doing things. The menu systems and the design and positioning of the buttons, in particular, vary greatly. But the principles are exactly the same.

Personally, I use Canon cameras, and have done since 2015. But I was a Nikon user for nearly 30 years and have used most other makes along the way. And, having spent more hours than you could possibly imagine helping people on my trips with their multitudinous cameras and camera problems, I can honestly say that, if you learn how to use one camera properly, you can easily adapt to use another.

So how do they work? I wouldn't be able to make one myself, admittedly, but understanding the basic principles isn't rocket science. Have a look at the diagram on the next page and follow these ten easy stages:

1. Light from your subject passes through the **lens**. The lens consists of a number of distinct groups of light-gathering, zooming, stabilising and focusing elements (they change position to focus or zoom, for example).
2. As light passes through the lens, it goes through the **aperture** (which, technically, is part of the lens). The aperture is the opening in the lens which allows the light in. Controlled by a variable diaphragm (not unlike the pupils in our eyes) it can be varied in size to let more or less light in. More about this later.
3. Then the light hits a **mirror** inside the camera chamber. The mirror sits at a 45-degree angle and bounces the light straight upwards to a focusing screen. (Actually, a small amount of light passes straight through a semi-transparent area of the main mirror and hits another, secondary mirror which directs it down to the **autofocusing system**.) The mirrors are a major reason for the large size of DSLRs.
4. The light that is bounced upwards from the main mirror hits a **prism**, which simply bends it from vertical to horizontal before it hits the eyepiece lenses in the viewfinder. (Technically speaking, the correct term is 'pentaprism', which is a five-sided prism).
5. You'll notice that the **viewfinder** does not look directly through the lens (it's a little higher). But thanks to the mirror and pentaprism reflecting and bending the light, as you peer through the viewfinder you are effectively looking through the lens and see exactly what you are about to capture.
6. Then you press the shutter button and several things happen pretty much all at once. The mirror flips up (quite simply, it gets out of the way) to let light through to the **shutter**. (For as long as the mirror is up, there is a blackout in the viewfinder.) The shutter opens up to let the light through



DSLR digital camera:

1 - Viewfinder (eyepiece lens)
2 - Pentaprism
3 - Condenser lens
4 - Focusing screen
5 - Color and infrared filter
6 - Digital sensor
7 - Shutter
8 – Display
9 – Electronics
10 – Autofocus system
11 – Reflex and relay mirror
12 – Focusing elements
13 – Aperture
14 – Zoom elements
15 – Front light gathering elements
16 – Batteries

to the camera's sensor and then closes again to complete the exposure (it's open for a predetermined amount of time - the 'shutter speed'). Think of the shutter as working much like the blink of an eye.

7. And, finally, when the light hits the camera's **sensor**, it records the image. As soon as the picture has been taken, the shutter closes and the mirror drops back to its original 45-degree angle, to continue reflecting light into the viewfinder. And everything is ready for the next image.

You'll have noticed a few other bits and pieces in the diagram on the previous page that I haven't yet mentioned. Just in case you're interested, this is what they do:

Condenser lens - this is located immediately below the prism. It collects all the light, then redirects and condenses it. In other words, it focuses the light and ensures a bright image in the viewfinder.

Focusing screen - located immediately below the condenser lens, this is a glass or Fresnel surface on which the image is reflected by the main mirror

(you can see it by removing the lens and looking inside the body above the mirror - as shown in the picture). Basically, it allows you to preview and focus the framed image through the viewfinder. It is exactly the same distance from the mirror as the camera sensor (so if your subject looks sharp through the viewfinder it will be sharp in the final image).

Colour and infrared filter - this is actually a series of filters that eliminate unwanted infrared and ultraviolet light. They are essential to achieve realistic colours in the final image.

Display - like a mini computer screen, the LCD (Liquid Crystal Display) screen provides a visual reference of the images you've taken, their histograms, current settings or whatever else you select to look at. It can also be used in 'Live View' mode in which the main mirror flips up and the scene in front of the lens appears on the monitor (you can no longer see through the viewfinder but use the LDC screen instead).

Electronics - a catch-all term for three separate categories of electronics: for photo capture (recording the images), controlling the camera, and for the user interface (anything to do with controlling the camera or interacting with it).

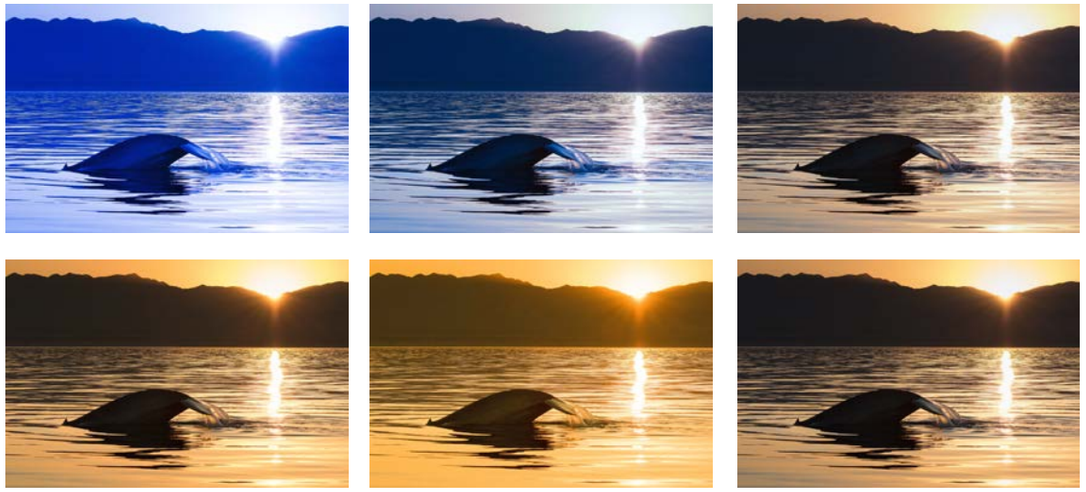
THINGS YOU CAN SET... AND THEN PROMPTLY FORGET ABOUT

There are a couple of important settings that you can do on day one - and then you don't have to worry about them ever again:

File naming

Every image you take is assigned a file name/number by your camera (eg IMG_1234.CR2 or DSC_5678.NEF). The first letters are unique to the manufacturer (IMG for Canon, DSC for Nikon and Sony, and so on). You can either leave them as they are or assign your own letters (I use my own initials as well as a code for the place and the date, eg 'MCME-0620' for 'Mark Carwardine Mexico June 2020'). The last letters, after the full-stop, are unchangeable and signify the type of file: if you shoot raw they will vary from manufacturer to manufacturer (CR2, CR3 or CRW for Canon, NEF or NRW for Nikon, ARW for Sony, etc); if you are not shooting raw, or once you have processed your raw files, the end letters will automatically be 'tif' or 'jpg'.

The number in the middle is more problematic. The file number is like the frame number on a roll of film, and continues in sequence (1, 2, 3, 4 etc). If you don't do anything, every time you re-format your CF or SD card the numbering goes back to '1'. So you'll end up with umpteen pictures with exactly the same number and you'll quickly get into a right old muddle. To avoid this problem, in your camera's menu system, under 'file numbering', simply set it to 'continuous'. Then, if you took 1,000 pictures one day, and re-format in the evening, the first picture you take the next day will be '1001'. Ultimately, you'll have a lovely collection of individually-numbered pictures from 0001-9999. That's plenty for most shoots or trips - so long as you personalise the file numbers afterwards and start again every time you do a different shoot or trip.



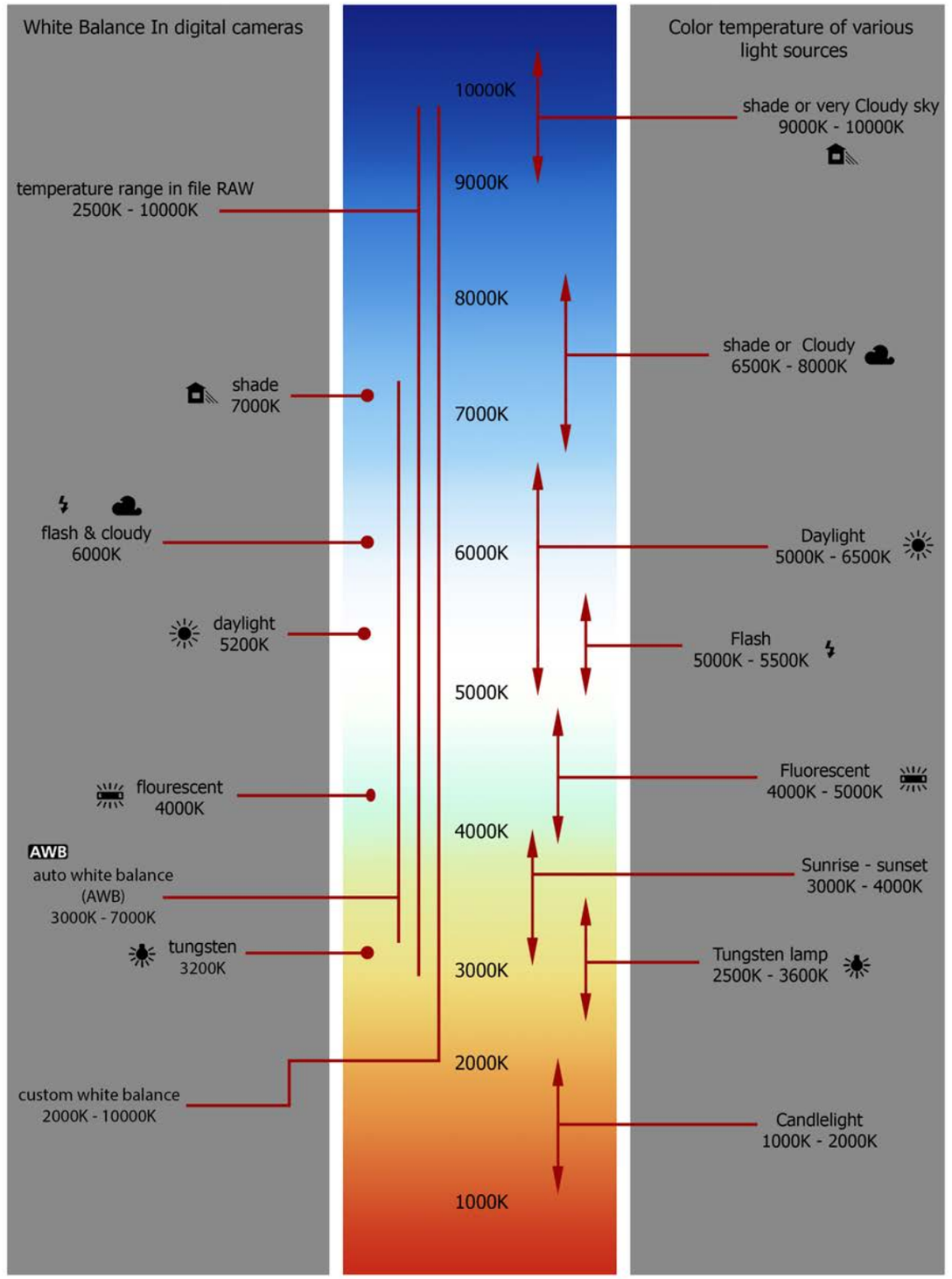
White Balance

Have a look at these pictures of a blue whale. They are all identical except for one thing: the white balance (the correct image, incidentally, is bottom right). White balance is your camera's way of adjusting colours so that they look natural.

Different light sources produce different coloured light (ie they have different 'colour temperatures'). These can be expressed using a measurement called 'degrees Kelvin'. Colours over 5,000K are 'cool' colours and those below 3,000K are 'warm' colours (you'd have thought it would be the other way round but, bizarrely, it's not). So a tropical sunset is about 1,850K and a clear blue polar sky is at least 10,000K.

The human brain is excellent at processing the information that comes from our eyes and automatically adjusting the colour temperature so that we see colours correctly. We can tell that it's golden light, for example, or that it's cloudy - and we take it for granted. Modern digital cameras are pretty good at doing the same thing by correcting the colour temperature (they do this by estimating the Kelvin value based on any white object in the picture that serves as a reference point). This is critical to make your photos looks as natural as possible. Otherwise, they appear to have a colour cast (such as an overall blue or orange tint).

I have my cameras set on Auto White Balance all the time. Usually, it's spot on. But it's not foolproof - as you can see from the diagram opposite, auto isn't so good with extreme warm or extreme cold colours, or indoors without flash (when your pictures tend to look yellow). But even when it doesn't get it quite right it makes a pretty decent attempt. And I shoot raw files (we're coming to that in a minute) and so I can easily correct it with a click or two in Lightroom, as if nothing ever happened (and without any loss of image quality). My attitude is that wildlife photography is challenging enough without having to worry about settings that you can happily put on auto and forget about. White balance is one of those settings.



Drive mode

Five main drive modes are available on most modern DSLRs:

1. **Single shot or single-frame (S)**. This is the default mode and does exactly what it says on the tin: every time you press the shutter button the camera takes a single picture. Even if you keep pressing the shutter button it will still only take one picture. To take another picture, you have to lift your finger and press the shutter button again.

2. **Continuous or burst (CL or CH)**. The camera keeps firing for as long as you hold the shutter button down (or until the memory card is full). You have a choice between high speed (more frames per second, or fps) or low speed (fewer fps).

3. **Silent shooting**. This softens (rather than eliminates) the noise of a DSLR while shooting. You can use it while shooting single shots or a continuous burst. Silent shooting can be very useful in wildlife photography, of course, but the catch is that the camera has to be in 'Live View' mode (you can't look through the optical viewfinder - because the mirror is locked up) so you have to use the LCD screen on the back of the camera instead.

4. **Self-timer**. Your camera waits a specific number of seconds (typically two, 10 or 12 - depending on what you select) before releasing the shutter and taking the picture. This is useful for taking self-portraits (it gives you time to run in front of the camera) and, more importantly, for minimising camera shake when using a tripod (it means you don't have to touch the camera at the moment the picture is taken).

5. **Remote**. This enables you to fire the shutter using a wireless or cable remote control.

So which drive mode should you use? Well, my cameras are nearly always set on continuous or burst mode - and I strongly recommend that you do the same. It will dramatically improve the overall quality of your action shots, by increasing the chances of capturing those split-second moments when the light, expression and pose are all absolutely perfect.

The reason is simple: wildlife rarely stays still. When you're photographing a bird pecking at a window, a surfacing porpoise, or any other active animal, shooting a continuous burst is a no-brainer. It's almost impossible to predict and capture the perfect moment with a single shot. But shooting a burst (anything from three to 16 frames per second) increases the odds exponentially (generally speaking, the more you spend on your DSLR the

faster the maximum frame rate). You're far more likely to get a shot of the bird in exactly the right position (look at the reflection in the mirror in this example), or the porpoise right out of the water, by taking lots of shots in rapid succession.

The same applies even when an animal is fairly static, as it may blink or move its head slightly between shots, and continuous shooting ensures that you capture the perfect. Plus, if the animal suddenly yawns, for example, you are far more likely to capture the critical moment among the burst of images.

Don't bother with low speed bursts - you might as well do it properly and shoot at high speed all the time. The more images you take, the greater your chance of capturing the moment. Having said that, it's a good idea to shoot in small, considered bursts. Try not to use the 'scattergun' approach, as if you're mowing down an army with a machine gun. I tend to wait and wait and wait, and then fire short(-ish) continuous bursts at the right moment.

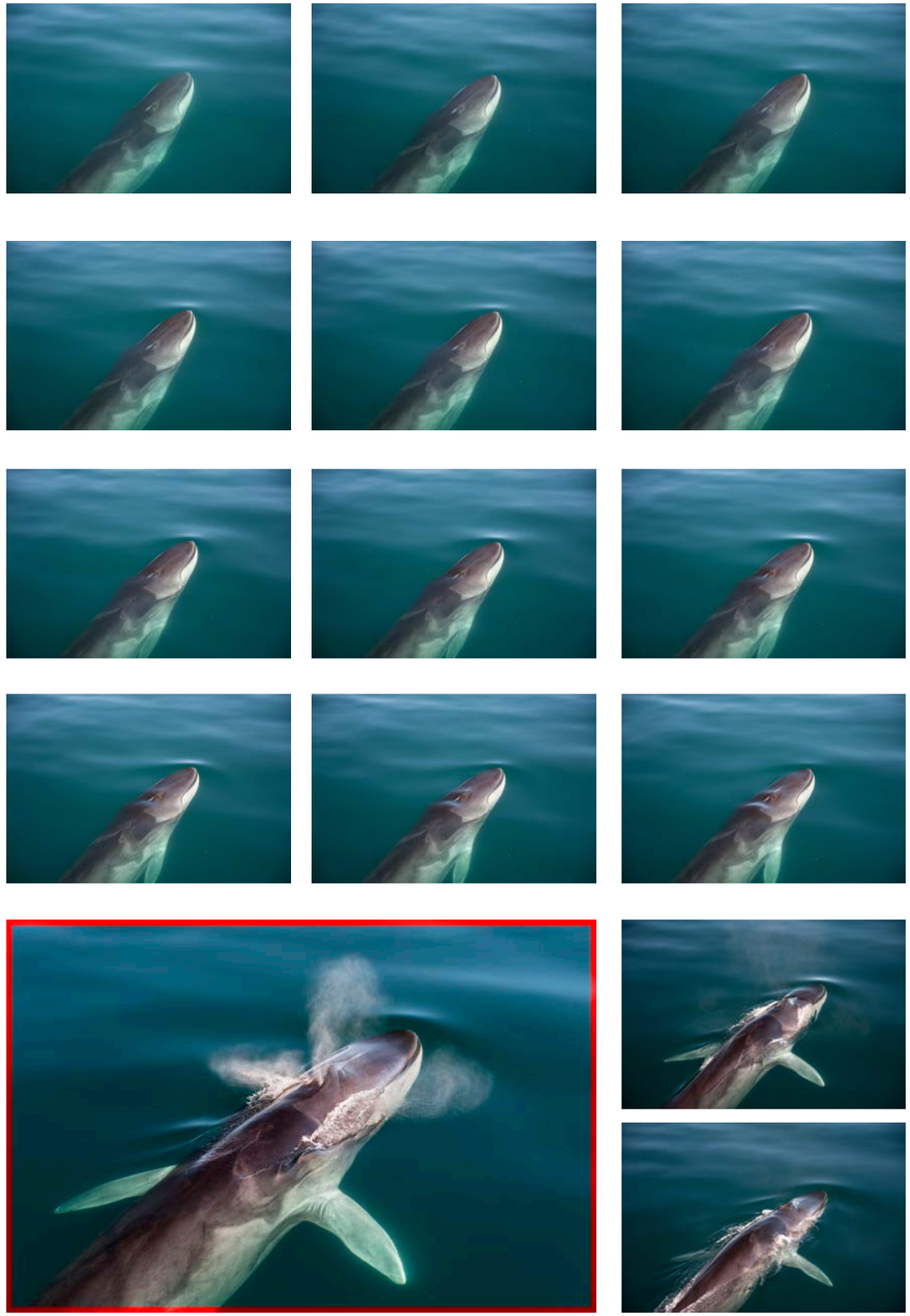
Incidentally, another advantage of continuous shooting is that it can also help to reduce camera shake, because your finger is resting on the shutter button rather than jabbing at it as you would in single-frame mode.

Finally, there are three downsides to shooting high-speed bursts all the time (though they definitely shouldn't stop you using this mode):

1. It takes up more space on your memory card - so you need to use bigger cards and/or have spare ones close to hand.

2. It means that you have many, many more images to edit. But that's alright because it doesn't necessarily mean you have more images to process. The whole point is that, usually, a single image will leap out from the crowd of a burst - and that's the one you process.

3. Continuous bursts may slow down your camera as its buffer gets filled. When you take a picture, your camera first copies it into its own buffer and then it is moved to a more permanent memory - your memory card (which is much slower and holds everything up). Therefore, your camera's advertised maximum frames per second can only be achieved while there is room in the buffer. If there isn't, the burst rate will slow down considerably as the camera waits for free space to come available. Using a fast memory card helps to extend your continuous shooting, by allowing the buffer to unload images faster; also, the buffer tends to be bigger and better in more expensive cameras. Shooting jpegs speeds things up, too, because they take up less space - but that doesn't help because you still have to shoot raw, if you're taking your wildlife photography seriously!



RAW VS JPEG

A digital camera can shoot two different file formats: jpegs or raws. Which should you shoot? I shoot raw. I always have and always will. And now I am going to explain why - and I'll try to encourage you to do the same. If you want to improve your wildlife photography, shooting raw is a critical first step.

Admittedly, jpegs and raws each have their place. It's not true that 'real' photographers only shoot raw - many top sports photographers, for example, shoot jpeg because they are quick and easy and can be uploaded to the internet while a match is still being played. But wildlife photography is different. We have time to process our pictures carefully and lovingly after a shoot (well, in theory - I'm way behind with my editing and processing!).

'Raw' means 'not analysed, evaluated or processed for use' - in other words, nothing is done to it in your camera. It's exactly as you took it. While we're on the subject (though you don't need to know this) 'jpeg' is an abbreviation for 'Joint Photographic Experts Group'. It's always shortened to 'jpeg' or even 'jpg' (because computer geeks love TLAs – three-letter acronyms).

If you were to take two pictures of the same subject with identical settings - one as a raw and one as a jpeg - would you notice a difference? Yes, you would. The jpeg would look better. So why would anyone in their right mind shoot raw? The reason is simple: your camera fiddles with the jpeg (that's the whole point) but doesn't touch the raw. While raw files are inherently flat, soft and under-saturated, jpeg files look better (thanks to pre-processing in-camera that makes any improvements deemed necessary). In fact, the preview you look at on the LCD screen on the back of your camera is a jpeg, so even that looks better than the raw file itself.

This is why so many people give raw a go - and then immediately give up and go back to the bad old days of shooting jpegs. But they're missing the point (and missing one of the easiest ways to improve their photography).

There are entire books on this subject, but I am going to keep it simple. Just enough for you to make an informed decision. You'll see a summary of the pros and cons of shooting raw versus jpeg on page 16 but, first, let me explain the main differences in a little more detail.

The main practical difference between a jpeg and a raw is that a jpeg is not supposed to be processed by you, the photographer. That's all done for you by the camera, which adds sharpening, corrects the exposure, fills in the highlights, tweaks the contrast, reduces any noise, adjusts the white balance, and so on, to make your picture as close to perfect as possible. Think of a jpeg as a Polaroid print - the result is instant but you're not able to (or not supposed to) make any adjustments.

Working with jpegs is convenient and means you can spend less time at the computer and more time shooting (or sleeping). You can process them, if you really want to, but you'll find it's fraught with problems. Here's why:

Compression

A jpeg is a much smaller file than a raw. That can be a big advantage, for two reasons: it takes up significantly less space on your CF or SD card and your hard drive, and it doesn't cause problems with 'buffering'. (As we've just learnt, the 'buffer' is the memory used to store image data before/as it is being written to a memory card; the size of the buffer, combined with the size of the image files, determines how many pictures can be taken in a rapid burst before the buffer fills and shooting grinds to a halt.)

But the problem is with the way the camera makes a jpeg file smaller. When it saves the image, it compresses it. And that involves discarding and losing quite a lot of data. The greater the compression, the smaller the file - but the more data is lost. Admittedly, it is done quite well. But a jpeg straight out of the camera is by no means perfect. The camera isn't as good as a proficient photographer at processing. For example, the algorithms for sharpening are much less powerful and, consequently, jpegs are often over-sharpened.

The real issue with compression, though, is when you try to process a jpeg. Since there is less data your processing capabilities are severely limited. There are fewer shades of colour (more about that in a moment), there is less dynamic range (the difference between the lightest and darkest tones in the image) and it's harder to draw detail out of deep shadows and bright highlights (because, quite simply, the detail is no longer there).

In contrast, a raw file is not compressed, no data is lost, and you have everything you need to squeeze out the very best from your camera's sensor.

Having said all that, storing files as jpegs is a different matter altogether. Just by looking at it, you can't tell the difference between a large jpeg (ie size 12) and a tiff file (a processed, but uncompressed file). And jpegs take up less space. So it's fine to store all your edited and processed images as jpegs.

Number of colours

A major difference between raw and jpeg is the number of colours. You can't tell the difference just by looking (our eyes and most computer monitors aren't good enough) but it becomes obvious when you start to process your images and make colour corrections.

Every colour in a digital image is made up of a combination of the three primary colours (red, green and blue). Combining colours gives you an almost infinite number of other colours. This is all explained in my sister book **Digital Workflow for Wildlife Photographers**, so I'll just give the headlines here.

Jpegs have 256 shades of red, 256 shades of green and 256 shades of blue; multiply them all together and you get roughly 16.8 million colours. Raw files have 65,536 shades of red, 65,536 shades of green and 65,536 shades of blue; multiply them all together and you get roughly 281 trillion possible colours. While that is a phenomenal difference, you may be wondering why it matters. Surely, 16.8 million unique colours is enough? After all, our eyes can distinguish between 'only' 7-10 million colours - and each picture probably contains no more than several hundred thousand colours at best. The answer is simple: it becomes a huge advantage when you are editing. If you don't have enough orange variations, for example, you can't achieve a smooth transition from one shade to the next and you get 'banding' or 'posterisation'. You can see this in these two images of a walrus. The top one shows banding (you can actually see the visible edges between shades) and the bottom one shows smooth gradation between the subtle shades.

The bottom line is that you can correct raw images with a much higher degree of accuracy and control. And the results are significantly better.

Non-destructive and destructive editing

You can process a jpeg, but the overall image quality will suffer. You can even process a jpeg in Lightroom (which is really designed for processing raw files). Lightroom itself doesn't degrade the image, but you still end up with twice as many compression artefacts. One set has already been introduced by your camera. The second set is introduced by you when you export the processed image (every time you open and save a jpeg you are further compressing an already-compressed file and discarding yet more information). You'd have to do it a number of times to see the degradation, but it is there.

In contrast, you can open, process and export raw photos as often as you like and there is absolutely no degradation or loss in quality - and you never have to worry about ruining you original file.

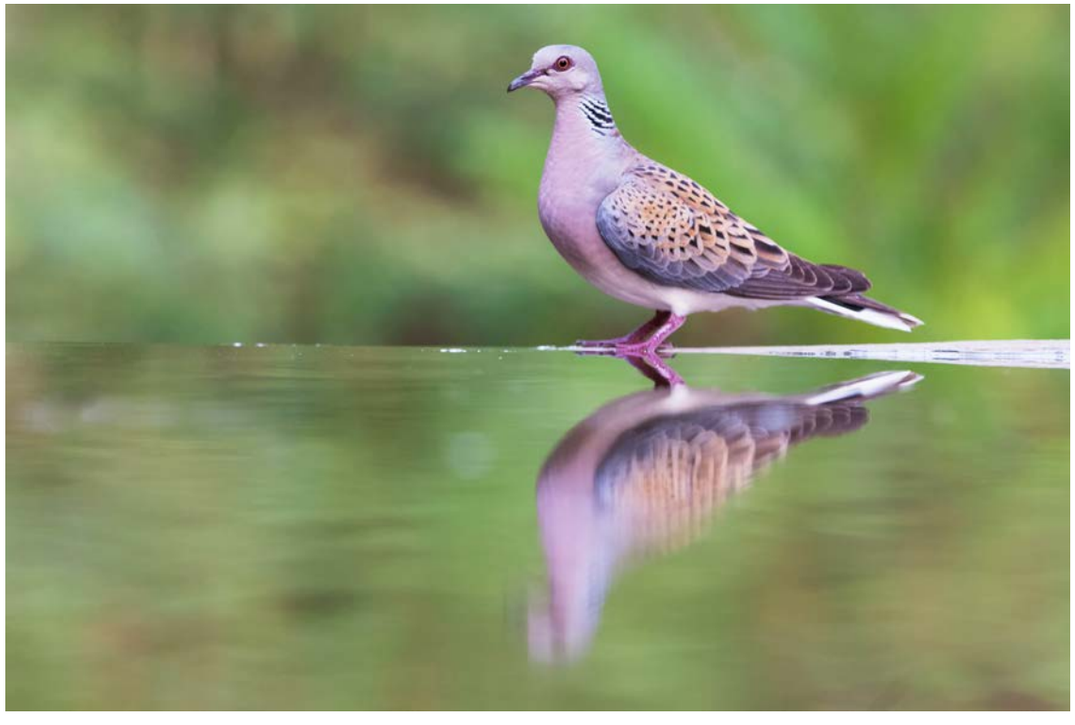
Processing time

If you shoot raw, you have no choice but to process them. You can't upload them to Facebook, Flickr, Instagram, your blog, your website, or anywhere else. You have to be prepared to spend time on them. And, of course, you have to be quite good at processing them - otherwise, jpegs may look better. But that's a minor hurdle that can be overcome with a little practice.

The bottom line

If you're not keen to mess around with processing your photographs, and don't need the ultimate in quality (or want to post them immediately on social media) then you should shoot jpeg. But, if you want to have creative control (ignoring the camera's idea of what the recipe for the picture should be), get the very best out of your images and take your wildlife photography to another level, you should shoot raw.

Needless to say, if you're shooting jpegs but you're also spending time on your computer processing them, then you're completely mad. What's the point? You might as well shoot raw. And, finally, if you can't make up your mind, you can always shoot jpeg and raw simultaneously. It will slow down your camera, and take up more storage space, but at least you can keep your head buried in the sand.



RAW format pros

Mind-boggling number of colours (281 trillion potential colours altogether) for smooth transitions between different shades.

Uncompressed - no data is lost.

Non-destructive editing - a raw file gives you much greater control over sharpening, exposure, highlights, contrast, noise reduction, white balance, colours etc with no loss in quality.

Higher quality end result.

RAW format cons

Rather like an old negative film, which needs to be developed in the darkroom, it has to be processed with software like Photoshop or Lightroom - so it is more time-consuming.

Uncompressed - the large files that take up a lot of space on your memory card and hard drive and can cause buffer problems in some cameras - but no information is lost.

More processing time.

JPEG format pros

Far fewer colours (16.8 million potential colours altogether) resulting in less smooth transitions between different shades.

Compressed - which means that the smaller file takes up much less space on your memory card and hard drive, and does not cause buffer problems.

Less processing time - the jpeg is pre-processed by your camera and, therefore, is designed to be used immediately for printing, posting on the web etc with no more input from you.

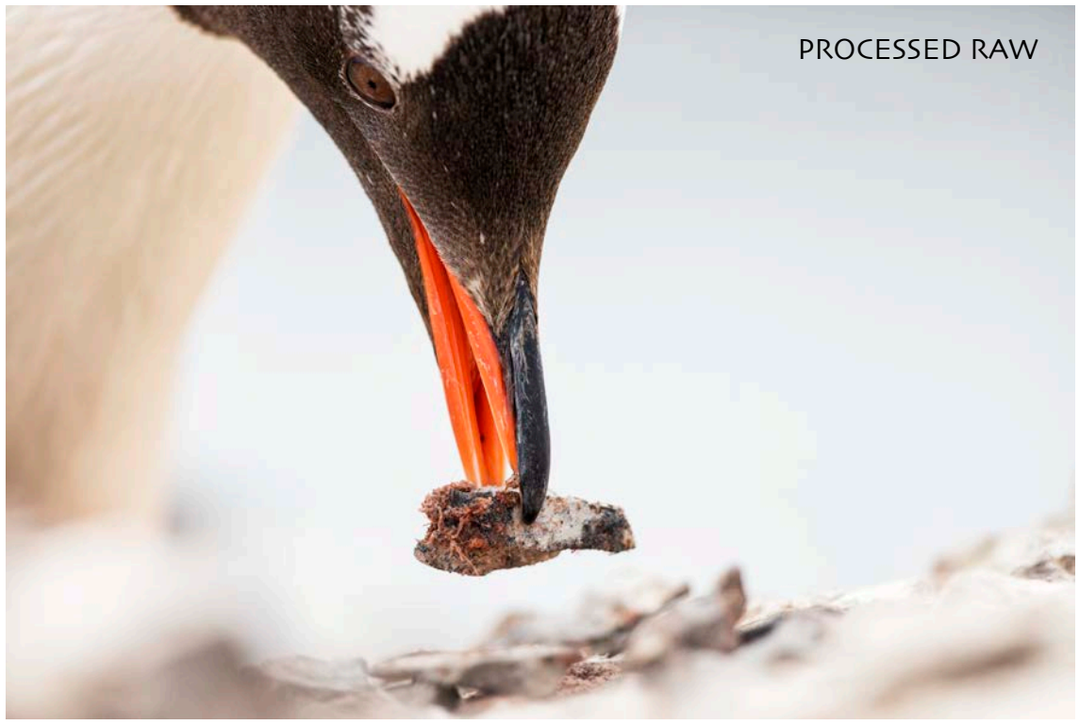
JPEG format cons

Rather like an old slide film (transparency) or a print that is the finished product - it shouldn't be tampered with.

Compressed - some data is lost.

Destructive editing - a jpeg gives you much less control over sharpening, exposure, highlights, contrast, noise reduction, white balance, colours etc with a much greater loss in quality.

Lower quality end result.



HOW DOES EXPOSURE WORK?

Exposure is a measure of the amount of light in a photograph. Photos can be underexposed (unacceptably dark - too little light hits the image sensor to make a good photo), overexposed (unacceptably bright - too much light hits the image sensor to make a good photo) or properly exposed (when you've captured just the right amount of light). Bear in mind, though, that 'properly exposed' is subjective and variable - it depends on what you are photographing and the effect you are trying to achieve.

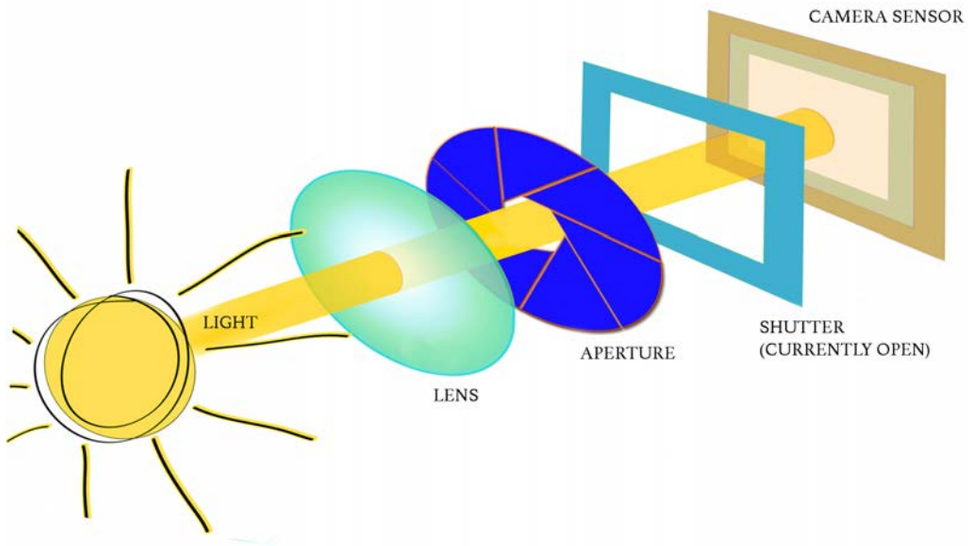
Overexposed

Underexposed

Properly exposed

Controlling exposure is a fundamental part of photography. You could use auto mode - and hope for the best - but that puts your camera in charge and it's not the best way to get great and creative photographs. Much of the time, auto will do a fairly good job but it has two inherent problems: it's by no means foolproof (it sometimes gets it wrong - in fact, in tricky lighting situations, it often gets it wrong) and it gives you no control (which is hopeless if you want to get more innovative and original).

So, you're never going to use auto exposure ever again - are you? Don't worry, taking control of exposure isn't difficult. Let's begin by understanding how a digital image is exposed. We covered the basics when we looked at how a DSLR camera works but, as a reminder, have a look at this simplified diagram.



The exposure is affected by three things:

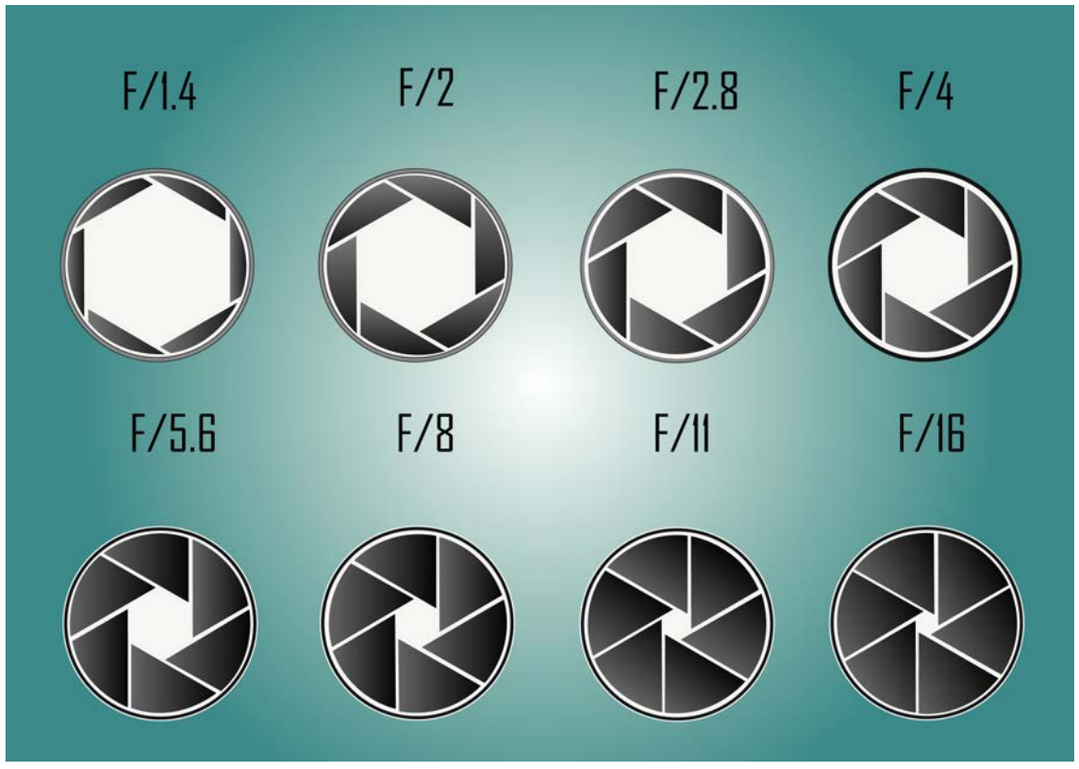
1. Aperture (the hole through which the light passes).
2. Shutter speed (the length of time the light passes through the hole).
3. ISO (the sensitivity of the camera sensor to light).

Together, these three make up what's called the 'exposure triangle'. Every time you change one setting, it affects the other two in a constant triangle. We're going to look at each one in turn and then learn how to use them in combination - not only for perfect exposures, but also to control everything from the 'depth of field' (the amount in focus) to sharpness in action shots.

APERTURE

The aperture is the hole in the centre of the lens that allows light to pass through. It works in much the same way as the pupils in our eyes (which dilate in darker conditions and contract in brighter conditions). As with our pupils, you can make the hole smaller or larger - and that, of course, has an immediate impact on the exposure (it also affects something else - the depth of field - which we'll talk about in a moment).

The most confusing part of understanding aperture is how the size of the hole is measured. It's measured using what are called 'f-stops' or 'f-numbers'. The main ones are f/1.4, f/2, f/2.8, f/4, f/5.6, f/8, f/11, f/16, f/22 and f/32 (sometimes, they are written simply as as f8 or F8, but it all means exactly the same thing). It's confusing - at first glance, anyway - because the smaller the f-stop, the larger the aperture (and the larger the f-stop, the smaller the aperture). You can see this in the diagram below. It all seems a bit contradictory.



You don't really need to know why this is the case. You just have to remember that a smaller f-stop equals a bigger aperture, and this makes the picture brighter (because it lets more light through); conversely, a larger f-stop equals a smaller aperture, and this makes the picture darker (because it lets less light through). And there's one other thing to remember - each step up on the main scale (eg from f/1.4 to f/2.8 or from f/4 to f/8) lets in half as much light.

In case you're a bit of a nerd, and interested, there is logic to f-stops. They are actually mathematical equations. Don't nod off - this is (surprisingly) interesting. The number is a fraction: so f/2 means one-half, f/8 means one-eighth, and so on. One-half is bigger than one-eighth, of course, so this explains why an apparently smaller f-stop equals a larger aperture. The letter 'f' stands for 'focal length' and refers to your lens (80mm, 200mm, 500mm, and so on). The mathematical equation enables you to calculate the physical size of the aperture, in millimetres, using the focal length and the number in combination. For example, if you have an 80mm lens and your f-stop is set to f/4, the diameter of your aperture will be 80 ÷ 4 = 20mm; or, if you are using an aperture of f/8 with the same lens, the diameter will be 10mm.

If someone tells you to pick a large or wide aperture, or to 'open up', they're recommending an f-stop like f/2.8 or f/4; if they suggest a small aperture, or

to 'stop down', they're recommending an f-stop like f/11 or f/16.

Understanding aperture is fundamental to photography. In fact, photographers care so much about it that camera manufacturers include the maximum aperture number in the names of their lenses - eg Canon 600mm f/4. More expensive lenses tend to have wider maximum apertures (they're called 'fast' lenses) for three good reasons:

1. A lens with a particularly wide maximum aperture is brighter, which means that you can shoot in darker conditions and still capture enough light.
2. The maximum brightness makes optimal use of the autofocus capabilities of your camera (and enables you to see as clearly as possible to compose more accurately).
3. The wider the aperture the easier it is to blur the background out of focus. This is probably one of the most exciting and useful tools in wildlife photography. By altering the aperture you can alter the 'depth of field' - the area of the photo that appears sharp. This is the fun bit. It's how you isolate your subject from the background.

Depth of field

Specifically, the depth of field is the zone that is sharp on either side of the point on which you focus. Everything in front or behind this zone, whether foreground or background, will look blurred.

There are two technical considerations when working with depth of field:

1. Your aperture. The wider the aperture (ie the smaller the f-stop) the shallower the depth of field.
2. Your lens. Generally speaking, the longer the lens, the shallower the depth of field (ie the narrower the sharp zone and the less there will be in focus).

Look at the two photographs of my pet owl, opposite. They were taken in front of a stone wall, using the same lens and within a few moments of each other. In both shots, I focused on the owl. But they look completely different. The one on the left was taken at f/32, and has a huge depth of field (not only is the owl sharp but you can see all the detail in the wall). The one on the right was taken at f/4, and has a narrow depth of field (the owl is is sharp, but the wall behind is blurred).

Depth of field is important because it's a way of making your subject 'pop'. You can shoot an owl in front of a stone wall and the wall becomes a simple colour wash - it doesn't compete with the owl for your attention. It's also a way of getting creative. You can play with backgrounds - and foregrounds - to make your images much more interesting.

With this in mind, when shooting wildlife, there are two other variables to consider:

1. Focusing on nearby subjects results in shallower depths of field (and, conversely, focusing on distant subjects gives greater depths of field).
2. The further away the background, the easier it is to use a wide aperture to blur it out of focus.

You can't actually see the depth of field just by looking through the viewfinder. This is because, when you are composing a picture and setting the aperture, nothing happens until you actually release the shutter. The aperture stays wide open - allowing the maximum amount of light in for the autofocus to work most efficiently - and then quickly closes (to whatever you've set on the camera) only when you press the shutter button all the way down. But the good news is that most DSLR cameras have a Depth-of-Field Preview button: when you press it, the aperture closes to whatever you've set (enabling you to see the depth of field as it will be when you take the photo).

There are no hard and fast rules about how out-of-focus something has to be before you notice it (it's quite subjective). In the picture of the Chatham Island

plover I've blurred the bushes behind (using a 600mm lens at f/4) just enough to remove all the busyness and make a green colour wash - and, despite all the potentially distracting leaves and branches, nothing draws your eye away from the plover.

You may have heard the word 'bokeh', which in broad terms refers to whatever lies outside the depth of field. More specifically, it is used to describe the aesthetic nature of the out-of-focus areas of a photo (its aesthetic quality rather than a specific amount). You either have 'good bokeh' or 'bad bokeh', not 'large bokeh' or 'small bokeh'. Generally speaking, the higher the quality lens the better the bokeh - you do get what you pay for.

And that's it. Of all the settings on your camera, aperture is the most confusing - and, arguably, the most useful. It's the single most important thing to master and the best reason for taking your camera off Auto. Selecting the right depth of field will take your photos from 'snapshot' to 'professional'.

As an aside, landscape photographers typically shoot at the other end of the aperture scale. They prefer a large depth of field, which keeps as much of the scene in focus as possible from the foreground to the background, and often shoot at f/16, f/22 or even f/32. But a small aperture doesn't allow much light into the camera, of course. This is where the exposure triangle kicks in - a small aperture requires a slower shutter speed - and this is why so many landscape photographers use tripods. But now we're getting ahead of ourselves.

SHUTTER SPEED

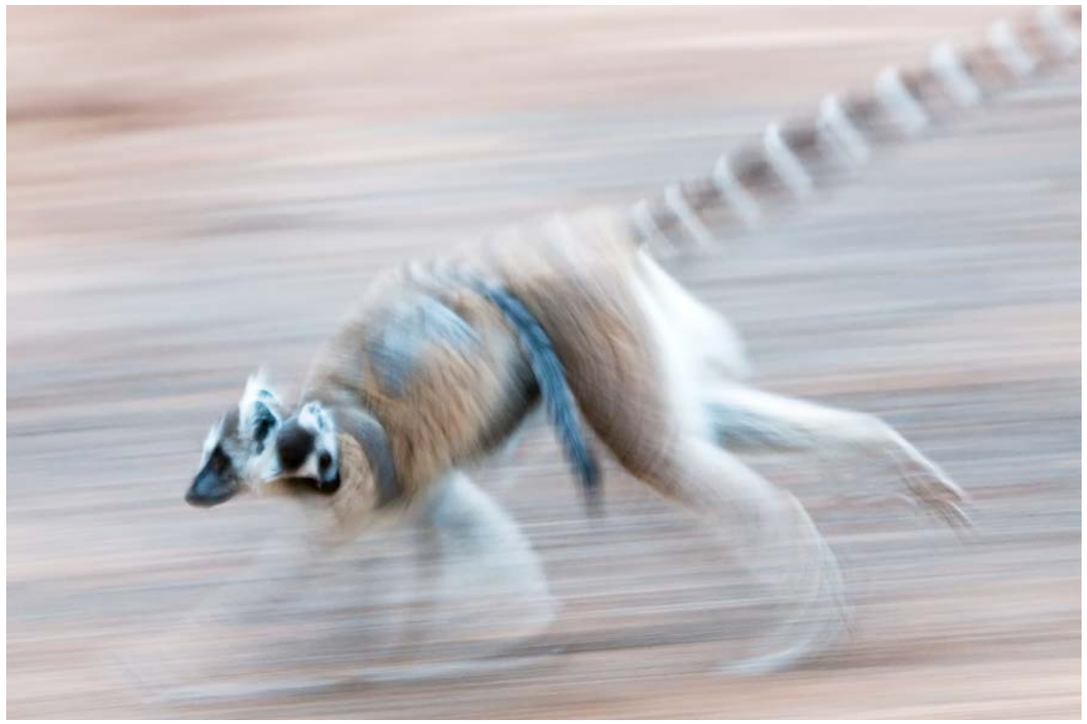
Think of your camera's shutter as a door that can be opened or closed. When you take a picture it is open for as long as you've set it to open, allowing light to pass through to the sensor and expose the image. When it is closed - when you are not taking a photograph - it stays shut and no light reaches the sensor.

The 'shutter speed' is the length of time the door remains open. The longer it is open (ie the longer the shutter speed) the more light passes through the hole in the lens (the aperture) and the brighter the image. (Technically speaking, it's slightly more complicated than that - the shutter speed is how long each pixel of the sensor is exposed to light - which doesn't affect us now but becomes more relevant when using flash.)

Shutter speed is one of the most important settings on your camera and can make or break a photograph. Quite simply, it either prevents or accentuates blur. Most of the time you want to capture sharp images, of course (as in the leaping bottlenose dolphin); when the shutter is only open for a tiny fraction of a second, you can freeze a moment in time. But sometimes blur can be used to create a sense of movement (as in the ring-tailed lemur mother and baby).

It's even more than that. A fast shutter speed helps to avoid camera shake (a form of blur that ruins images, caused by moving the camera when you take a picture); this is critically important because camera shake is impossible to correct in image-editing software such as Lightroom or Photoshop. At the other end of the scale, if you're using a tripod, a slow shutter speed enables you to shoot in surprisingly dark conditions. Shutter speed is also linked with aperture (as we'll soon discover): a slower shutter speed means a smaller aperture and, consequently, a greater depth of field.

Depending on your camera, possible shutter speeds typically range from as long as 30 seconds (often shown as 30") to as short as 1/8000 (one eight-thousandth of a second). There is also an untimed shutter speed, called 'bulb' (a strange name, to do with the way very old camera shutters worked); you determine the length of the exposure simply by pressing the shutter button down for as long as you want it to remain open (or you can use a wireless remote or a shutter release cable, to save your finger all the effort).



As you move up the shutter speed scale - from 1/15 to 1/30, for example, or from 1/250s to 1/500s - you halve the amount of light hitting the sensor. Likewise, if you move down the scale - from 1/1000 to 1/500, for example - you double the amount of light. Each step is known as a 'stop' (a stop of shutter speed either halves or doubles the amount of light entering the camera).

So which shutter speed is best? Well, that depends on four things:

1. **The amount of available light**. The less light, the slower the shutter speed needs to be to get a satisfactory exposure (although, as we'll see, it's always a balancing act between shutter speed, aperture and ISO). Indeed, the light conditions will often dictate whether you shoot with fast shutter speeds or get more creative and use slower ones.

2. **What you are photographing**. The subject and what it's doing are also critical considerations. You could get away with a much slower shutter speed on a tortoise, for example, than you could on a hummingbird in flight. If you are shooting a portrait of an animal that is staying still, with good camera and lens support you might be able to shoot at 1/50 second. Walking animals might need 1/500 second, running animals at least 1/1000, large flying birds from 1/1600 second, and small flying birds 1/4000 or even faster. With practice, you get a feel for the right shutter speed to aim for, and then it's a matter of experimentation.

3. **How you want the photograph to look**. If you want to freeze the action, you will need a fast shutter speed (with any active or moving animal that means at least 1/500 second). But if you want to show dynamic movement, by creating intentional blur, you'll need a slow shutter speed (if the shutter stays open for longer, the subject has more time to move across the frame while the picture is exposed - and this creates blur). For intentional blur, try starting with a shutter speed of 1/30 second. The result will depend on the subject, how fast it is moving and how much detail you want to be able to see. Do a few test shots and take it from there. It's usually better to pan (that is, follow your subject in the frame) to make the background blurred and the running, swimming or flying animal as sharp as possible (otherwise, the whole image will be a blur of unrecognisable shapes and colours). This is a challenging technique that requires practice and more than a smidgeon of luck, but at its best can produce outstanding results.

4. **Which lens you are using**. Long, powerful lenses (300mm, 500mm, 600mm etc) magnify camera shake and are the most common cause of fuzzy images. When you are hand-holding a long lens you need to use a

faster shutter speed to keep your images sharp. Remember that an ounce of movement of the camera becomes a ton of movement in the actual photo.

It's hard to give precise figures for hand-holding, because it depends on how good you are at holding your camera still (do you have steady hands?), how heavy the lens is (and how strong you are), whether you are on dry land or shooting from a rocking boat, how much coffee you have been drinking, and so on. But a very simple rule of thumb is that you should not use a shutter speed slower than the reciprocal of the focal length of the lens. So, for example, if you are using a 500mm lens, don't shoot any slower than 1/500 second; if you are using a 200mm lens don't shoot slower than 1/250 second. These are minimum suggestions - ideally, shoot even faster. (If you're not shooting with a full-frame sensor, as with some mirrorless cameras, you need to take the crop factor of your sensor into account: if the crop factor is 1.5 then multiply that with the focal length of the lens to get the minimum handheld shutter speed; 300mm becomes 450mm which requires a minimum shutter speed of 1/500.)

Nowadays, many lenses have built-in image stabilisation or vibration reduction (there's a special section on these so-called IS/VR lenses at the end of the book). This allows you to capture sharp images at shutter speeds several times slower than previously possible. Most of these lenses are good for at least 'two steps' (which is the way the manufacturers describe them). 'Two steps' means that, instead of 1/500 second for example, you could get away with shooting at 1/125 second). Some modern lenses claim as much as a seven-step gain: instead of shooting with a 500mm lens at 1/500 second, in theory, you can shoot at 1/4s (1/500 - 1/250 - 1/125 - 1/60 - 1/30 - 1/15 - 1/8 - 1/4). But the ultimate advantage is that, by using slower shutter speeds, you can shoot with smaller apertures and lower ISOs. Bear in mind, though, that image stabilisation can't freeze fast-moving subjects at slow shutter speeds - it can't correct blur caused by the subject. It's designed specifically for limiting camera shake.

Having said all that, most very long telephoto lenses (500mm and upwards) are too heavy to hand-hold for any length of time, so try to use a tripod if you possibly can. If you do, remember to turn off the image stabilisation, because many (though not all) IS or VR lenses detect their own vibrations and try to counteract them in what's called a 'feedback loop' - which actually shows up in your images as blur.

The bottom line? My advice is to practice to see how good you are at hand-holding different lenses at different shutter speeds, to know your boundaries. And then, unless you are aiming for creative blur, always to try and shoot with an even faster shutter speed than you think you can get away with.

How does the shutter work?

You don't really need to know how your camera's shutter works, unless you are using flash creatively. But it doesn't do any harm to understand what is happening every time you take a picture.

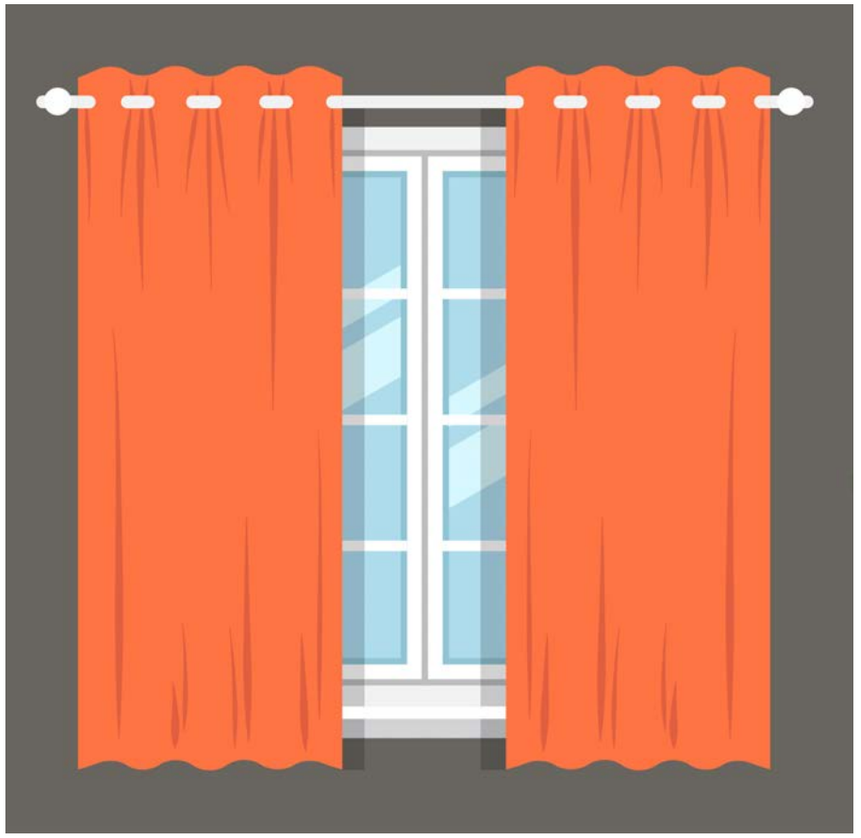
You don't normally see the shutter in a DLSR, because the mirror is in the way. But if you lock the mirror up you will see that, in fact, it isn't a single door that opens and shuts. It's more sophisticated than that.

There are several different kinds of shutter (mechanical and electrical) but the one that is most commonly used in today's DSLRs is the focal-plane shutter. It gets the name from its location: just in front of the focal plane (ie the image sensor).

Focal-plane shutters consists of a series of very thin overlapping blades (the technical term is 'shutter curtains' because, in the old days of film, they were made of cloth). They spend most of their time blocking the light - without them, a constant stream of light would be able to shine through the lens and hit the sensor. But when you take a picture, they get out of the way and allow light in to expose the image (for as long as you have instructed in your shutter speed settings).

Think of a focal-plane shutter as a pair of curtains hanging over a window in your house. If the left curtain is drawn right across the window (as if the shutter were closed) it blocks sunlight from entering the room. To let sunlight in - mimicking the way a focal-plane shutter exposes a picture - you start drawing both the left and the right curtains to the left, but leaving a six-inch gap between them. This allows a sliver of light to move across the room, until the left curtain is folded back on the lefthand side and the right curtain is drawn across the window. This is how fast shutter speeds work, by exposing the sensor one section at a time as the curtains move across at the same speed and with a gap between them (and it's why a camera has a 'flash sync speed' - the fastest speed that exposes the entire sensor at once); the smaller the gap, the shorter the exposure. Long exposures are achieved slightly differently: one shutter curtain opens up completely and exposes the whole frame for as long as is required.

The only difference between this analogy and modern focal-plane shutters is that the curtains move up and down instead of left to right (which used to be the case in film cameras and older digital cameras). This way, it gives more precise control of exposure and, since it has a shorter distance to travel (24mm instead of 36mm), can offer faster shutter speeds and faster flash synchronisation speeds.



ISO

ISO is the third component in the exposure triangle, along with aperture and shutter speed. Unlike the other two, it doesn't brighten or darken your photos by physically capturing more or less light. Instead, the ISO setting tells the sensor how much to amplify the light signal as it is captured.

For the nerdy among you, ISO stands for International Organization for Standardization (it's a shortened name, rather than an acronym), which sets the sensitivity standard for all photographic recording media (originally film, now digital).

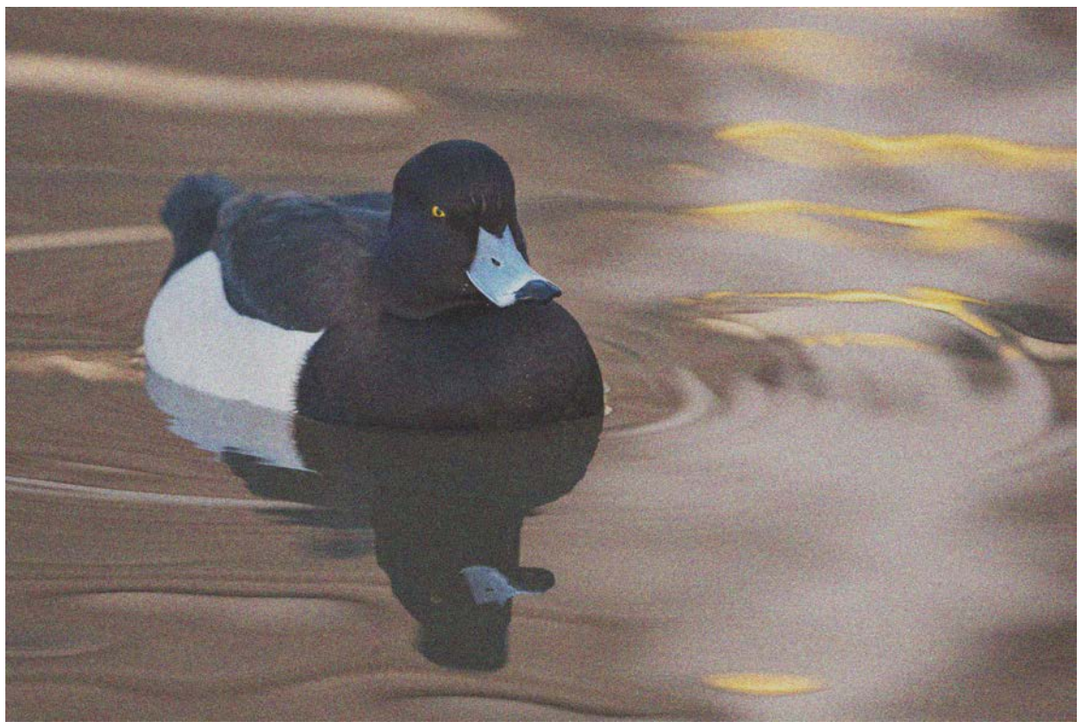
The easiest way to understand ISO is as the sensitivity of your camera's sensor to light. (Technically, this isn't quite correct - sensors have a single sensitivity, regardless of ISO; it would be more accurate to describe it as how much the signal is turned up or down - but you don't need to worry about such details.)

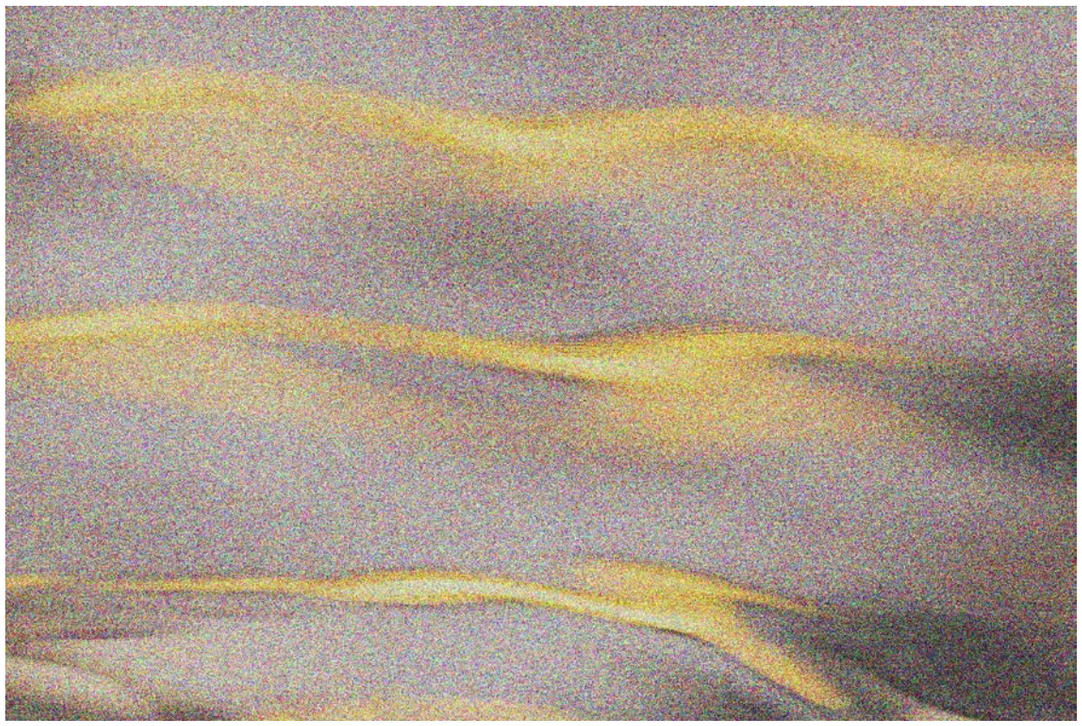
In simple terms, think of ISO as a setting that will darken or lighten your photos. Turning it up to a higher number makes the picture brighter, and turning it down makes it darker. Setting a high ISO has two advantages: it enables you to use a faster shutter speed (or a smaller aperture) because less light is needed for a correct exposure, and it enables you to capture images in darker environments. But it comes at a price, as we'll discover in a moment.

Another way to think about it is like film speed (if you remember the old days of film). Film boxes used to have ISO numbers on them (25, 64, 200, 400 etc) to indicate the sensitivity of the film to light (originally it was ASA or DIN numbers - you may have seen those). The lower the number, the lower the sensitivity (ie the film needed a lot more light to expose correctly). At the other end of the scale, 'high-speed' or 'fast' film (ISO 400, for example) was more sensitive and needed less light to expose the photo. The catch was that the light-sensitive crystals in fast films had to be larger to catch the light faster - and the pictures tended to look grainy. Another all-round problem with film, of course, was that once you had loaded a roll, you couldn't change the ISO for the entire shoot and were stuck with whatever film speed you had chosen.

This is where digital wins hands-down:

1. You can change the ISO in real time, from picture to picture, and react to changing lighting conditions or creative impulses on the fly.





2. You can also dial in much higher sensitivities, which enables you to shoot in much darker conditions and/or with much faster shutter speeds (or smaller apertures). The picture of the jaguar was taken at 6,400 ISO.

Most digital cameras start at 100 ISO and go to at least 6400. You'll notice that the numbers double as you move up the scale: 100, 200, 400, 800, 1600, 3200 etc - each doubling (from 200 for 400, for example) doubles the amplification and makes the picture twice as bright.

Some modern (and more expensive) models go as high as 3.2 million ISO. If you were brought up on film, as I was, such astronomical figures boggle the mind. In many cases, the seriously high ISOs are made possible by 'ISO expansion', which is a way of boosting the camera's ISO capability, albeit to sensitivity levels that the manufacturer considers outside the recommended range. But even 6,400 is a significant improvement on film.

Now for the caveat. It's all very well being able to increase ISO willy-nilly, but it comes at a significant price. As high ISOs magnify the light signal, they also magnify background interference and other unwanted signals - and the result is 'noise'. This is rather like grain in high-speed films (though, many would argue, far less easy on the eye) and is caused by pixels that are not representing the colour or the exposure of the subject correctly.

Not all image noise is created equal, and two main types are caused by high ISOs (there's another type - thermal noise - caused during particularly long digital exposures):

1. Chromatic or colour noise, which shows itself as small, random discoloured blotches and flecks in the image. This tends to be much worse in shadows and other darker parts of the image.
2. Luminance noise, which produces a grainy appearance (dark in the brighter parts of the image, and light in the darker parts of the image). This is created by under- and overexposed pixels. You can generally get away with more luminance noise in a photo than chromatic noise, before it becomes too unsightly.

At low ISOs, noise is essentially invisible. But the higher the ISO the more obvious it becomes. There is an inevitable tipping point, where it begins to compromise an image until it completely dominates and renders it almost useless. I've exaggerated the effect, to show you what it looks like, in these two pictures of a tufted duck.

It's worth noting that noise doesn't affect every picture in the same way. It isn't particularly visible in light areas or areas with complicated textures, and is much more visible in smooth, darker areas.

There other trade-offs, too: high ISOs mean less vibrancy and reduced dynamic range (the range of brightness levels or tones between the lightest and darkest parts of an image). This is important for a number of reasons but, in particular, a greater dynamic range means greater contrast. Therefore, an image shot at a high ISO tends to look flat and lacks 'punch': the dark areas become featureless black blobs, instead of beautiful jet blacks, and the light areas become featureless white blobs, instead of beautiful bright highlights.

So, how can you limit these adverse affects of noise?

First of all, test your camera. All DSLRs handle noise differently (one of the features you pay for when you take out a second mortgage to buy a top-of-the-range model is its ability to shoot at high ISOs with relatively little noise). Shoot a sequence of the same subject (preferably with plenty of shadow) in the same light, starting at the lowest ISO and working your way up to the highest. Then study them on your computer (not on the back of the camera) to determine where your camera's limits are. In other words, how high can you set your ISO and still get a usable picture? Hopefully, you will be pleasantly surprised - it's amazing how superb many modern DSLRs are these days and, in good light, the effect of ISO is usually trivial with settings under ISO 800 (especially if you're not blowing up your images to outrageous sizes).

Incidentally, you may be tempted to use your camera's built-in noise-reduction facility. I have this turned off all the time, but it's a matter of personal preference. It can do a reasonable job, in some cameras at least. But in-camera noise reduction is achieved in one of two ways, and each has its issues:

1. The camera analyses the image as soon as it has been shot, looking for any pixels that have been incorrectly rendered, then selectively fixes them. This can take some time (usually, at least as long as the original exposure) so it slows things down significantly.
2. The camera applies a blanket smoothing across the entire image, resulting in a loss of finer detail in the shot, which then looks 'waxy' and horrible.

These two images of a brown bear illustrate the point - one is sharp and punchy and the other (after noise reduction) is waxy-looking and flat.

Another temptation is to rely on Lightroom or Photoshop, or a similar software, to remove the noise in processing. Technically, you can get all the noise out of an image, and this can sometimes work well if you know what you're doing and the noise isn't too bad. But it can also result in waxy, flat images as badly as if it was done in-camera. It's certainly not a magic solution. The trick in processing is to minimise the noise as much as possible, while maintaining maximum detail. But there is a limit.

The best way to avoid noise is to keep it to a minimum when you are shooting. There are two ways of doing this:

1. Avoid unnecessarily high ISOs (obviously!).
2. Expose your photographs as bright as possible (as close to the right side of the histogram as you can without overexposing) so that you have to do minimal brightening at the processing stage. If you don't, when you brighten your photos in the computer you're effectively turning up the volume which increases the intensity of noise along with everything else.

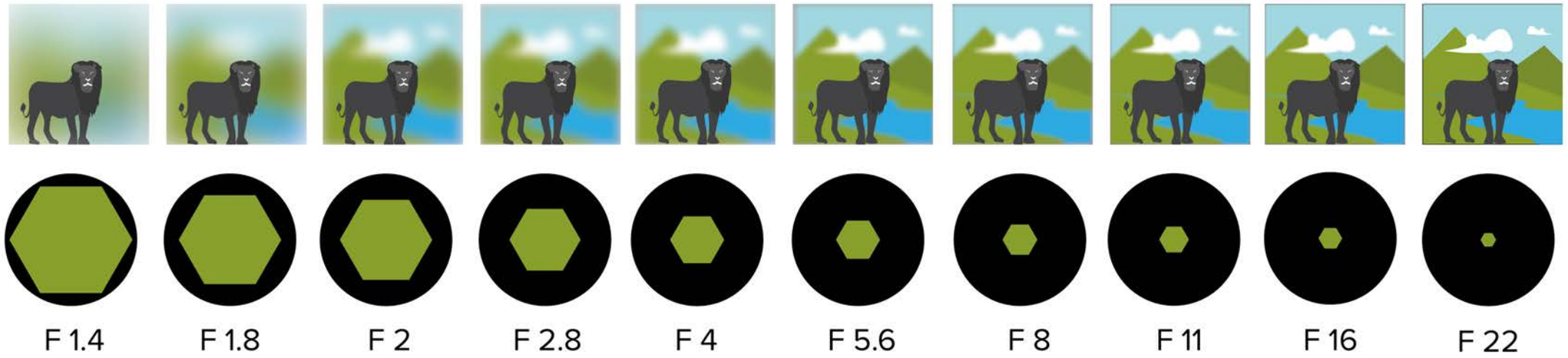
ISO is always a trade-off. You learn to judge how far to push it. As a general rule, you should only raise your ISO when you are unable to brighten or darken the photo using shutter speed or aperture instead. I start low (ISO 200 or 400) and push it higher only if I really have to (if the light gets really dull and overcast, for example). Having said that, my philosophy is that I'd rather have a sharp image and a little noise than a blurry image (because I couldn't achieve a fast enough shutter speed) and no noise. I adjust my ISO all day long, according to the subject and the amount of light. And I'm not afraid to push it to a really high number, if that is the only way to get a picture.

Just remember that there is a reason why your camera allows such a wide range of ISO settings: different situations call for different ISOs. Use them to your advantage. I would be more aware of ISO when shooting the picture of the eider, for example, because it would show up on the water; but I'd be less worried about the Arctic fox, because it wouldn't be so obvious in the light snow or the complicated textures of the rocks. And try not to get too paranoid about noise - don't keep zooming in so much that you are 'pixel peeping', because you'll see imperfections that don't actually matter in real life.

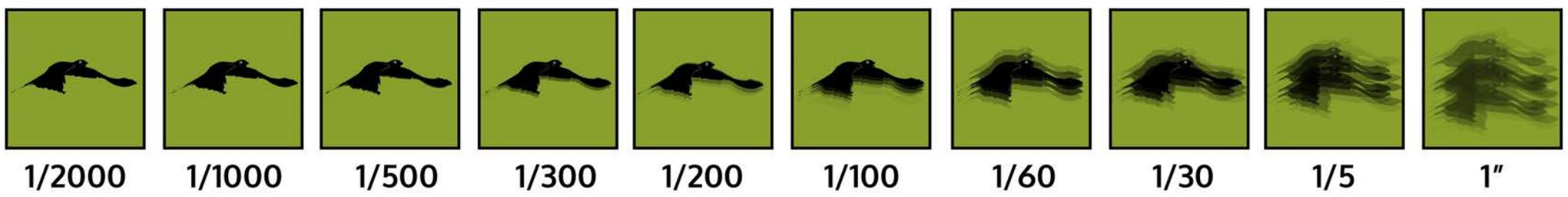
If you are using a tripod you don't need to worry as much, of course, because you can more readily cope with slower shutter speeds (and therefore keep the ISO quite low). That works well for landscape photographers, but it's not quite as simple for wildlife photographers - much of the time we need fast shutter speeds and, even with a tripod, often have to shoot at higher ISOs.

An entirely different way of working, which is popular with some wildlife photographers, is to set the aperture and shutter speed manually and leave the ISO on Auto. The camera adjusts the ISO according to conditions (within limits - which you can set) and you keep your preferred aperture and shutter speeds. Personally, I prefer to retain full control and keep balancing the pros and cons of different apertures, shutter speeds and ISOs myself.

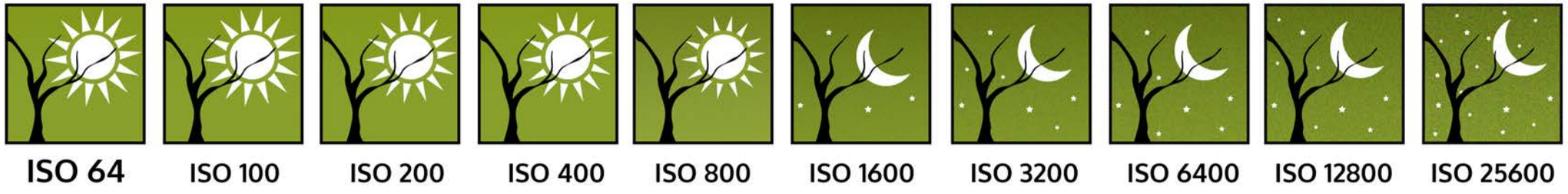
In conclusion, everything we've just studied to do with aperture, shutter speed and ISO (the exposure triangle) is neatly summarised in this diagram.



APERTURE

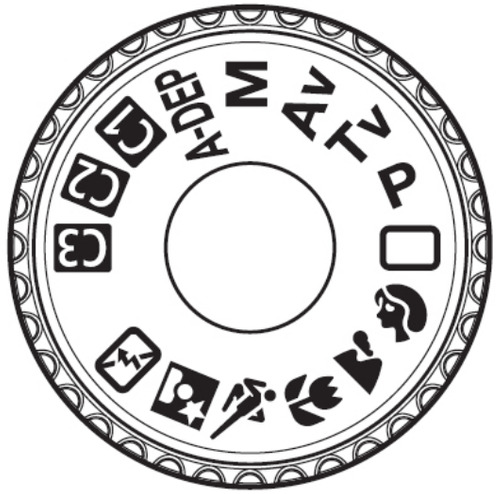


SHUTTER SPEED



ISO

SHOOTING MODES: WHAT ARE THE OPTIONS?



Now that we know all about the exposure triangle - aperture, shutter speed and ISO - let's put it to good use. In this section, we'll learn how to set these three different elements to get perfect exposures every time and to take complete control of depth of field and freezing (or blurring) the action. Camera sensors are not as good as our eyes - we can see much more detail in the shadows and highlights - so exposure is always a compromise. But there are great ways of working around these limitations.

There are five shooting mode options: Auto (A), Program (P), Manual (M), Shutter Priority (S or Tv) and Aperture Priority (A or Av). Let's assume you're not going to use Auto, where everything is done by the camera (otherwise, you've wasted your money buying this book). Auto is great if you want your pictures to turn out looking nothing like you intended: it can work, but it doesn't give you much creative freedom. And let's assume you're not going to use Program Mode, either (where the camera selects the shutter speed and aperture - ie the exposure is automatic - but other settings can be set manually). Some professionals I know do use Program Mode and just set the ISO themselves (leaving the camera to figure out the shutter speed and aperture) but I prefer to have more control than that.

How about Manual Mode? There are fanatics out there who claim that photos taken on Manual Mode are somehow more worthy, as if shooting manual is a point of pride. My advice is: don't listen to them. It's rubbish. Admittedly, I do use Manual - but only when shooting macro or using camera traps or complicated flash setups. Most of the time, as wildlife photographers, we need to react quickly to changing circumstances, and manual slows you down (there isn't time to estimate the correct exposure and set everything yourself). So there's rarely any point in shooting Manual - unless you want to miss the shot.

WHY APERTURE PRIORITY IS BEST (MOST OF THE TIME)

Given that it's not a good idea to shoot Auto, Program or Manual, that leaves two options: Shutter Priority (in which you pick the shutter speed and the camera sorts out the appropriate aperture to balance the exposure) or Aperture Priority (in which you pick the aperture and the camera picks the shutter speed). They are both semi-automatic. In other words, you control one element and the camera controls the other.

They will both give you the same exposure (all other things being equal). And they will both free you up to concentrate on more important things, like getting the focus spot-on and, of course, perfecting the composition.

I do know a few professional wildlife photographers who prefer to shoot in Shutter Priority. But the vast majority - myself included - shoot in Aperture Priority. And there are very good reasons why it is better.

It's easy to understand the simple logic for shooting in Shutter Priority. As wildlife photographers, we tend to use long lenses and shoot subjects that move fast, so our top priority is usually a fast shutter speed. We want to freeze the action and avoid camera shake. But Shutter Priority falls at the first hurdle. It's complicated, for a start. First, you have to analyse the light conditions, then check the ISO and then guess the fastest possible shutter speed (while still getting a decent exposure). Is it 1/500 second? Or 1/4000 second? I'd be damned if I could ever guess that accurately. The problem is that, once you've guessed, you have to check the settings to see if that really is the fastest shutter speed possible. The chances are it won't be, and so you adjust the shutter speed and check all over again. And then the light conditions change, so you have to guess and check yet again. If you don't keep checking, you may get it right sometimes, but most of the time you'll face one of two problems: you won't be shooting at the fastest shutter speed possible (you could go even faster), or you'll be underexposing (because the aperture can only go so wide).

This may come as a surprise, but with Aperture Priority you can control the shutter speed much more accurately. Think about it. If you want the fastest possible shutter speed, all you do is open up your lens to its maximum aperture (which happens to be f/4 on my 600mm lens, for example) and then, whatever ISO you have set and whatever the lighting conditions, you are guaranteed to get the fastest shutter speed possible (because you are letting the maximum amount of light through the aperture, so the camera always picks the fastest speed). Not only that, your images will consistently be correctly exposed (because the camera can always let in more light by slowing the shutter).

The other great advantage of shooting Aperture Priority is that it gives complete control over depth of field. In wildlife photography, we often want the background to be beautifully out of focus, so it doesn't compete with the subject (as in the shot of the red kite). In Aperture Priority, the camera can't suddenly change the aperture and pull the background back into focus; once you've set the aperture it won't change (unless you change it). Alternatively, your priority may suddenly switch from a beautiful background bokeh (the aesthetic out-of-focus part of the image) to a greater depth of field (for example, if you are shooting a group of seals on an ice floe, or macro). You are already controlling the aperture, so you just close it down as much as you need. How simple is that?

It's also worth noting that, when you are shooting at fast shutter speeds, slight deviations in shutter speed will have relatively little impact on your picture. However, deviations in aperture will have a considerable impact on depth of field. Yet another reason to shoot Aperture Priority.

This is a great way to hand over some of the responsibility for accurate exposure to the camera (and there is nothing wrong with that - it's certainly not cheating, as some photographers ridiculously claim). Yet it still allows you complete control. And it frees you up to concentrate on more important things.

Finally, I have an admission to make. I do very, very occasionally use Shutter Priority: where there is lots of movement and I am shooting creative blur. With subjects like bow-riding dolphins, running wildebeest or flying geese, for example, I will sometimes choose a specific shutter speed (typically 1/15 to 1/50 second) and let the camera sort out the aperture.

There is one problem with any automatic or semi-automatic shootings mode: camera meters do not always get the exposure right. That's where histograms and the wonderful exposure compensation dial come into their own - they are real game-changers. And we're going to talk about them in a bit.

WHY EVALUATIVE METERING IS BEST (MOST OF THE TIME)

Your camera uses an in-built 'light meter' to determine how much light is in the scene you want to photograph. The amount of light determines what aperture, shutter speed and ISO sensitivity is needed in order to take a correctly exposed picture. There are three main ways of doing this, and they are called camera metering modes:

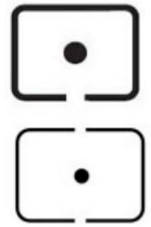
Evaluative, matrix, zone or multi-segment metering

This is usually the default mode and, in many ways, is the simplest to use. The camera divides the scene into zones (there are 252 zones on my Canon 5D Mark IV, for example) and evaluates the brightness of each zone separately, to determine an average exposure for the scene. It uses a sophisticated computer algorithm, or compares the reading with a large database of predefined scene patterns, to get an accurate measure for a very large number of photographic scenarios. In some cameras, it does place greater emphasis on what lies beneath the current AF point (which can work well - unless you are using the focus-and-recompose technique, discussed later). This is an excellent general purpose metering mode and works particularly well when the scene you are photographing is evenly-lit.

Centre-weighted metering

This meters the entire frame, but gives priority to the centre and takes less information from around the edges (typically 70% from the centre and 30% from the edges, but this does vary from camera to camera and on some models you can change these proportions). It does not take the current AF point into consideration. Falling somewhere between evaluative metering and spot metering, it can work well with relatively large subjects in the centre of the frame.

Spot metering



In this mode, you select the exact spot in your frame where you want to expose (a small circle typically covering about 1-4 per cent of the total frame, depending on the camera model). It's best used if you really need to calculate the exposure from a very precise spot (ignoring the rest of the frame), for example when your subject is backlit (ie between the camera and the sun) or it's a lot brighter or darker than the surroundings. Some camera models let you change the size of the spot and/or enable you to link it to the current AF point. Incidentally, Canon has an extra mode, similar to spot metering, but the size of the area is a little larger (totalling approximately 8-13 per cent of the frame). It's called **Partial metering**.

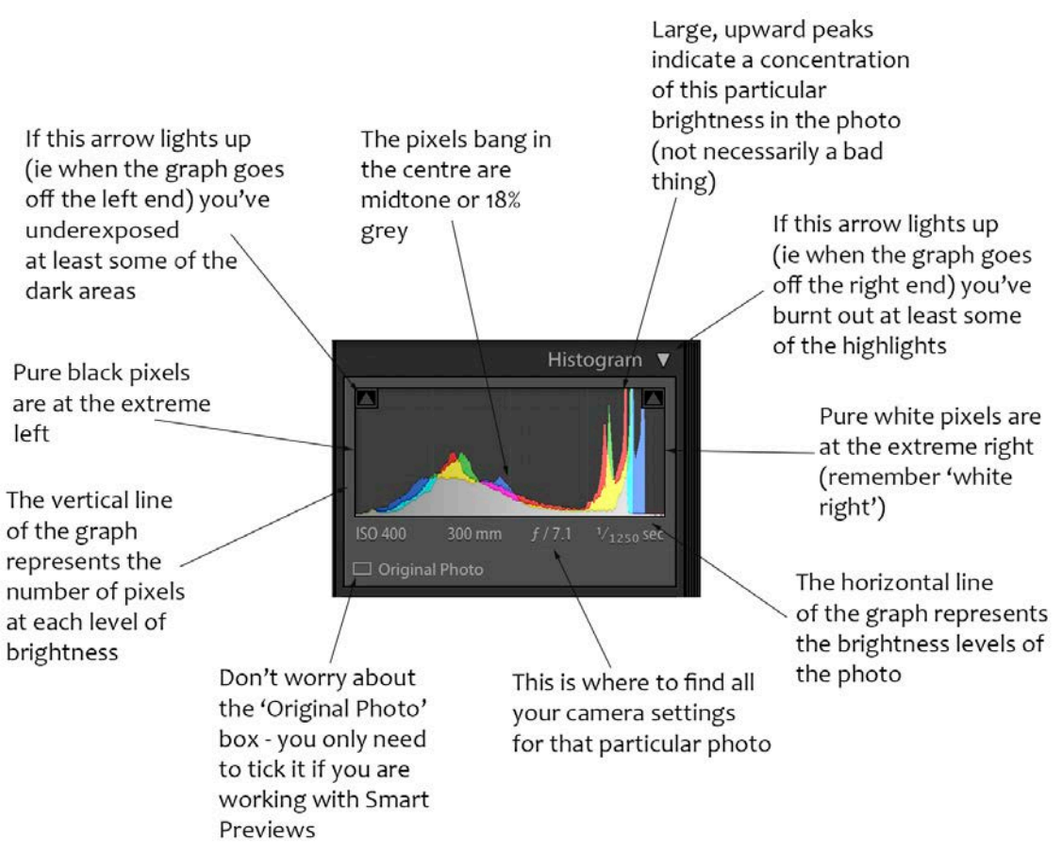
I use evaluative metering 90 per cent of the time, simply because it's easier. It doesn't slow me down when the lighting conditions change or the subject suddenly moves. And it works pretty well. It's not so good when the lighting conditions are particularly tricky, such as when there are bright highlights or dark shadows. When you're photographing wildlife under difficult circumstances like this, it's often necessary to overexpose or underexpose the rest of the scene in order to expose the subject properly. To do that I use the histogram and the exposure compensation dial - which works brilliantly. And that's what we're going to look at next.

USING THE HISTOGRAM

Don't turn the page! Histograms are amazingly easy to use and will help enormously with your photography. They'll help you to achieve perfect exposures - with the right combination of aperture, shutter speed and ISO - every time.

In theory, you could just look at the picture on the LCD screen on the back of your camera to see if a picture is exposed properly, but it's not particularly accurate and varies depending on how bright you've set the screen; it's also very difficult to see in glaring sunlight. Instead, when you view the image you should press a button (usually 'Info') to toggle through various pages of shooting information for that shot. One of the options is the histogram.

The histogram is simply a graphical representation of the brightness levels of your photo - all the way from the darkest shadows to the brightest highlights - with all the other brightness levels in between. It helps you to determine the overall balance between bright areas and dark areas, and whether you are in danger of under- or overexposing parts of your image.



The horizontal line of the graph is a measure of the brightness, from dark on the left to light on the right, and the vertical line is the number of pixels of each brightness along the range. High peaks and mounds represent large numbers of pixels, while dips and valleys show fewer pixels; bare spots reveal that no pixels have that particular brightness.

The shape of the histogram doesn't matter. Basically, you're checking to see if the graph going off either end:

1. If it's off the lefthand end at least one part of the image is too dark and is recorded as jet black with no detail.
2. If it's off the righthand end at least one part of the image is too bright and is recorded as burnt out white.

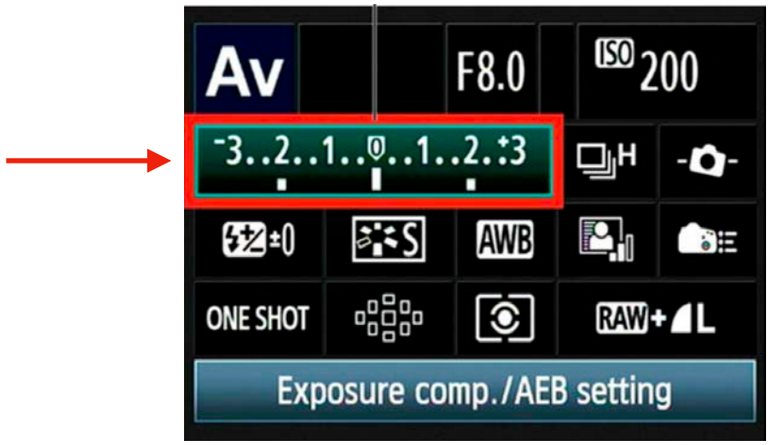
These aren't necessarily bad things - remember you don't always want (or need) a 'perfect' exposure. But you do need to know about any exposure issues in order to decide what, if anything, to do about them.

This is how I use the histogram:

1. I take a test shot (before shooting properly). I do this again and again during the the day, as the subject and lighting conditions change.
2. I examine the histogram to check the exposure - checking to see if the graph goes off at either end.
3. Then I'll make adjustments accordingly, to the aperture or the ISO (especially if the light is fading or brightening) or the exposure compensation dial (which we're coming to next).

Incidentally, another useful tool is what photographers dub the 'blinkies'. You can set your camera to show, at a glance, when you have clipped the highlights (ie blown all the detail out of the brighter parts of the image). This feature is called 'Highlight Alert' (Canon), 'Highlights' (Nikon), or something similar in other makes. When it is on, overexposed areas in the photo you're looking at on the LCD screen at the back of the camera will blink.

THE EXPOSURE COMPENSATION DIAL



This is the answer to all your prayers. The magic button with a +/- sign, otherwise known as the exposure compensation dial, allows you to brighten or darken your pictures with minimal fuss. It's easy to use and, once you've mastered it, you'll find yourself reaching for this dial all the time.

Modern cameras are pretty good at coping with a surprisingly wide range of brightness levels in a photograph and can often capture both shadow and highlight detail in a single frame. But they are not as good as our eyes. There are many tricky lighting situations (such as a pale bird against a dark background - as in this Australasian gannet) when they don't get it right. In a high contrast scene, in particular, camera sensors either capture all the detail

in the shadows and blow out the highlights, or they expose for the highlights and lose all the detail in the shadows.

Exposure is often a compromise. If there is a lot of contrast, something in the image will inevitably be too dark or too bright. Also, even if the camera gets it right, you may not like the 'correct' exposure. So you have to find a way to circumvent these limitations and get the best balance possible.

Unless you are shooting in manual, you can't correct exposure by adjusting one of the three dials in the exposure triangle (aperture, shutter speed or ISO). The camera will just work around you, making up for any changes you make to one dial by adjusting another. This is where the exposure compensation dial comes into its own. It allows you to override the exposure while keeping your preferred settings.

In this particular shot of a gannet, it enabled me to make the cliffs in the background completely dark (I didn't want any detail in the shadows) and perfectly expose the brilliant white feathers on the gannet. If I hadn't compensated, the cliffs wouldn't be jet black and the feathers would be washed out.

So how do you do it? First, you check the exposure by checking the histogram. Then, if it's too dark, you dial the compensation to the right (towards the + sign) to brighten the image and get detail back in the shadows; if it's too bright, you dial the compensation to the left (towards the - sign) to darken it and get detail back in the highlights. Each dot on the dial is a third of a stop (going as far as '1' is compensating by a whole stop). Knowing how far to dial comes with practice and, in some extreme situations, you might be compensating by as much as two or three stops.

Expose as far to the right of the histogram as possible. This is the best way to get the least noise in your images (which tends to be worse in dark areas) and the most detail. Don't go too far or you'll burn out the highlights (the graph should nearly be touching the right side of the histogram, but not quite).

Obviously, something changes when you use this dial. It's not really magic. What happens is this: if you are shooting in Aperture Priority, it keeps the aperture you have selected but overrides and changes the shutter speed; if you are in Shutter Priority, it keeps the shutter speed but changes the aperture. So just remember to check that you're still happy with the new settings (you may not want the shutter speed to get too low, for example).

Finally, do remember to return the exposure compensation dial to zero at the end of every session or, inevitably, it will be wrong the next time you shoot.


+2 1/3 to brighten the image from dull grey


+1/3 to get detail in the eye and dark feathers


-1 2/3 to darken the image and focus on the gorgeous light on the bird

THE PRINCIPLES OF FOCUSING

Accurate focusing is one of the great challenges in wildlife photography. More pictures are ruined by a lack of sharpness than almost anything else. And, unfortunately, you can't make nearly sharp images really sharp in Lightroom or Photoshop - you have to get it right in-camera. So how do the professionals get such consistently razor-sharp images? All will be revealed in this section.

Ninety-five per cent of the time, you should use autofocus because it is faster than manual and often more accurate (though manual focus does prove invaluable in certain situations when you have to 'out-think' the autofocus, such as in some macros shots, when you are waiting for a bird to land on a particular perch, or when shooting through foliage or glass). Autofocus is phenomenally good in modern DSLRs, but it's not quite as simple as it sounds. It does need careful direction. The camera can only focus where you put the AF point, so it's all about getting that in exactly the right place and operating correctly.

With this in mind, there are two main considerations.

1. Which focus mode is best?
2. Which focus point to choose?

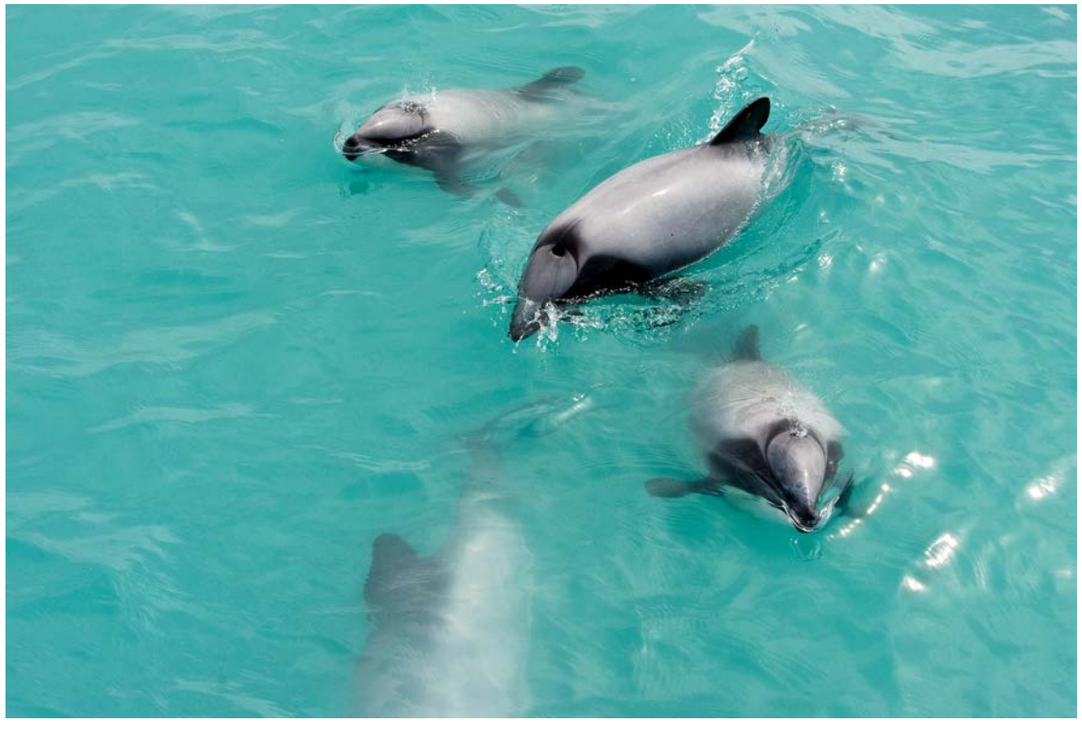
But before we get onto that the first thing you have to do is to adjust your optical viewfinder to suit your eye. There is a small wheel next to the viewfinder. Turn the camera on, look through the viewfinder (if you normally wear glasses while taking pictures, wear them now) and focus on something with distinct lines (so that it's easy to see when it is sharp). Turn the wheel slowly - and stop when the image looks most sharp. You can also look at the settings around the frame (the aperture and shutter speed, for example) to see when the numbers are sharpest. Adjusting the diopter dial, as it's called, does not affect the image recorded, but it does make everything that is tack sharp in-camera look tack sharp to your eye (otherwise, nothing will look sharp and you'll be miserable).

WHICH AUTOFOCUS MODE IS BEST?

There are three possible auto-focusing modes to choose from. Which one works best depends on what you are shooting. (If you are using back-button focusing - which we'll discuss later - it doesn't really matter which mode you set.)

1. **One Shot or AF-S (Canon), Single Shot (Nikon)**. This is pretty straightforward. Let's assume the focus point (the red rectangle, square or circle you see when you look through the viewfinder) is in the middle of the frame. Wherever that focus point hits in the picture is where the camera will focus. When you are shooting in One Shot/Single Shot Mode, you press the shutter button halfway down, the camera focuses just once and holds that focus, then you take the picture. This works really well when your subject stays still, because you can lock the focus (on, say, an eye) and easily recompose. But it's hopeless if your subject is moving (or if you are moving - even if you are swaying slightly backwards and forwards). Using this mode all the time is one of the main reasons many wildlife photographers struggle to get their images sharp. Suppose you are photographing some albatrosses squabbling over food; your camera focuses on one of their heads and locks the focus; but by the time you press the shutter button all the way down to take the picture, that particular bird has inevitably moved and you are focusing on thin air, or water. The picture won't be sharp.

2. **AI Servo or AF-C (Canon), Continuous (Nikon)**. (Incidentally, 'AI Servo' stands for 'Artificial Intelligence' and 'Servo' is short for 'servomechanism', a device that uses error-sensing feedback to correct the performance of something.) This is the mode to use most of the time, because as long as you have your finger pressed halfway down on the shutter button, it keeps adjusting the focus. So if your subject is moving (which is normally the case with wildlife) or if you are moving (if you are shooting from a boat, for example, or swaying about in the wind) it will continuously track the subject to ensure that it is always in focus. When you press the shutter button all the way down, and take the picture, the focus should be spot-on.

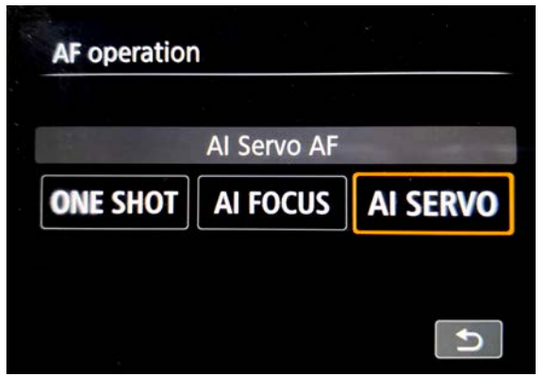


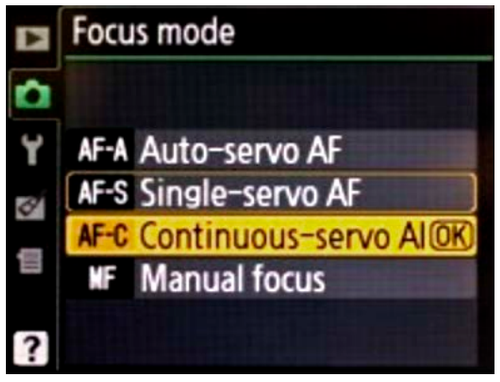
AI Servo/ Continuous will not only maintain focus on a moving subject, it will also predict its speed and direction of movement. It even makes allowances for the short time between pressing the shutter button and the image being captured. It means you'll get many, many sharper shots for your buck.

1. **AI Focus or AF-A (Canon), Automatic (Nikon)**. In this hybrid mode, you leave the camera to decide - it changes automatically between the two other modes. It typically starts with One Shot/Single Shot, and locks on, but if it detects movement it will switch to AI Servo/Continuous to change focus with the subject. And it will jump back and forth accordingly. In theory, this sounds like the best of both worlds. But the reality is somewhat different. In my experience, it is the worst of both worlds. The in-joke is that it's great for shots where you want nothing to be in focus. It's better in more recent (and more expensive) models, but still not perfect because there is always a delay while the camera analyses whether or not the subject is moving. Even if it does get it right, there is always that time lag (by which time you've probably missed the shot).

I use the AI Servo/Continuous mode most of the time - and I strongly recommend you do the same. It will increase your chances of capturing crisp, sharp images significantly. You can keep up with any movement and can still lock the focus and recompose (either by freezing the focus with a dedicated button on the back of the camera, or by using back-button focus - more about that later). It's the better mode to use even when your subject is stationary, because rarely do animals stay absolutely still (they blink, yawn, look from side to side, and move in all sorts of subtle ways).

Very occasionally, I will switch to the One Shot / Single Shot mode. But only if I want critical focus on a tiny point of a rock-solid subject (particularly in low-light and/or low-contrast conditions, which are often challenging for AF systems and make it difficult to hold focus). But otherwise it's AI Servo/ Continuous all the way.





CHOOSING THE RIGHT FOCUS POINT(S)

Focus points are those little empty squares, rectangles or circles that are visible in the viewfinder - they are the points where the camera focuses. Determining which focus points to use, how many to use and how to use them is the other main factor in achieving critical sharpness.

DSLRs have a patchwork of selectable focus points (ranging from as few as 7 to as many as 153, depending on the camera); generally speaking, the more you pay the more focus points you get. The camera usually only focuses on a single point at any one time (except in Auto or 3D Tracking) but the more available focus points the better (because there are more options to configure and fine-tune the focus).

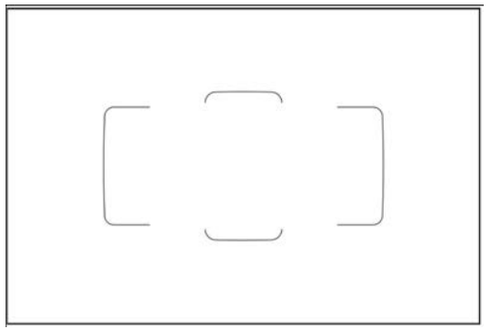
You can see them light up (usually red) when you half-press the shutter button to focus (there is sometimes a 'bleep' when you focus, as well, depending on your camera and how you have it set). The focus point that lights up shows exactly where the focus will be in the final picture.

The big decision is which of these focus points (AF points) to make 'active'. You can activate a tiny part of one, a whole one, or a combination of them all working together. With this in mind, there are five possible modes:

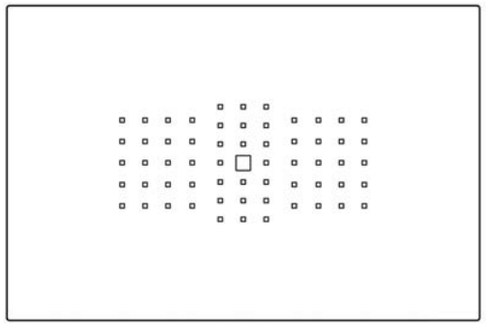
1. **Automatic Selection AF (Canon), Auto Area AF (Nikon)**. In this mode, all the focus points are active - and you play no part in selecting which one to use. When you press the shutter button halfway down, they independently search for something - anything - to focus on. The first focus point to latch on to any object in the frame 'wins' and that's where the camera will focus. It's quite a clever mode for 'point-and-shoot' photographers, especially because it's pretty good at recognising a person's face and focusing on that. It can also be useful if, for some reason, you can't look through the viewfinder to focus yourself (for example, if you are holding the camera high above your head). But if it doesn't recognise a face, it typically focuses on the nearest subject in the frame. And, very often, it goes for the wrong point (or the wrong part of the right point).

It's temperamental, to say the least. If you are photographing an Arctic fox, for example, it's likely to focus on the tip of the nose or an ear - instead of one of its eyes. It's understandable - how can it possibly know that you want to focus on an eye? Therefore, most of the time, I would advise against using this mode.

However, it can work when there are strong differences in colour and/or contrast between the subject and the background - for example, a flock of birds against a cloudless sky. If you do use this mode, try to start by acquiring initial focus when one of the birds (or the single bird, if that's what you are shooting) is in the centre of the frame, because the central focus point is always the most accurate.

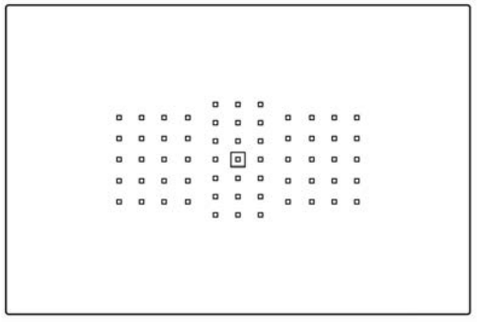


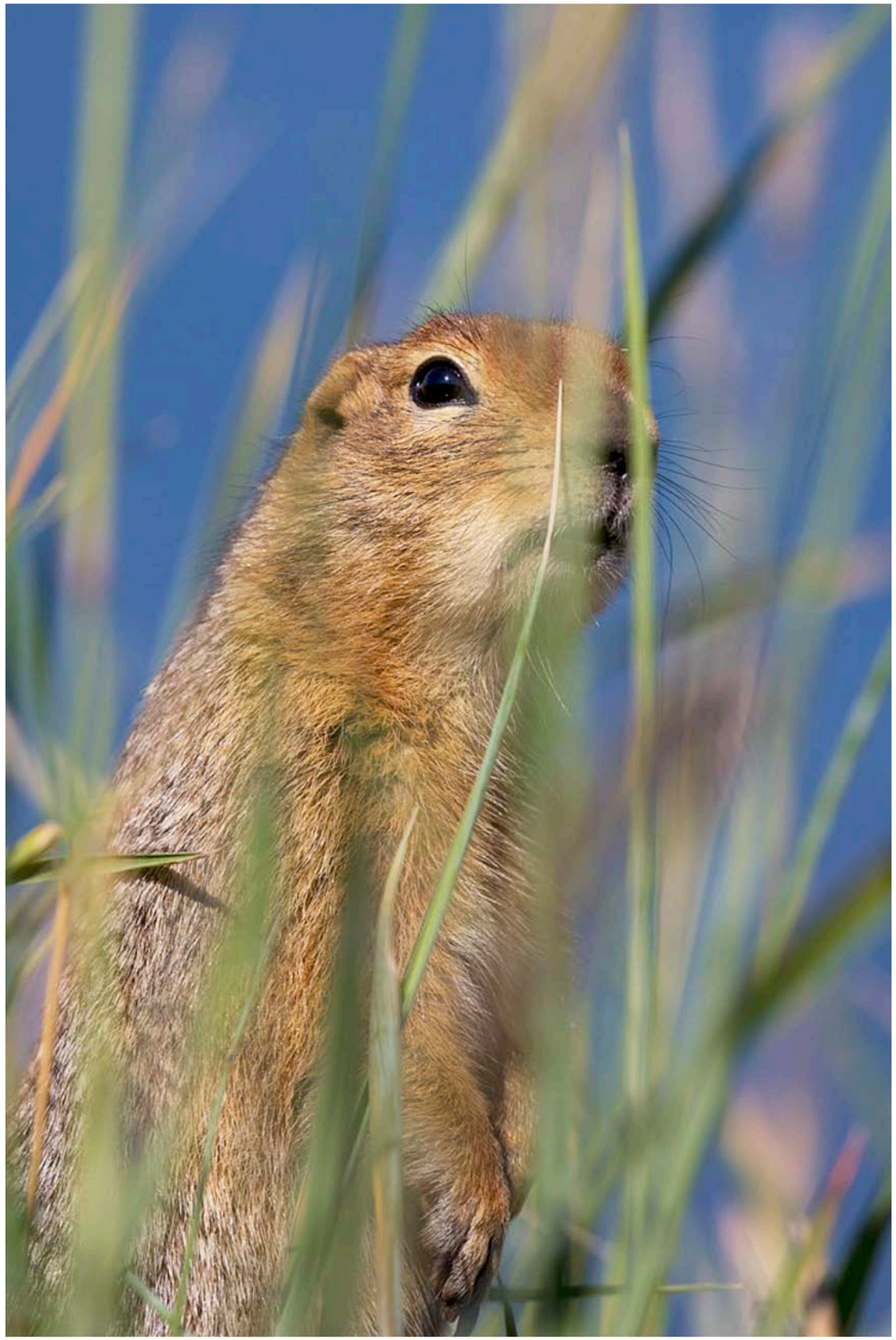
2. **Single-point AF.** The camera uses only one focus point to acquire focus (you select it while looking through the viewfinder). By default, it is bang in the middle of the frame. But you can select different focus points in different parts of the frame to suit your composition (move it to the top righthand corner, for example, if that is where the animal's eye is). Alternatively, you can leave the focus point in the middle, but move the camera to position it over the correct part of the subject (wherever that happens to be in the frame). Then half-press the shutter button to focus, 'hold' the focus (usually by pressing a button on the back of the camera with your thumb), recompose, and shoot.



I use Single-point AF a lot of the time, for two reasons: the central focus point tends to be the most accurate and reliable (it's the safest choice for locking onto a subject); and it's the mode that puts me fully in charge of what the camera is focusing on (quite simply, if my preferred point of focus isn't directly under the selected focus point, I know that the camera will be focusing somewhere else). I move the focus point around the frame continuously, depending on what I want to be in focus. This mode is perfect for relatively stationary or slow-moving subjects. I use it for animal portraits, macro and landscapes, in particular.

Some camera models have a variation on Single-point AF, called **Single-point Spot AF**. It works in exactly the same way, but the focus point is half the size (it looks like a square within a square) for even more pinpoint precision, enabling you to home in on an exact spot. It's particularly useful for macro photography and when you have lots of obstructions between you and your subject (such as when shooting this ground squirrel through long grass).





3. **AF Point Expansion (Canon), Dynamic Area AF (Nikon)**. In this mode, multiple focus points are used in combination to achieve focus (although only one is in focus at any one time). Just like Single-point AF, you start by choosing one focus point, and the camera will acquire focus right there on that point. However, if your subject moves, and leaves the initial focus point, the camera then activates the neighbouring focus points (which effectively act as back-up) to track its movement and maintain focus. You track the subject (by panning the camera) and keep it as close to your initial selected focus point as possible, while the camera does the rest.

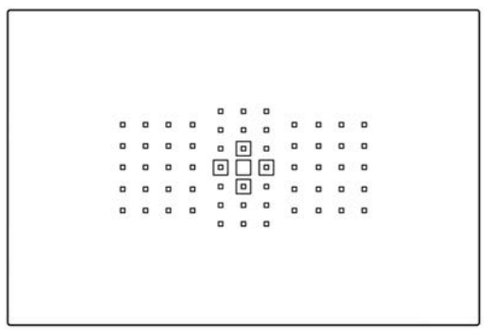
   You can move the group of focus points around the screen en masse, as you would a single focus point.

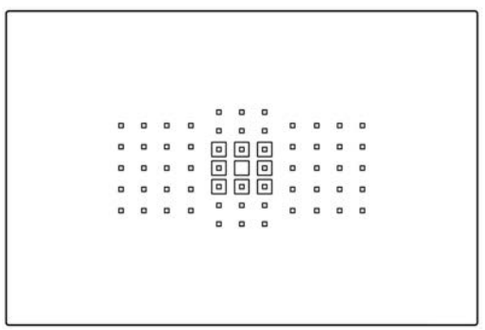
   With higher-end DSLRs you can select the number of surrounding focus points to activate, depending on how much of the scene you want to track. If you choose a group of 9 focus points, for example, subject tracking will only work within those 9 (if your subject moves outside the group, the camera will lose focus).

   Canon has a variation on this mode, called **Zone AF**, which divides all AF points into 9 focusing zones (with each zone comprising 12 focus points). Effectively, it's halfway between AF Point Expansion and Large Zone AF.

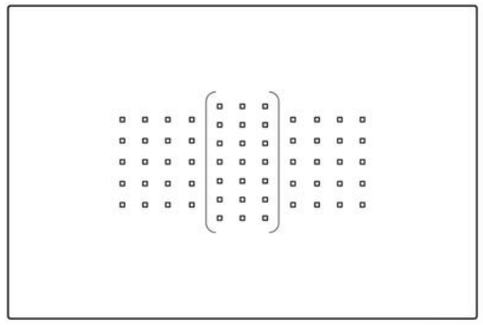
   AF Point Expansion/Dynamic Area mode is incredibly useful for wildlife in action. I use 5-point or 9-point expansion (ie one central focus point plus 4 or 8 neighbouring points) much of the time and it works remarkably well.

   In theory, the more active and unpredictable your subject the more focus points you should activate. But in the real world using too many points can be counter-productive. It slows down the autofocus system because there are too many calculations for the camera to deal with (making it more temperamental and more easily confused). So if you use too many points it can actually be harder to maintain focus on a specific target. The trick is to use as few as you think you can get away with.





4. **Large Zone AF (Canon only)**. This mode divides all the AF points into three focusing zones: one on the left, one in the centre and one on the right. The camera will focus on whatever appears to be closest to the camera within that zone. It does this by looking at several focus points at once, taking data from all of them, and averaging the result. This gives you an even wider autofocus sensitivity area, but at the expense of handing over even more control (and possible confusion) to the camera.



5. **3D Tracking (Nikon only)**. All focus points are used in combination to achieve focus. You start by selecting a single focus point. But this time the camera attempts to find and follow a moving subject, automatically activating whichever focus points are needed to track it. It uses as many focus points as needed (five, for example, instead of just one).

   3D Tracking works by using special colour-recognition algorithms. So, for example, if you are photographing a dark-coloured skua among a flock of light-coloured kittiwakes, it should automatically maintain focus on the skua (even if the skua moves, or you move the camera). It can also be useful when photographing birds flying quickly and erratically (they are often hard to keep in the frame, let alone line up with a specific focus point).

   But it can be quite temperamental. In my experience, 3D Tracking isn't as quick as AF Point Expansion/Dynamic Area AF. It works best where there are strong differences in colour and contrast between the subject and the background, otherwise there's a risk that your camera will 'jump' to another subject and focus on that instead.

Getting to grips with how to use the various focus points on your camera is one of the biggest challenges in wildlife photography. But mastering this tool will make a phenomenal difference to achieving critically sharp focus. A great way to learn is to enable the 'AF Point Display' option in your camera's playback menu. Then you can see which AF point was active at the moment of exposure when you examine your images on the LCD screen. Was the active point where you intended it to be? If not, why not? And take it from there.

BACK-BUTTON FOCUS

You've probably heard the term 'back-button focus' bandied about by wildlife photographers. Many claim that it is a game-changer. It's not a particularly easy technique - it certainly requires practice - and there are other ways of achieving a similar result. But I would definitely recommend experimenting to see if might work for you.

The 'old-fashioned' way of shooting is to half-press the shutter button to wake up the camera and focus, then fully press the same button to take the picture. Quite simply, back-button focus is a way of separating the focus and shutter-firing functions into two separate buttons - enabling you to control them independently.

Once back-button focus has been set up on your camera, nothing will happen when you half-press the shutter button (apart from waking the camera up). You simply press it all the way down to take the shot. But you still have to focus, of course, and you do that with your right thumb on the newly-appointed focusing button on the back of the camera. Press that button and the lens will focus. It will keep adjusting the focus as long as you keep the button pressed, and will lock the focus when you lift your finger off the button.

So, what's the advantage? Primarily, it's that you no longer have to fiddle with different focus modes (which loses precious time and makes you miss shots that require super-fast reactions). Back-button focusing enables you to combine three modes into one, without having to switch between them:

1. Manual focus - simply take your finger off the newly-customised back button and manually adjust the focusing ring on the lens - when you take the picture, the camera will not change the focus even if your lens is not in manual mode.
2. Single Shot or One-Shot - hold down the newly-customised back button and release it when your subject is in focus - then you can recompose and shoot as often as you like and the camera will not attempt to change the focus.
3. Continuous Focus or AI Servo - keep your finger on the newly-customised back button and the camera will keep tracking your subject and adjusting the focus until you take it off.

This means there is less risk of focusing error when you are shooting moving or otherwise tricky subjects. Suppose you are photographing a jaguar through a tangle of undergrowth that's blowing about in the wind. With back-button focusing, it's easy to pull your thumb off the button momentarily as branches and other obstructions get in the way. Then you can keep shooting without the camera refocusing and hitting the branches instead of the jaguar.

It's also easier to lock focus - while you are waiting for something to happen or to change composition. Suppose you are photographing a horned puffin on a rock and you're waiting for it to look the 'right' way. If you've focused with the back button, your finger is free to fire the shutter at the decisive moment - you don't have to hold it halfway down to keep the focus locked while you wait.

Macro focusing is easier, too. When you are shooting extreme close-ups, and hand-holding your camera, the best way to get consistently sharp images is often by pre-focusing in the general range and then moving the camera backwards and forwards. Using back-button focus, once you have critical focus, you can shoot freely without the autofocus trying to re-focus each time you touch the shutter button.

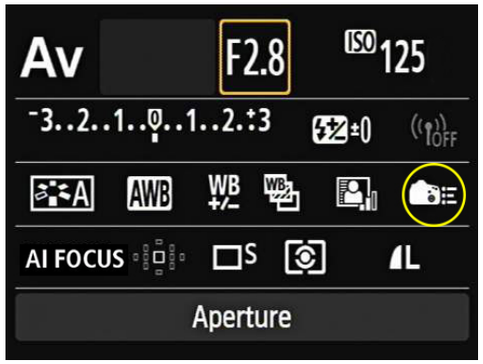
Finally, there is another advantage: it makes the camera work quicker. When you fully press the shutter button and the camera has to focus before firing, it takes fractionally longer than if back-button focus is enabled and all it has to do is to take the shot. Every second counts in wildlife photography.

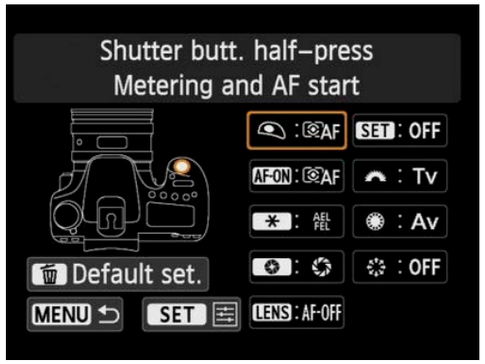
One of the great challenges with back-button focus, though, is that it's hard to do if you're used to taking pictures the old-fashioned way. Using the shutter button to focus and take the picture will be so automatic (almost like having muscle memory) that you will have to train yourself to achieve focus any other way. And you'll inevitably miss lots of shots in the process.

Another consideration is that there are other ways of locking focus to change composition, without using back-button focus or switching focusing modes. You simply configure one of the buttons on the back of the camera to lock the focus. Then the shutter button still focuses when you hold it halfway down, but you hold down the newly-configured button with your thumb to lock the focus while you recompose and take the shot. Or, of course, you can move the focus point to exactly where your main subject is in your ideal composition (so there is no need to recompose).

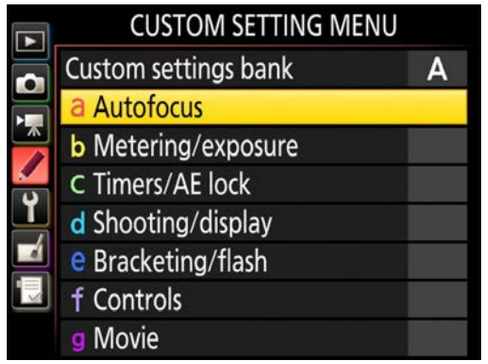
Having said that, do give it a try. There is no specific 'back-button focus' mode or button on your camera, so you have to set it up in the menu by removing focus from the shutter button and then assigning focusing to one of the rear buttons. The exact process varies from camera to camera, but here's how to do it for Canon, Nikon and Olympus:

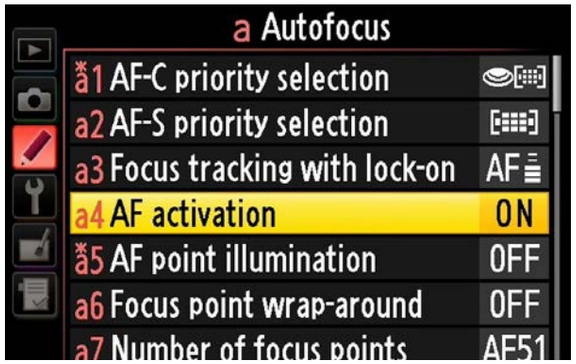
Canon - in Quick Settings, select the button highlighted in yellow (in the LCD image below), to bring up the 'Custom Controls' menu. Then set 'Shutter butt. half-press' (at the top of the lefthand column) to 'Metering start'. Then move down one (still in the lefthand column) to 'AF-On' and assign 'Metering and AF Start' to that button. Finally, set your camera to AI Servo mode. In lower end models, do the same but assign the asterisk button for this function instead.

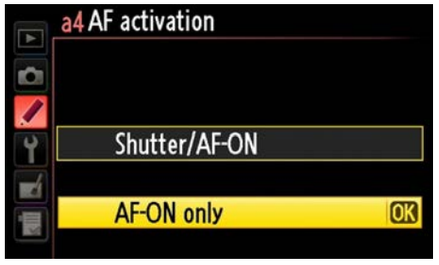




Nikon - in the Custom Setting Menu go to 'Autofocus', then scroll down to 'AF activation' and switch this to 'AF-On only'. Some Nikon cameras have a dedicated AF-On button, in which case you are ready to go (you just have to set your camera's AF dial to AF-C). If yours doesn't have an AF-On button, in the Custom Setting Menu go to Controls, then go to 'Assign AE-L/AF-L button' and select 'AF-On'. And, of course, you also set your camera's AF dial to AF-C.







Olympus - in the Menu go to 'Custom Menu', then move down to 'AEL/AFL' and press OK. Select 'C-AF', move across again to 'mode' and select 'mode 3'. Press OK. On some models, under 'AEL/AFL', you also have to go to 'Half Way AF' and check that this says 'Inoperative'. And, finally, unlike on Nikon and Canon cameras, with Olympus you press the AEL/AFL button on the back for back button focus.

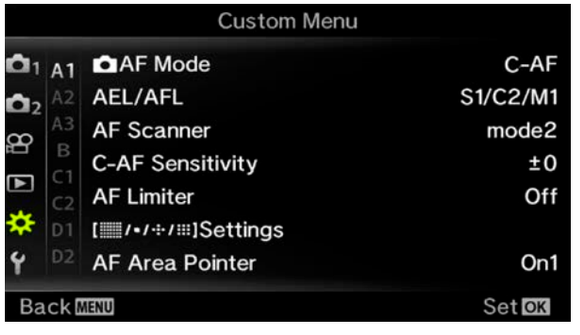


IMAGE STABILISATION

Many lenses have a fantastic facility called Image Stabilisation (IS) (or, depending on the manufacturer, Vibration Reduction (VR), Vibration Compensation (VC) or Optical Stabilisation (OS)). This helps to reduce camera shake - the thief of sharpness.

Camera shake is caused by moving the camera and lens when you press the shutter button. It's that movement while you are exposing the image that causes blur. It is a particular issue for wildlife photographers, because long lenses don't just magnify the subject, they also magnify the effects of camera shake.

The only way to overcome it is to eliminate movement - a rock-steady camera is essential to critical image sharpness. You can do this in a number of ways: by using a fast shutter speed (though you're still likely to get some blurring, visible when you zoom in to look at an image closely) or by putting your kit on a sturdy tripod. Alternatively, you can reduce (in fact, almost eliminate) camera shake by using image stabilisation. This enables you to handhold longer lenses at slower shutter speeds. It can also improve autofocusing performance, because the AF sensor gets a clearer view of the target.

How well image stabilisation works depends on how steady your hand is, how good your technique is, what you are photographing, and which lens you are using. But even basic stabilisation can be incredibly useful for wildlife photography. As we discussed with shutter speeds, most image stabilised lenses are good for at least 'two steps' (meaning that, instead of 1/500 second for example, you could get away with shooting at 1/125 second). Many modern lenses have four-step or even five-step gains and at lease one claims a seven-step gain: instead of shooting with a 500mm lens at 1/500 second that means that, in theory, you can shoot at 1/4s (1/500 - 1/250 - 1/125 - 1/60 - 1/30 - 1/15 - 1/8 - 1/4).

How do they work?

Stabilised lenses have two gyro sensors (one for yaw, and one for pitch) that detect the angle, speed and magnitude of any movement. This information is sent to a microcomputer in the lens, for analysis, which then sends instructions to a special group of lens elements. These move at precisely the correct angle, speed and magnitude to counteract the camera shake. All that in a fraction of a second. The instructions are revised and repeated

continuously to adapt to any change. There is no reduction in the optical performance of the lens. However, power for image stabilisation comes from the camera battery, and image stabilisation eats it up; the longer the lens and the larger the sensor the more power is required. Despite that one drawback, image stabilisation is brilliant - and you should use it whenever you are shooting handheld.

Do bear in mind, though, that image stabilised lenses cannot freeze fast-moving subjects at slow shutter speeds - they can't correct blur caused by the subject itself. They are designed specifically to avoid camera shake, and only camera shake.

Which mode is best?
Most image stabilised lenses have a choice of modes - and you have to select which one to use. Each is optimised to counter a specific type of movement:

Mode 1 (Canon) - use this when shooting static subjects. It is active all the time you are pressing the shutter button halfway (and all the way) down.

Mode 2 (Canon) - use this when you are panning (following) a moving subject, such as a bird in flight. The lens detects the sweeping movement and switches off the correction in that direction (it doesn't matter whether it is horizontal or vertical). Stabilisation in the opposite direction (vertically, if you are shooting a bird flying horizontally across the screen) continues as normal.

Mode 3 - use this when you are likely to be moving between active subjects quickly and frequently. Mode 3 is rather like Mode 1 (ie it corrects both horizontal and vertical camera shake). However, unlike in Mode 1, the image in the viewfinder doesn't bump or jump as the stabiliser motor races to keep up with all the extensive lens movements (because it activates only when you fully press the shutter button to take an image).

Normal mode (Nikon) - use this most of the time (it's like a cross between Canon's Mode 1 and Mode 2). Camera shake is differentiated from intentional movement, such as panning (which the lens is able to detect), and compensated accordingly; this means that it doesn't ruin intentional blur. It is active all the time you are pressing the shutter button halfway (and all the way) down.

Active mode (Nikon) - use this when shooting from a moving vehicle or boat (or any other unstable platform).

Tripod mode (Nikon) - use this when shooting with a tripod (it automatically differentiates between vibration caused by the lens stabilisation and camera shake). This is only available on a few super-telephoto lenses.

What about using a tripod if you don't have tripod mode?
This is a bit of a conundrum. With some earlier image-stabilised lenses you definitely need to switch the IS/VR off when using a tripod. The lack of movement confuses the system and causes what's called a 'feedback loop', in which the stabilisation detects its own vibrations and starts moving around even when the camera is completely still. Yet many recent lenses are able to sense the use of a tripod and automatically disable the system.

The bottom line is that it's worth checking the manufacturer's advice for your specific lens, rather than just switching off stabilisation to play safe. Using a tripod - even a sturdy one - doesn't guarantee sharp images. With a super telephoto lens, and especially when you are shooting in strong wind, there can still be some camera movement, so image stabilisation can help.

What about with a monopod? That's easy - keep image stabilisation on. It's almost impossible to keep a monopod perfectly still, so image stabilisation works properly and can be invaluable.

GETTING CREATIVE

Some people enjoy the technical side of photography above all else. They like nothing better than talking about f-stops and shutter speeds, reading reviews about the latest camera kit, and muttering about people who don't shoot on manual. They continually strive for bigger and better stuff and they are the go-to people when you want advice on software problems. They are perfectionists who tend to take tack-sharp photos, with perfect white balance, no clipping in the highlights - and relatively little creativity. Sadly, just because an image is tack-sharp doesn't make it a great photo.

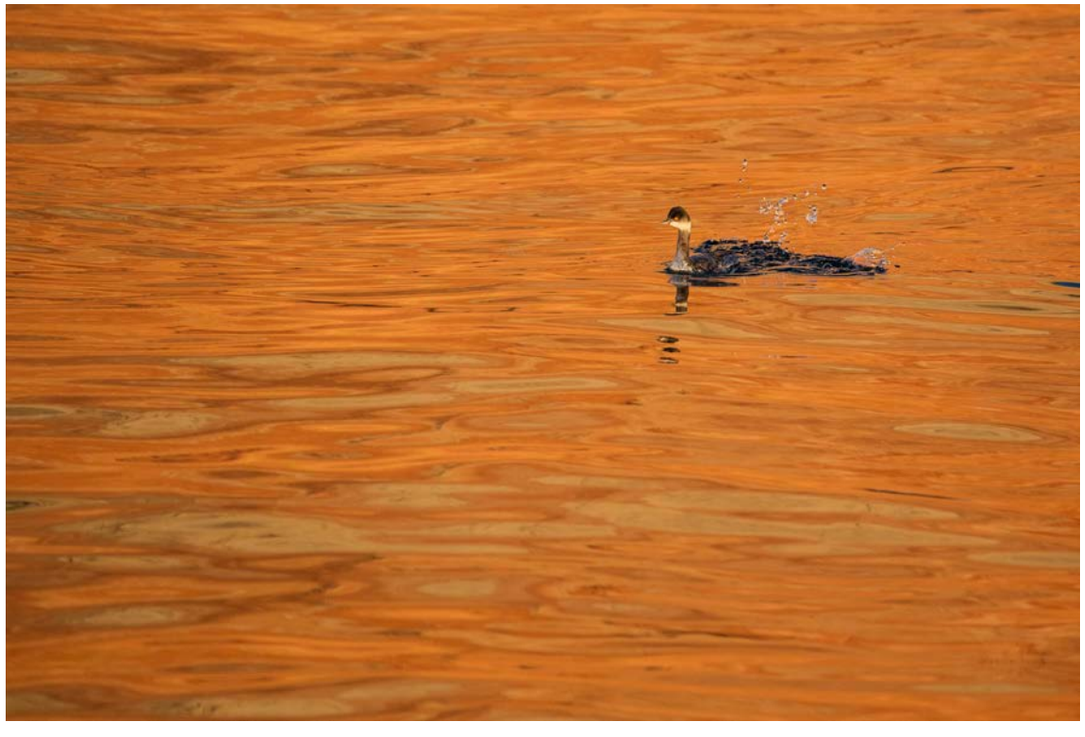
Other people are more interested in the artistic side of photography, constantly seeking out subjects and behaviour that stimulate them. They enjoy experimentation, innovation and spontaneity. But their pictures often don't turn out quite how they'd imagined. Sadly, just because an image is blurry doesn't make it a great photo.

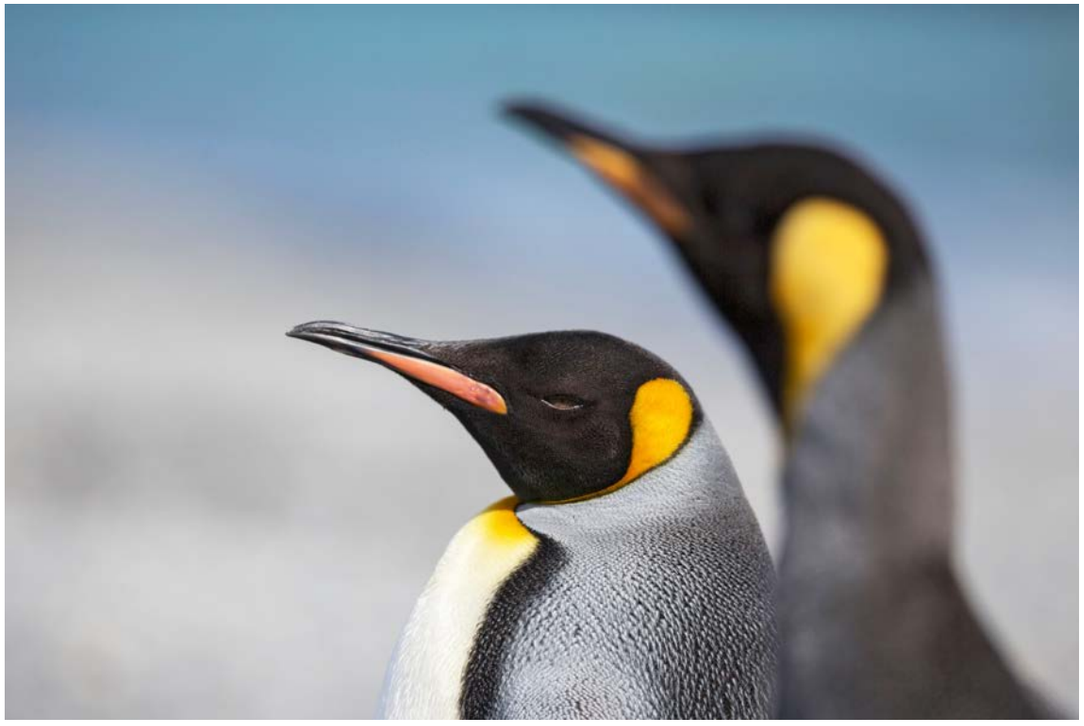
Most people looking at a photograph really don't care if you took it as 1/125 second or 1/8000 second. They probably don't even notice if it's technically perfect. What they care about is whether an image 'works' or not - whether they love it, or not. And you'll need a happy synthesis of technical expertise and creative flair to increase the odds of them loving it.

Therefore, to be a successful wildlife photographer, you need to use both sides of your brain: the logical, analytical right side that understands camera settings and the artistic, creative left side that fires emotion into your pictures.

Camera settings are just the beginning. But you do need to understand them before you can move on to the next level - and get really creative. You need to be able to turn the images you picture in your mind's eye into technically solid photographs (and, hopefully, you feel you are much closer to being able to do that after reading this e-book). Practice until your camera feels like an extension of your arms and hands, and you can use it instinctively.

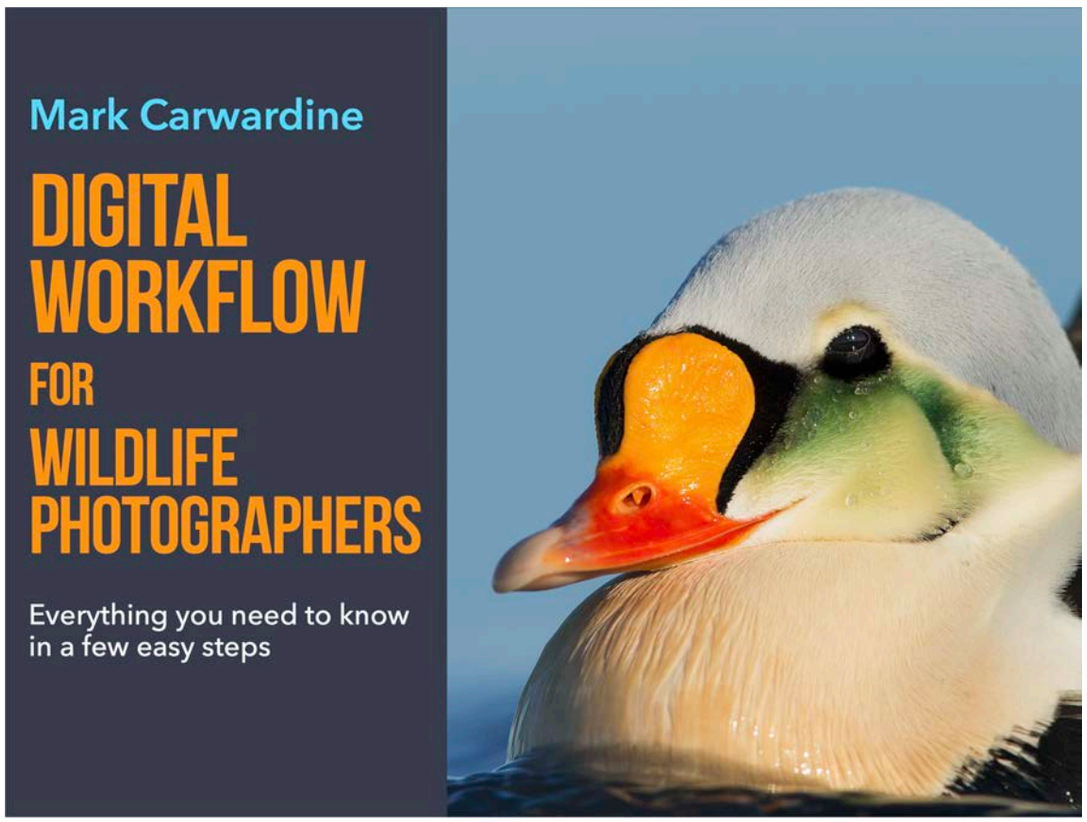
Some photographers are lucky and have an 'eye' for composition, apparently creating eye-catching images instinctively. Others have to learn. Either way, composition is not as clear-cut as camera settings. There are no set rules - no 'good' or 'bad' - so it's a lot more scary. But this is precisely what turns an otherwise technical pursuit into art. And it's precisely what makes it such fun.





OTHER BOOKS IN THE SERIES

Mark is writing a series of lavishly illustrated e-books on wildlife photography, covering a variety of subjects in simple language. The first was Digital Workflow for Wildlife Photographers, shown here, and future titles will include How to Photograph Garden Birds, My Pictures Aren't Sharp!, Top Tips for Composing Your Wildlife Photographs, and The History of Wildlife Photography.



There seems to be a lot of confusion among wildlife photographers about the digital workflow - turning images from your camera into perfectly processed tiffs or jpegs. But there needn't be. It's not rocket science. You don't have to spend weeks attending complex workshops to understand and master the basics. And you don't need to know absolutely everything.

That's the idea behind this easy and informative e-book. It covers all you need to know - from getting the images onto your computer, through Lightroom and Photoshop (you do need to use both) - in really easy, straightforward steps. It explains all the technical stuff, such as 'megapixel', 'bit depth' and 'dynamic range', in simple language. And it even tells you how to calibrate your monitor (and why you really should).

How can any budding wildlife photographer cope without it?

MARK CARWARDINE

Zoologist Mark Carwardine is a widely published wildlife photographer, an award-winning writer, a TV and radio presenter, a best-selling author of more than 50 books, a wildlife tour operator and leader, a BBC Wildlife magazine columnist and an outspoken conservationist.

He was Chair of the Judging Panel of the prestigious 'Wildlife Photographer of the Year' competition for seven years (2005-2011). He was selected as one of 'The World's 40 Most Influential Nature Photographers' in Outdoor Photography magazine and was one of 58 European nature photographers chosen to contribute to 'Wild Wonders of Europe'. He also wrote the monthly four-page 'Photo Masterclass' in BBC Wildlife magazine, which ran for two years. His own extensive collection of wildlife images are sold through Getty, Minden Pictures and Nature Picture Library.

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