

## Introduction to Image Processing- Rob Parker

[This article is based on the presentation I gave at the Ingham Digital Photography in the Bush event, October 2013.]

### Workflow

This article covers the workflow involved in processing your digital images – everything that happens after you take the picture:

- TRANSFER from camera or memory card to computer
- BACKUPS
- CATALOGUING

Followed by the things involved in getting from your as-shot image to a final image:

- EXPOSURE and/or COLOUR CORRECTION
- CROPPING and/or RESIZING
- IMAGE TOUCH-UP – not much on this, as it's more complicated, and beyond the scope of this article
- SHARPENING
- SAVING AS ... - and backup again

### Image Format – JPG vs RAW

Before getting into details, I should mention image formats – JPG/JPEG and RAW.

How many of you shoot in RAW format? If you don't know, you almost certainly don't. Hopefully, by the end of this article, you'll all have decided that RAW is for you.

JPEG stands for Joint Photographic Experts Group, which developed this widely used image format. JPG gives smaller file sizes (generally 4-8 times smaller) than raw files, by compressing the information within the file, and also by using a smaller range of levels (8-bit, or 256 different values) for each of the red, green and blue channels within the file. The compression process is what is termed "lossy", in that some information is lost during the process; because of this, each time a JPG image is saved, there is a loss of quality.

RAW is not a defined format; each camera manufacturer's raw files are different, with different file extensions – CRW, CR2, NEF, etc. A raw file contains the original RGB data from the camera's sensor, usually 12 or 14 bits per channel. The larger file size means that they use more storage space – both in your camera's memory card and your computer's disk drive – take longer to transfer and process, and need more processing power. But they give much more flexibility for processing. They need a raw convertor for processing, but those are built-in to many editing packages, or available as a "plug-in" (usually free); and they'll almost certainly need sharpening. Changes applied to a raw file are stored in a separate

(usually .xmp) file; the original file is unchanged for edits made in the Camera Raw convertor.

For a more detailed discussion, see Tom Oliver's article in our June 2012 Newsletter.

Later I'll cover processing during import into an image editor, and you'll see the advantages of shooting in raw format. Note that *the raw format may not be available if you're shooting with your camera in an auto mode.*

## Downloading Images

The first thing to do is get your images from your camera to your computer.

Your camera likely came with a cable to connect it directly to our computer, via a USB port, to transfer images. My advice is to throw it away, and get a card reader – they seem to work much faster. They're cheap (\$10 to \$20) and easy to use. The one shown here (with an SD card inserted) takes six different types of memory cards. If your camera uses an SD card, and you've got a modern laptop computer, you'll quite possibly have this download facility built-in to your system.



Depending on what software you're using for your image processing, you might find that when you connect a camera or card-reader, an auto-loader for your software opens (immediately, or perhaps after a short delay). Use that if you are comfortable with it, but take care about where it puts your images – you'll need to know for backups; and it may set up lots of folders (perhaps one for each day when photos were taken).

My preference is to use Windows Explorer (NOT Internet Explorer) to organise where I transfer my images to; later, I'll open my image processing software, and import the images from where I've already put them on my computer.

## Backup

The next step in your workflow should be making a backup copy of your images.

Depending on the software you're using, you may have the option of doing backups from within it. If so, that's probably a better option, particularly if your software does cataloguing, since you'll also have that information backed up. You'll need to do a full backup first; subsequently, incremental backups – only data that has changed – are all that's

needed. Alternatively, you can choose to backup files externally, using Windows Explorer (or Finder, in Apple Mac systems).

You might choose to do a quick scan of your just-imported images and delete anything you're sure you'll never need – the branch that a bird flew from an instant before you pressed the shutter; the blur when the auto-focus didn't. But before you start serious image selection and processing, back-up to your medium of choice. It's a good idea to check that your back-up copies are readable before you move on – more important with DVD/CD.

DVDs or CDs are cheap and portable – so you're more likely to put your back-up in a different place to your computer, so they don't get lost in the same disaster. They are claimed to have long life – I've got CDs I recorded 15 years ago which are fine. With big raw files from modern DSLR cameras, you might need lots of them. Also, you can get printable disks for easy labelling.

Demountable hard disks are a viable option; you can get a huge amount of storage space for very little outlay – I recently bought a 2TB drive for \$89 – and with USB 3 connection they're also reasonably fast. They can be stored off-site – but if you're like me, they probably won't be.

Another option is “cloud storage” – where you trust the safe-keeping of your files to some company's servers somewhere. This needs a reliable high-speed Internet connection, and is likely to be costly for lots of large images – although this is already changing; I saw recently that Yahoo's Flickr site is now offering 1 TB of **free** storage. It's perhaps more viable for storing backups of a few files – perhaps just your finished images, tweaked to your liking. It's definitely off-site, and it's accessible from anywhere.

## Cataloguing Images

**Cataloguing is important. It lets you find specific images.** Having a sensible cataloguing method might seem unimportant when you're starting out in bird photography, but it will be essential when your collection of images grows – as it will.

My choice is to use cataloguing within my image processing software. Photoshop/Photoshop Elements, Lightroom/Aperture, and PaintShop Pro all provide this capability; probably many other packages too. Check before you buy. The image processing software that comes bundled with your camera is less likely to have cataloguing capability. The usual method is to **tag images with keyword tags**; and the ability to set up a hierarchical tag structure is useful – for example, Bird – Raptor – Whistling Kite. Tags can also be set up to allow you to find images by criteria other than species – I routinely add tags such as in-flight, feeding, juvenile, female, etc to my images where it's appropriate to do so. I also rate my better images with stars – one to five. But I'm a hard judge – I don't think I've got any 5-star ones!

Keyword lists of birds are available online, and can be downloaded and imported into software packages.

Alternative methods of cataloguing are using spreadsheets, cataloguing packages, or custom databases.

Another viable method is to incorporate cataloguing into your file naming structure, and then use your computer's operating system (Windows Explorer or Apple Mac's Finder) to search by part of a filename. However, this won't be able to cope with as many search options as a hierarchical tag system. You'll also have to be disciplined about renaming all your image files. It's perhaps worth noting that Windows Explorer, in versions from Vista onwards, allows tags and ratings to be applied to files. Apple Mac's Finder may also do so.

## Image Editing

The most important thing to do is [learn how your image-editor program works](#). Use it, practice things, check the Help facility (which for many programs these days may need an on-line connection, or else a downloaded .pdf file), find on-line tutorials or third-party books. Follow the tutorials in these newsletters.

## FAMILIARITY BREEDS EXPERTISE

I use Photoshop Elements (Version 8 – about 4 years old now) for my image processing, but most editing packages will cope with the basics I'll be demonstrating. I was thinking about changing to Lightroom 5 – a very well credentialed package, and excellent value-for-money. I tried the beta version, but when it expired and I downloaded the full new package, I found that it will only run on Windows 7 (or later); and I'm not about to change my operating system.

In the sections that follow, the names of menu items that I use might well be different in different editors; translate as necessary.

I occasionally use GIMP for ad-hoc image editing, and I wrote a review of it a few years ago which you can find in our December 2009 Newsletter. As I said there, it's an extremely capable freeware program, if a little "quirky"; but I won't be switching to it because it has no cataloguing capability.

## Global Image Adjustments

Let's start by looking at some global adjustments you might want to make. These are *changes that will affect the entire image*, not just a part of it; they include **cropping** and **resizing**.

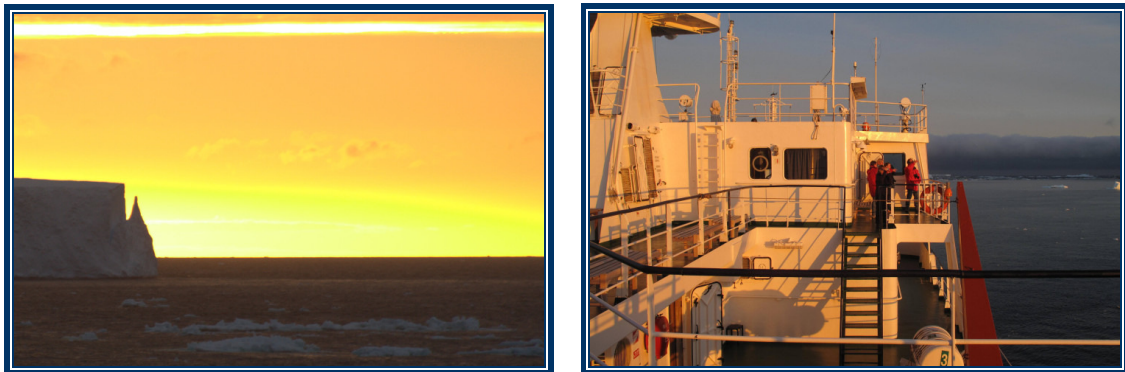
Global adjustments include things like colour correction for **white balance**, or a **colour cast**; although the latter is perhaps more likely to be something affecting only part of the image, and is therefore a local touch-up – an area I'll get to later. Think "*green tinge on white underwing of bird flying over green grass*". But some image editors use the term "colour cast" to mean an overall colour problem, such as from incorrect white balance; and the correction method they apply reveals this.

We might also want to fix problems with *incorrect exposure*, *dynamic range*, and perhaps *contrast* or *saturation*. But be careful of changes to contrast and saturation, as this might change the colour of the subject – something you shouldn't be doing with bird photographs.

**Be wary of applying any of the “Auto ...” fixes that your editor might offer** – they adjust your image to a pre-set formula that the software producer thinks is what most images should meet to look good.

## White Balance

White balance correction is not commonly needed, but there are situations, such as these images, where it might be necessary.

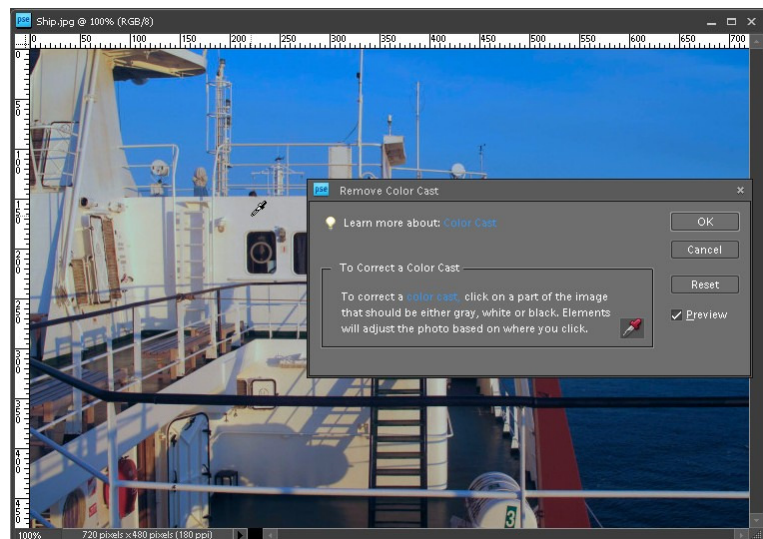


The image on the left was taken at about midnight in the Ross Sea; there was a definite yellow-coppery colour to everything. The image on the right was taken on our ship at about the same time – and the ship's superstructure is white!

White balance will usually be OK if your camera is set to Auto White Balance, or one of the other presets which are commonly available: outdoors or daylight, shade, cloudy/overcast, incandescent light, fluorescent light, etc.

If you know there's likely to be a problem, you can set your camera to manual white balance to compensate for the lighting conditions at the time. To do this, you take a picture of something which is – or should be – white, and tell the camera to use that as the basis for its white balance setting. Consult your camera manual for details.

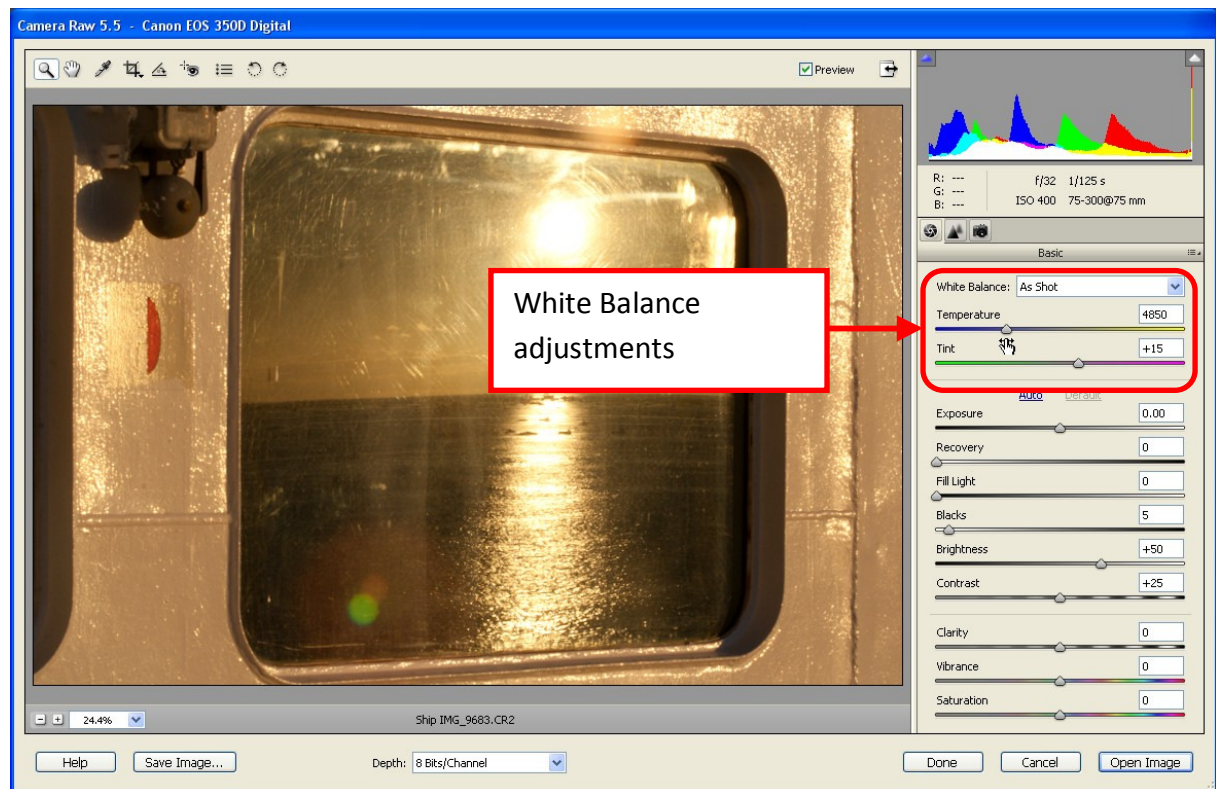
Let's look at how we can fix this if we find there is a problem. I've opened the JPG image of the ship shown above, and chosen the **Enhance – Adjust Color – Remove Color Cast ...** menu item. This opens a dialog box to allow you to select, using an eye-dropper icon, a point in your image which should be white, or grey, or black; a point where the Red, Green and Blue



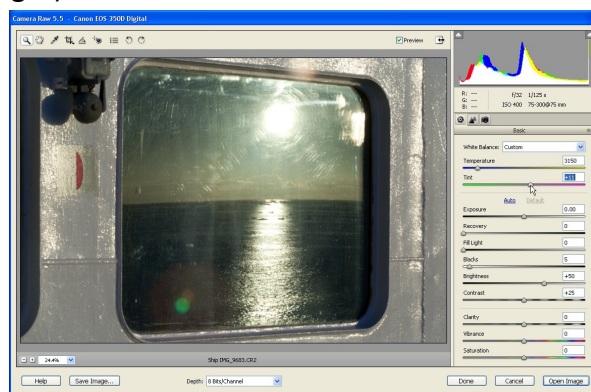


channels SHOULD all be the same, but are not (which gives the colour cast). It's easiest if you pick something that should be white, such as the point shown here. Note that the adjustment has also changed the sky rather drastically in this image. You may find that the point you sample produces other colour problems; if that happen, just click on another point until you achieve the best correction possible.

When you open a RAW file, a raw convertor dialog opens where you have the opportunity to adjust the image before it opens in the editor. Here's a raw file (my camera generates them with a CR2 file extension) of a portion of the ship taken in similar lighting.



There is a **White Balance drop-down**, which offers a choice of several pre-set conditions; or you can adjust the colour **Temperature slider** to get rid of the coppery tone. This works by adjusting the blue/yellow balance; but you'll probably also have to adjust the **Tint slider** somewhat to adjust the complementary green/magenta balance. With this particular image I can't get it back to white, only to grey (the overall light level was not high enough for white because it was late at night).



## Opening Files

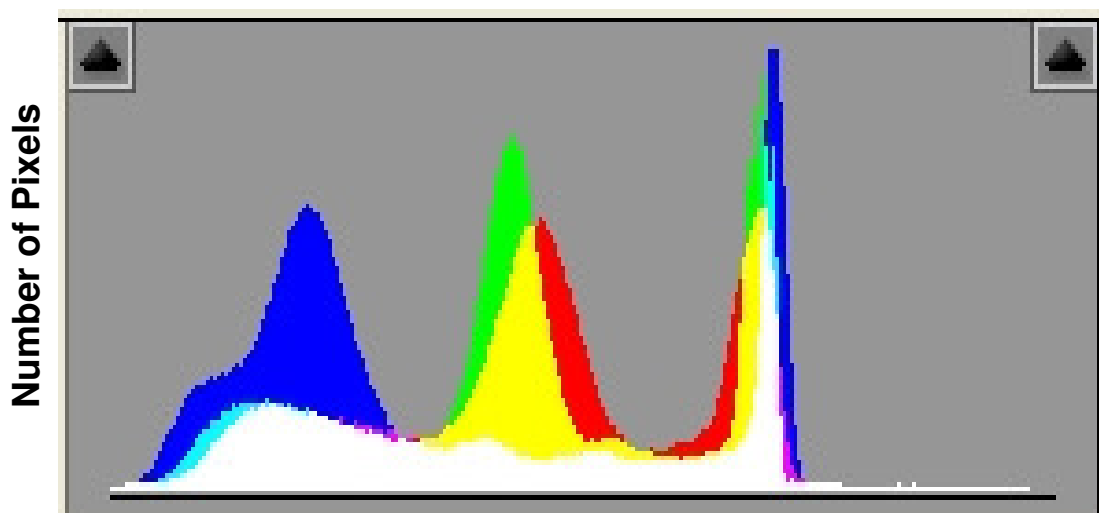
In the examples in the White Balance section, there is a difference between opening a JPG file and a RAW image. A JPG opens immediately in the editor, a RAW file opens in a convertor which allows various global adjustments to be made.

With Photoshop Elements, *it's important that you take notice of the Depth setting for subsequent actions in the editor*. If it's set to 16 bits/channel, *some editing options become unavailable*, and – very important for local adjustments – *layer actions are not available* (they are in the full version of Photoshop). Also (and in the full version of Photoshop too) *you will only be able to Save As ... in formats that support more than 8-bit colour – you won't be able to save as jpg*. The Depth setting in Photoshop Elements Camera Raw convertor is the drop-down below the centre of the image (see previous figures).

## Exposure Correction - Histograms

A very useful tool for exposure correction is the **histogram**, and it's important to understand what they are telling you, and to use them to help in your image processing. You'll find these in many cameras, so you can check while you're taking your photos; you'll find them in Camera Raw modules (see the images on the previous page); and you'll find them in editors, as a display window, and also in some editor tools (eg. the Levels tool).

A histogram is a chart showing luminance or brightness (dark to light) and the number of pixels in the image at each brightness level.



**Luminance:** dark (left) to light (right)

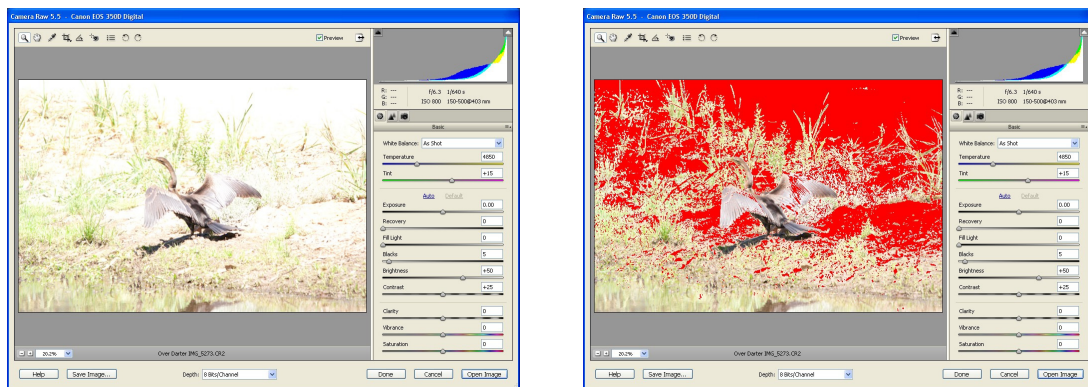
This chart is from Photoshop Element's Camera Raw module; it shows colour for RGB and combinations (cyan, yellow, magenta, white). Some histograms will display the composite (white), or allow you to select which colour you want to view.

*Importantly, if there's a spike at the end of the histogram, the image (or part of it) is underexposed (left end) or overexposed (right end). If you've got that **in a JPG image, there is no way that you can shift the histogram to recover lost detail**; if you've got that **in a RAW image, you can recover lost detail**.*

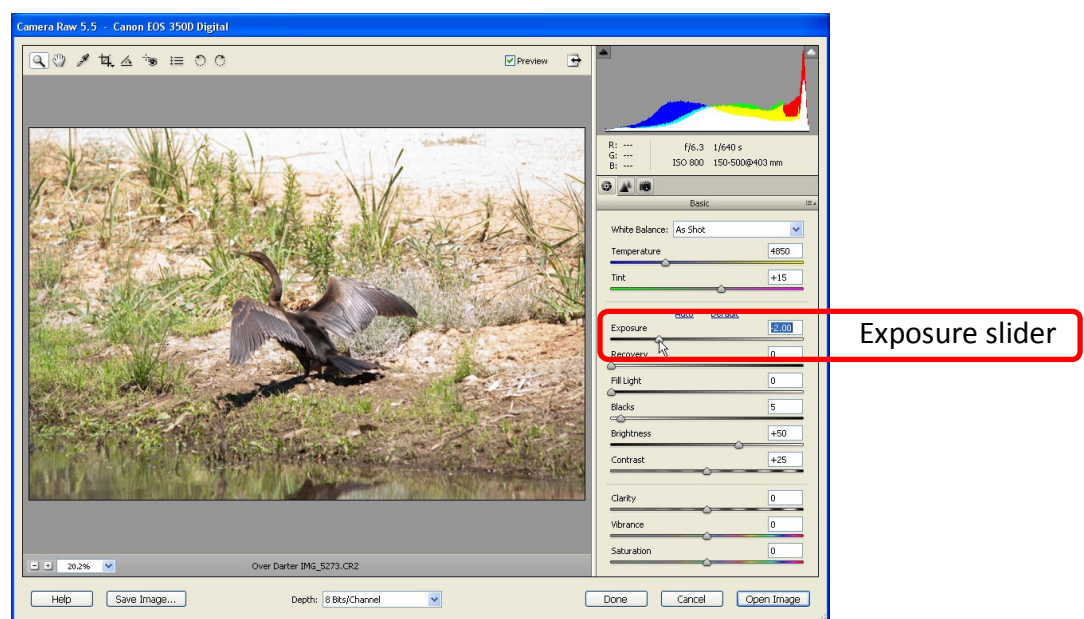
In many histogram displays, you'll also have **clipping indicators** (the arrow-boxes at top-left and top-right of the histogram, above), which will allow you to see shadow (underexposure) or highlight (overexposure) problem areas within your image. In most editing software, if you hold down the **Alt** key (or **Option** key on an Apple Mac), you will be able to see what areas of your image will be affected while you're tweaking the sliders to make changes. Subsequent examples will show this.

## Overexposure

Here's a picture, opened in the Camera Raw convertor, which I took immediately after taking a dark bird against the sky; I had deliberately overexposed, then forgot to re-set my camera before I saw this bird and grabbed this shot. It's overexposed by 2 stops. The image on the right is the same view, with the clipping highlights turned on; the red area indicates the over-exposed regions.



I can fix this image very simply by adjusting the **Exposure** slider. The clipping highlight changes as I do so. If I hold down the **Alt** key, portions where some, but not all, colour channels are overexposed are shown; with the Alt key down, the image will be black if everything is not overexposed.

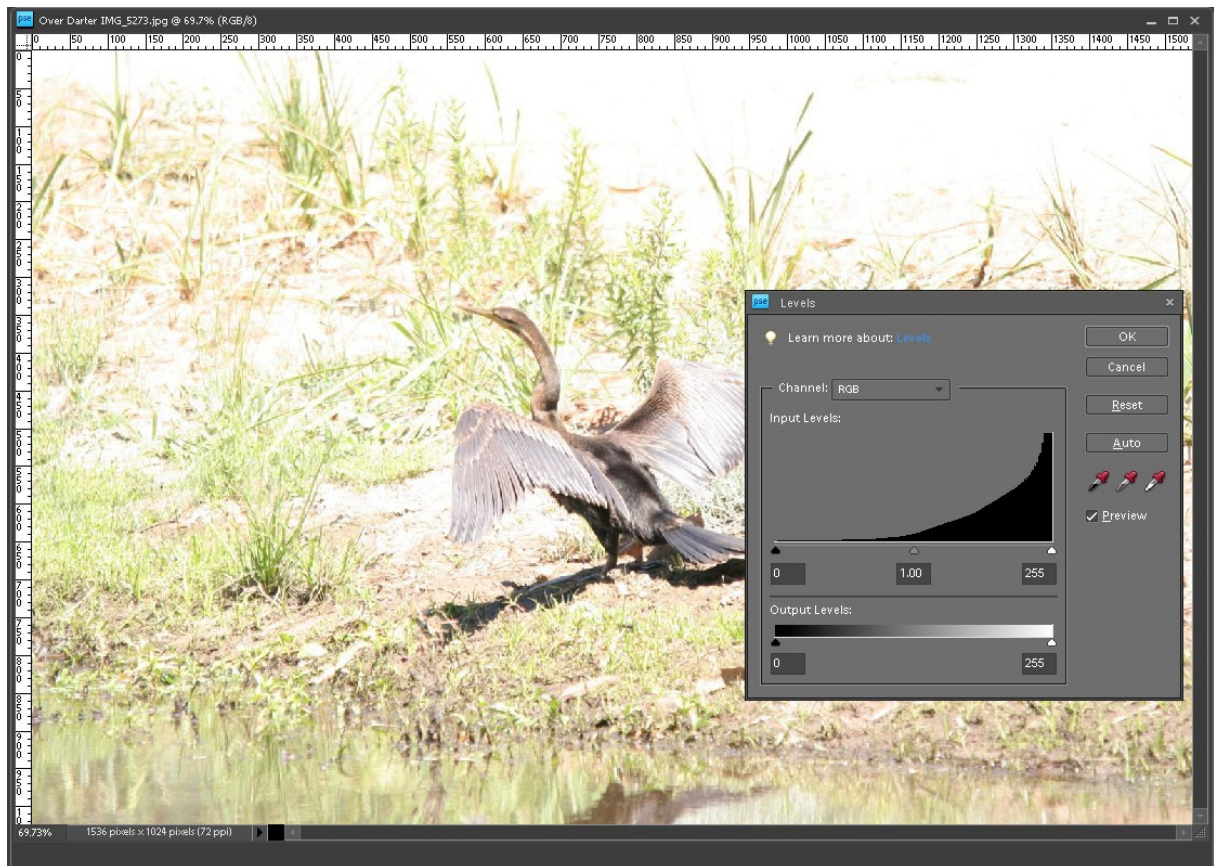


Notice that the histogram for the image has changed; there is no longer a peak at the right-hand edge.

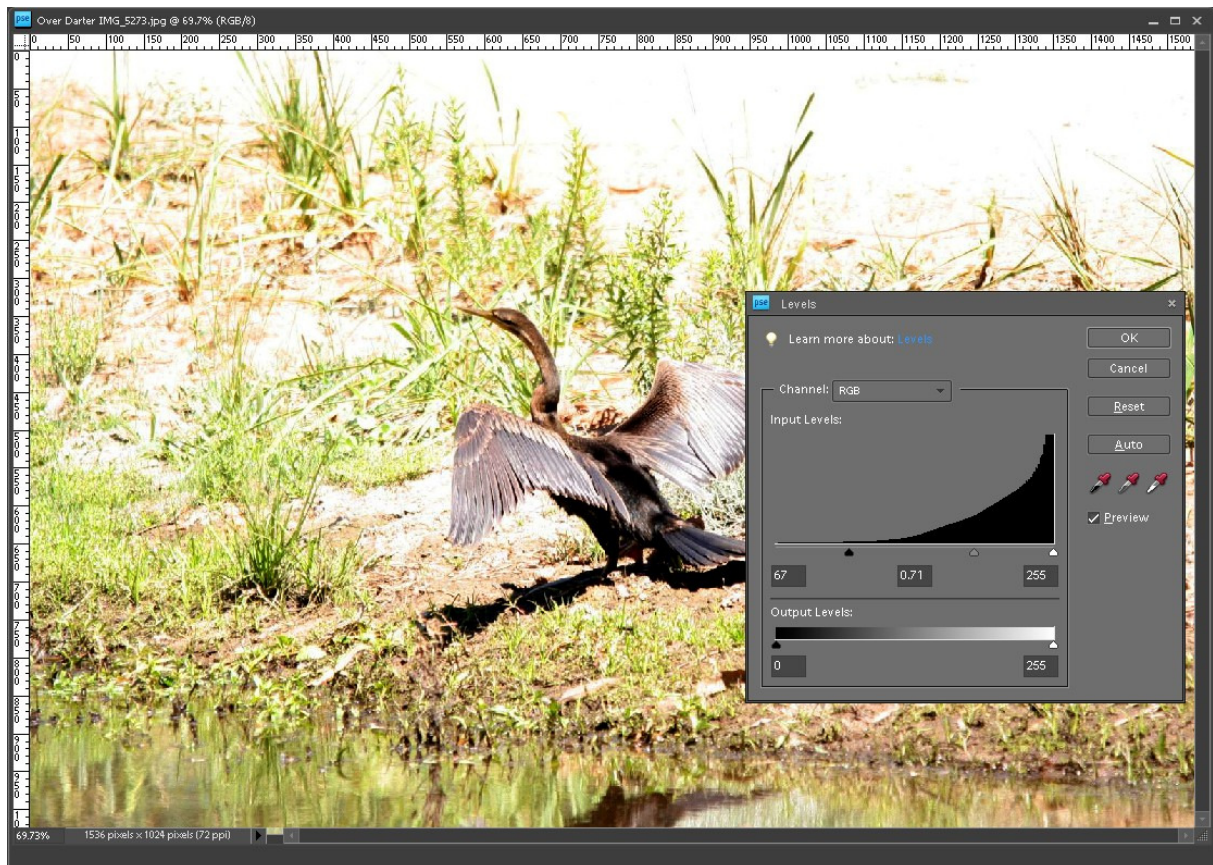


The Recovery slider (immediately below the Exposure slider) will also correct overexposure and restore detail in parts of the image; it is more useful for correction when the overexposure is less severe than in this image.

With an overexposed JPG image, life is much tougher. Here's a JPG version of the same overexposed image. There is no exposure correction tool comparable to the Camera Raw convertor. The most sophisticated adjustment available for a JPG image is via the **Enhance – Adjust Lighting – Levels ...** menu item.



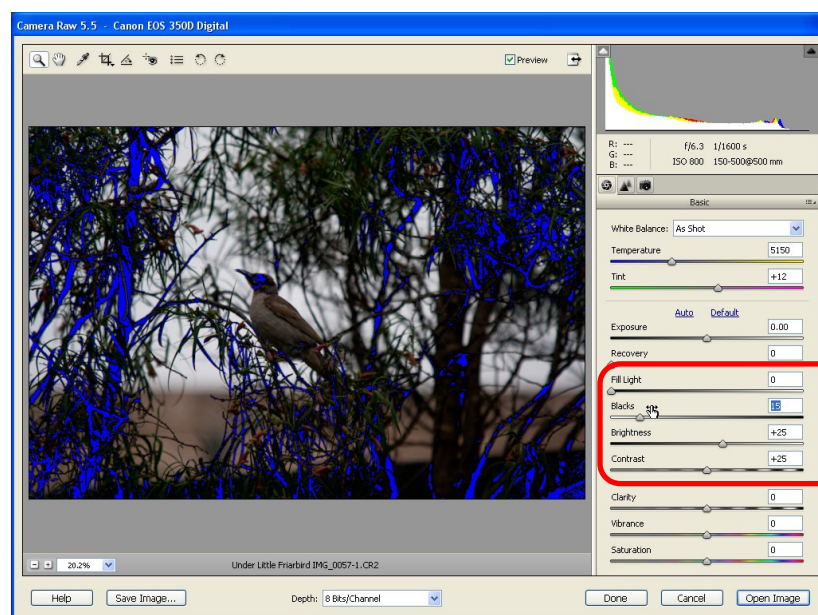
The Levels tool displays the histogram for the image; it looks like the raw file did before I adjusted it. I can get some improvement by moving the **black end point** (the arrow-point at the left end of the histogram, currently set to 0) to spread the image over the available output range, and tweak things with the **mid-point** setting (the arrow-point in the centre of the histogram, currently set at 1.00), but there is no way that I can shift the **white end point** (the arrow-point at the right end of the histogram, currently set at 256) to recover detail from beyond the white end. The image below is about the best that can be done here.



Other methods of darkening an image – a duplicate layer set to Multiply mode, for example – will also not recover detail beyond the white end point.

## Underexposure

And now let's have a look at an underexposed image. With the shadow clipping indicator turned on, the underexposed portions are shown in blue. Using the Exposure slider to try to fix this won't work, since the light portions of the image are near the end of the available range before becoming overexposed. In this case, I can use the Blacks slider to get rid of the underexposure.



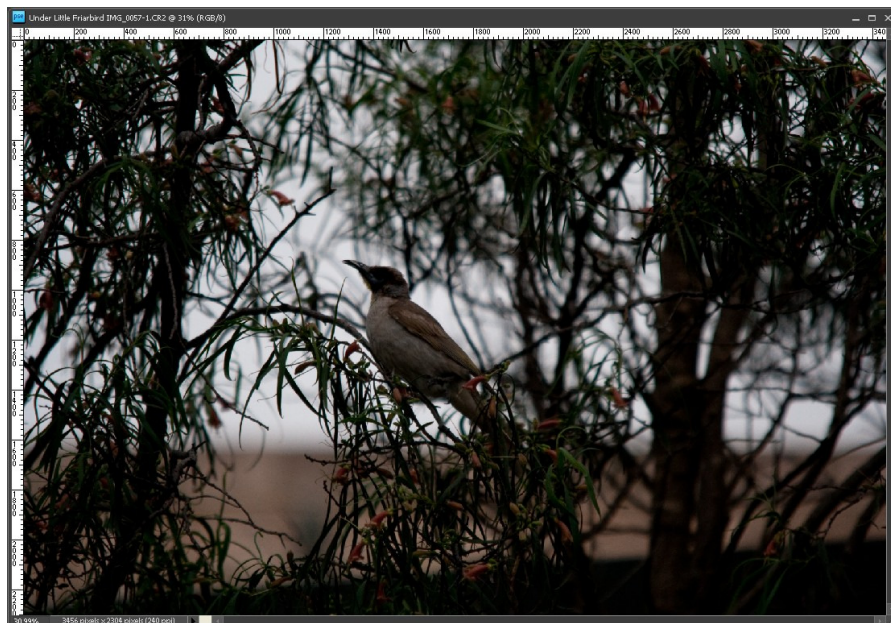
Fill Light, Blacks, Brightness & Contrast sliders



Doing this still leaves parts of the image too dark – the bird's face still lacks detail. The Fill Light slider will brighten dark areas, without affecting light areas. A little fine-tuning with the Brightness slider, and perhaps a slight Contrast adjustment, and I've now got a much more acceptable image.

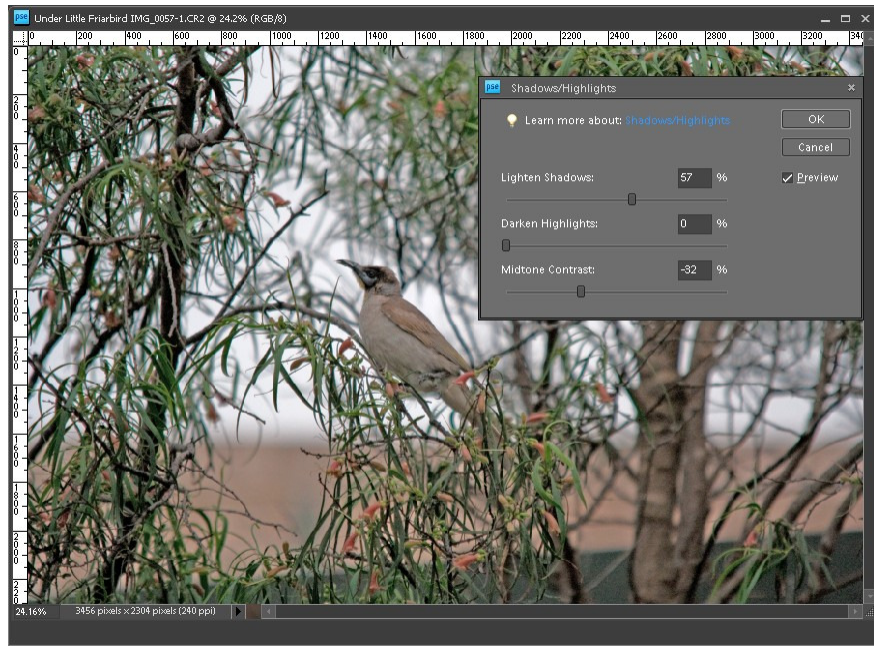


If this was a JPG image, it would open in the editor looking like this. There's a couple of ways we can improve an image like this.

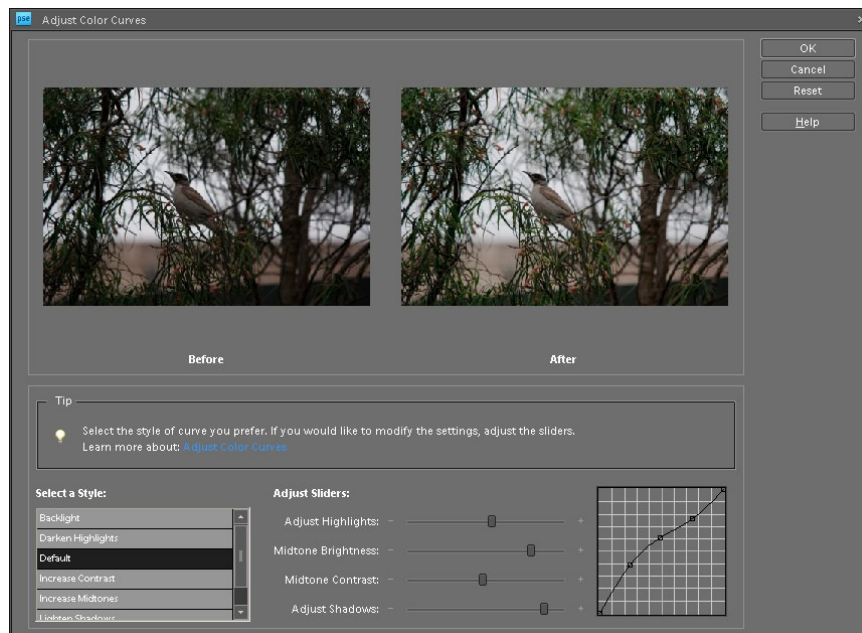


There's a **LEVELS** tool (Enhance – Adjust Lighting – Levels), but this is more useful when your image is a bit flat, not using the full dynamic range available; then you can adjust the black point and white point to increase the range, and perhaps tweak the mid-point to improve the contrast. I'll show you this shortly.

More useful here is the **Enhance – Adjust Lighting – Shadows/Highlights** tool:



For a bit more control, you can use the **Enhance – Adjust Color – Adjust Color Curves** tool. In Photoshop Elements, the curve is adjusted via a set of sliders; other editors allow you to click on the curve itself and drag it to the shape you want to get the effect you want, with more than the three point control (there are four sliders, but only three points being adjusted on the curve: Midtone Brightness moves the centre point vertically, Midtone Contrast moves the centre point horizontally) in this editor.



It's important not to overdo the changes using these tools. It's possible to produce crazy effects:





## Dynamic Range

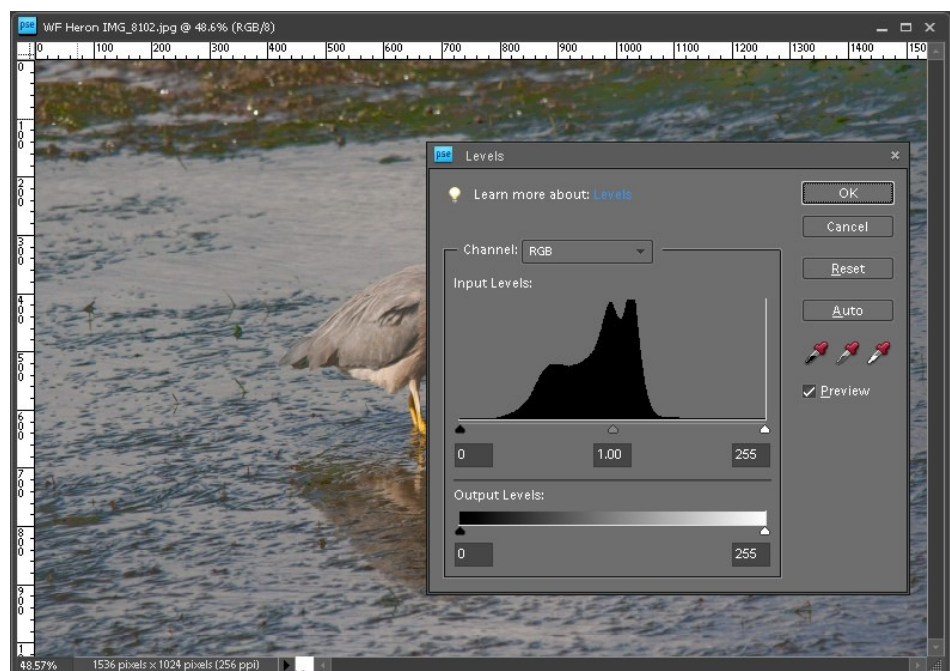
For the last of the exposure corrections, let's have a look at improving a "flat" image, by adjusting the dynamic range. I'll do this with a JPG image, rather than the original RAW file, and I'll use the Levels tool.



I said earlier to be wary of the **Auto ...** correction tools. Just for the exercise, let's see what Adobe thinks this image should look like, by applying the **Auto Levels ...** correction. *I think I've now got a candidate for fixing a colour cast.* So I'll **undo** that – using the standard **Control-Z** key combination.



The **Enhance – Adjust Lighting – Levels** tool allows me to adjust the black point and white point to use the full range of output levels – 255 for 8-bit colour depth images. This image is only using about 150 of these: the darkest point is at about 30, and the



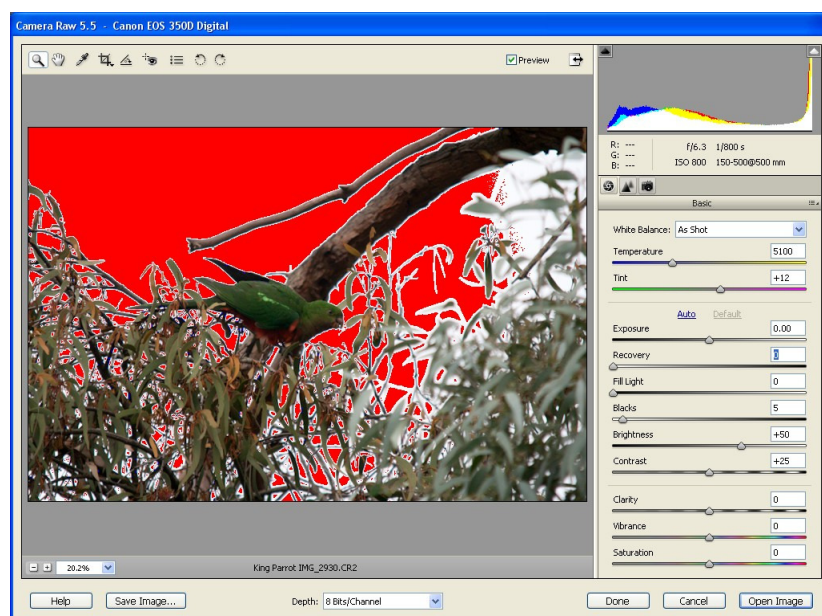
lightest point at about 180. To improve this image, I move the indicators on the input level histogram to set the **black point** just below where the darkest point is, and the **white point** just above where the lightest point is. I could also use the eye-dropper icon to set these; but that's easier to do if there are true black and white areas in the image that you can just click on – it's not really a viable option with this particular image. When I adjust the black and white points, the **mid-point** will automatically move; but that's also adjustable if you want – it affects the midtones, making the overall image lighter or darker. Applying these changes, and cropping the image to improve the composition, gives this as the final result:



## Cropping and Resizing

Finally, in the area of global adjustments, let's look at cropping, to improve composition, and resizing, to meet specific requirements, such as for submission to our web galleries.

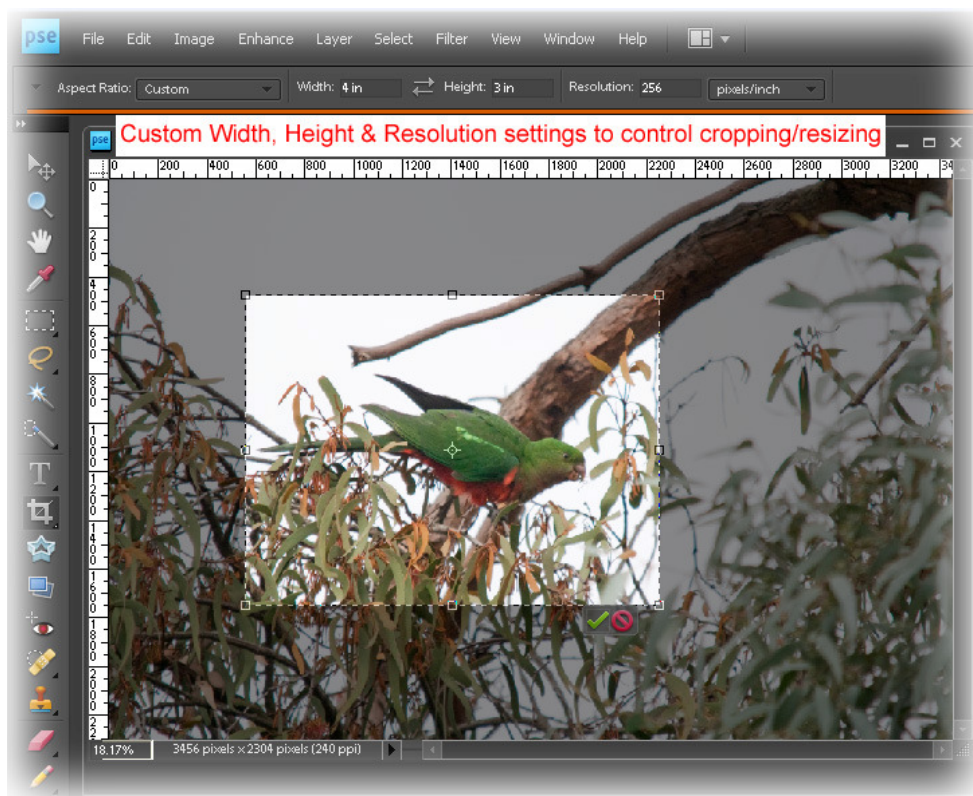
I'll use this image for this demonstration. It can really benefit from cropping to improve the composition, and I'll also show a touch-up technique later. But first, let's improve it a little on the way.





When I open this image (it opens in the Camera Raw convertor, since it's a raw image), I see immediately from the clipping highlight indicator that the sky is blown out. I can correct this with the **Recovery slider**; changing the **Exposure slider** will only worsen the dark areas. Holding down the **Alt** key makes it easy to see when all the blown-out areas have been corrected (the entire image will be black); it's easier to see than the red clipping highlight. Next, I'll make details in the bird a little clearer by adjusting the **Fill Light slider**. I then open the image in the editor, and select the **Crop** tool. There is a crop tool in the camera raw convertor, but I prefer to use the one in the editor, for reasons which will become apparent.

I commonly constrain the aspect ratio of my image while I'm cropping. This is particularly useful when I'm aiming at producing images for display on a particular device (eg. a 16:9 widescreen TV) or printed at a specific size (6x4 or 10x8 prints), or to use the full size available for images on our website galleries (4:3 ratio – 1024x768 pixels). Here's how I'd crop this image, while at the same time resizing it to meet the 1024x768 limit of our web galleries. I set the aspect ratio to 4" wide and 3" high, with a resolution of 256 pixels per inch; then I just drag the crop tool to give a pleasing image, and click the **Done** tick when I'm happy with it. For further details, see my article in our December 2011 Newsletter.



I find it useful to display rulers, and sometimes a grid, on my images when I'm doing this; these can be turned on and off via the **View - Rulers** and **View - Grid** menu items. I also ensure that the ruler, and the little info panel below the image, display in units which suit my purpose; these can be set in the **Edit - Preferences** menu.

## Resizing

It's also possible to resize using an **Image Resize** tool – probably available in every editor. If you use this, the most important thing to do is **ensure that the Constrain Proportions checkbox is set**; in Photoshop Elements this is also indicated by the chain link beside image

dimensions/resolution. In some editors, this may be set or unset by clicking on the chain icon itself. *If you don't constrain proportions, your image will become distorted.*

The other key thing is **resampling**. *With no resampling, changes to image size simply change the resolution; the overall file size does not change.* Also, the change in size will only really have an effect in a device which reads *and obeys* the size and resolution data stored within the image file. If you're resizing to reduce file size, you must resample your image. There are several algorithms for this, but I'm usually happy with the default Bicubic. Try others to see the difference – but you might be hard pressed to see any difference, particularly on a monitor; a print might reveal more.

The final point I'd make about resizing is that, *although you can use it to increase image size, if you do so your image quality will be reduced* – either because the resolution decreases, or because the resampling process generates additional pixels which were not originally present.

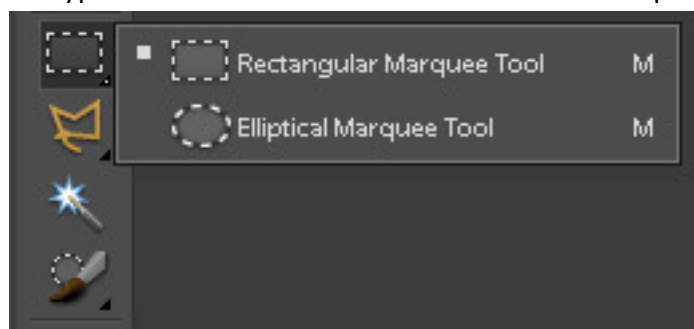
## Image Touch-up

It's likely that you'll want or need to make other changes to get your image looking as good as possible. Image touch-up is really beyond the scope of this article, so I'll just mention a few points.

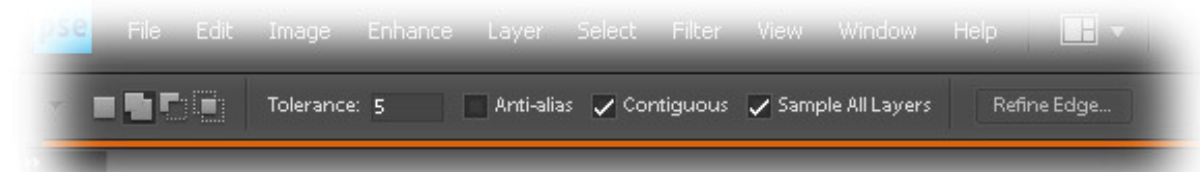
## Localised correction of exposure/colour

Localised correction of exposure or colour will probably require the use of either **layers** or **selections** – so *learn to use those tools in your image editor*. If you're using Lightroom, you'll have various touch-up tools available that don't seem to need the use of either layers or selections; but Lightroom is actually using layers "behind the scenes".

For selections, you'll probably have several types of selection tools available. In Photoshop Elements I have rectangular or elliptical **marquees**, various types of **lassoes**, a **magic wand** (probably the most useful), and a **quick selection** or **selection brush** tool. Right-clicking a tool icon in the **Toolbar** (displayed at left of screen) allows variants of a tool to be used.



The **Options bar** (under the main menu items at top of screen) displays controls to let you add to, subtract from, or union with an existing selection, together with other options for



the particular tool in use; these can be used to refine selections to get exactly what you need.



The Selection menu lets you do things with selections – including saving them, which can be very handy. *When you have a selection, changes are applied only within the selection, not globally.*

*Layers, adjustment layers, and layer masks are usually easier to work with.* Layer masks are particularly useful, since they allow you to paint on them with either black or white to stop an effect, or allow an effect to operate – you get fine control over where corrections occur. There's an excellent series of tutorials on using layers, written by David Jenkins, in our newsletters over the last couple of years, starting in June 2011.

### Removal of distracting elements

It's fairly common that it would be nice to get rid of distracting elements within an image, and that can be done by either cloning them out, or changing their brightness/contrast/focus to make them less apparent.

Let's return to the previous image I was working on, and that horrible bare branch top-centre. To get rid of the branch, I select the **Clone Stamp tool**. This will clone, or copy, one spot in the image to another. First I hold down the **Alt** key, and **click** in an empty area of the sky to make that the portion I will use to replace the branch. If the **Aligned** box in the Options bar is checked, it will move relative to the position where I'm replacing. Take care with choosing the sample spot – but if you get something wrong, just use **Control-Z** to undo it. A few strokes, and the offending branch is gone.



Sometimes it's useful to work at full-size, particularly for touch-up operations. *Short-cut keys can be real time-savers* – I commonly use **Control-0** for **whole image**, and **Control-1** for **full-size**. The **square-bracket keys [ and ]** will control **bush size** in most editors.

It's easy to do this in the background area of an image; it's more difficult if it affects main subject, but can be done with a bit of care. It's also worth noting that the cloning tools have improved considerably in recent software releases.



*From original (left) to final (right) in a few easy steps*

Here's another example of removal of distracting elements.



Original image © Peter Crane

In addition to cropping to get rid of the worst distractions and focus on the bird, there have been various techniques applied to draw the viewer's attention to the bird, rather than any of the surroundings. Our April 2013 newsletter contains details, and four different, but similar, treatments by four people. This particular example has used cloning to remove the light area just in front of and above the bird, with selective sharpening of the bird. The one I did used selection and blurring to soften the large rock at front-right.

### Spot Correction

Here's one more tip that might be useful. I experienced this with lots of photos I took in China. Happily, I rarely need it for my bird photos. This is *getting rid of "dust bunnies"* – spots in the image from dust on the lens, or maybe the sensor. The lighting direction of the image can affect how visible these are.

Prevention is, of course, better than cure. Keep your lens clean; use the sensor cleaning function available in most DSLR cameras; or CAREFULLY clean the sensor manually – or get it done professionally.

If you do need to fix this, a **Spot Healing Brush** is a useful tool. Just select the tool, set the brush size (with [ and ] keys) to suit the imperfections, and click on the spots to remove them. It's like magic!



## Sharpening

The final thing to do, particularly with RAW images, is to apply some sharpening to the image. There are several ways to do this, but I usually use the **Unsharp Mask tool**. Other options are the **Adjust Sharpness tool** – simple to use, but I don't think it works as well as Unsharp Mask – or more technical methods, such as using a **high-pass filter**. Note that JPG images will have had some sharpening applied in camera, and will probably require less sharpening than raw images; also note that the Camera Raw convertor may apply a small amount of sharpening, if left at its default settings.

The Unsharp Mask tool has three sliders:

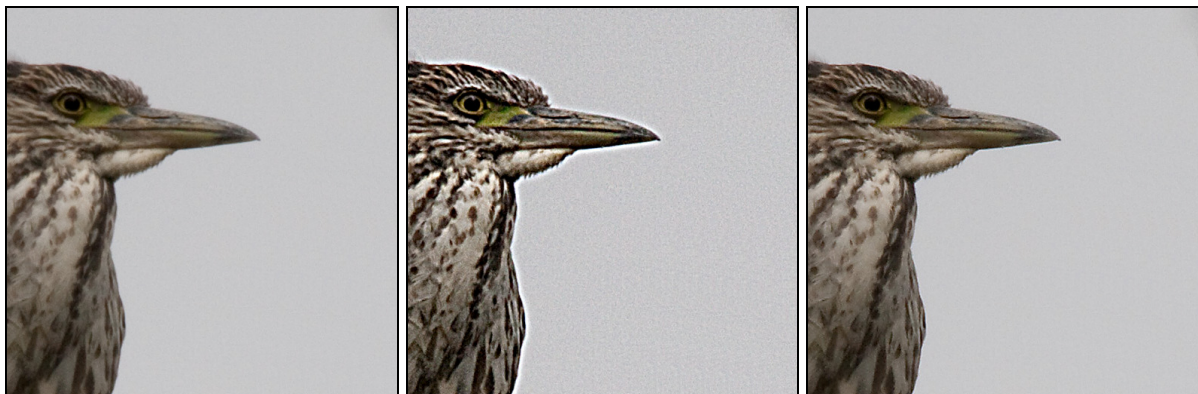
**Amount:** Determines how much to increase the contrast of pixels. For high-resolution printed images, an amount between 150% and 200% is usually best; for on-screen images, lower values are generally OK.

**Radius :** Specifies the number of pixels to sharpen around edges. For high-resolution images, a radius between 1 and 2 is usually recommended. A lower value sharpens only the edge pixels, whereas a higher value sharpens a wider band of pixels. This effect is much less noticeable in print than on-screen, because a 2-pixel radius represents a smaller area in a high-resolution printed image.

**Threshold:** Determines how far different pixels must be from the surrounding area before they are considered edge pixels and sharpened. 0 sharpens everything!

When applying sharpening it's essential to work with the image at 100% size, perhaps more. I generally set the radius to about 1, then increase the amount until halos begin to appear on edges; I then slightly reduce both the radius and the amount until halos disappear; finally, I increase the threshold from 0 to get rid of "speckles" (noise) that may have been generated by the sharpening.

Here is a set of images showing sharpening of a raw image. The original is on the left; the centre image is (deliberately) over-sharpened to show halos and speckles (most apparent in the sky); the image on the right has had both the radius and amount reduced (to remove halos) and the threshold increased (to remove speckles/noise), and is suitable for use on-screen. For a high-resolution print, more sharpening would almost certainly be required. [You may need to view at higher magnification to see the differences, particularly between left and right].





There are several articles/tutorials by Bob Young on various sharpening techniques in previous newsletters: June and August 2010, and February and April 2011

## **Saving for Final Use**

Last, save your final image, in a format suitable for what you want to do with it, and at a resolution suitable for the medium and size that you choose. Generally, JPG will be OK, unless you really need to save all the layers that you used, or need more than 8-bit colour – for professional printing, for example, where TIFF is a commonly-used format.

*When saving as JPG, be careful of the option you choose*; progressive JPG, for example, will not display on some devices – our new smart TV for one! See my article in the August 2013 newsletter. Also, when saving as JPG, you might need to *turn on a Preview checkbox to have the filesize displayed*; if it's too large for the purpose (over 512 KB for an image you're planning on uploading to our web gallery, for example) you might need to reduce the Quality setting a bit. If the filesize is acceptable, keep the Quality setting as high as possible – particularly if your original image was also a JPG.

If you've saved an edited RAW file as a JPG, you'll be prompted as to whether you want to save changes to the RAW file when you close it. If you do decide to do so, it won't be saved in the original file; instead, it will be saved as a PSD or DNG file. And, even if you don't choose to save changes, you'll find that next time you open the RAW file, any adjustments you made in the Camera Raw convertor will still be in effect – but you can unapply them by changing the settings in the convertor, even things such as cropping or rotating. If you want to get rid of those changes completely, you'll need to delete the .xmp file for the image; it will be in the folder where the image is stored.

And at the very end – *backup your edited images*.