Macro Photography

Beyond Flowers and Butterflies

An introduction to the fascinating world of close-up and macro photography

Reinier Munguía
email: rmung@wildstockphotos.com
www.wildstockphotos.com

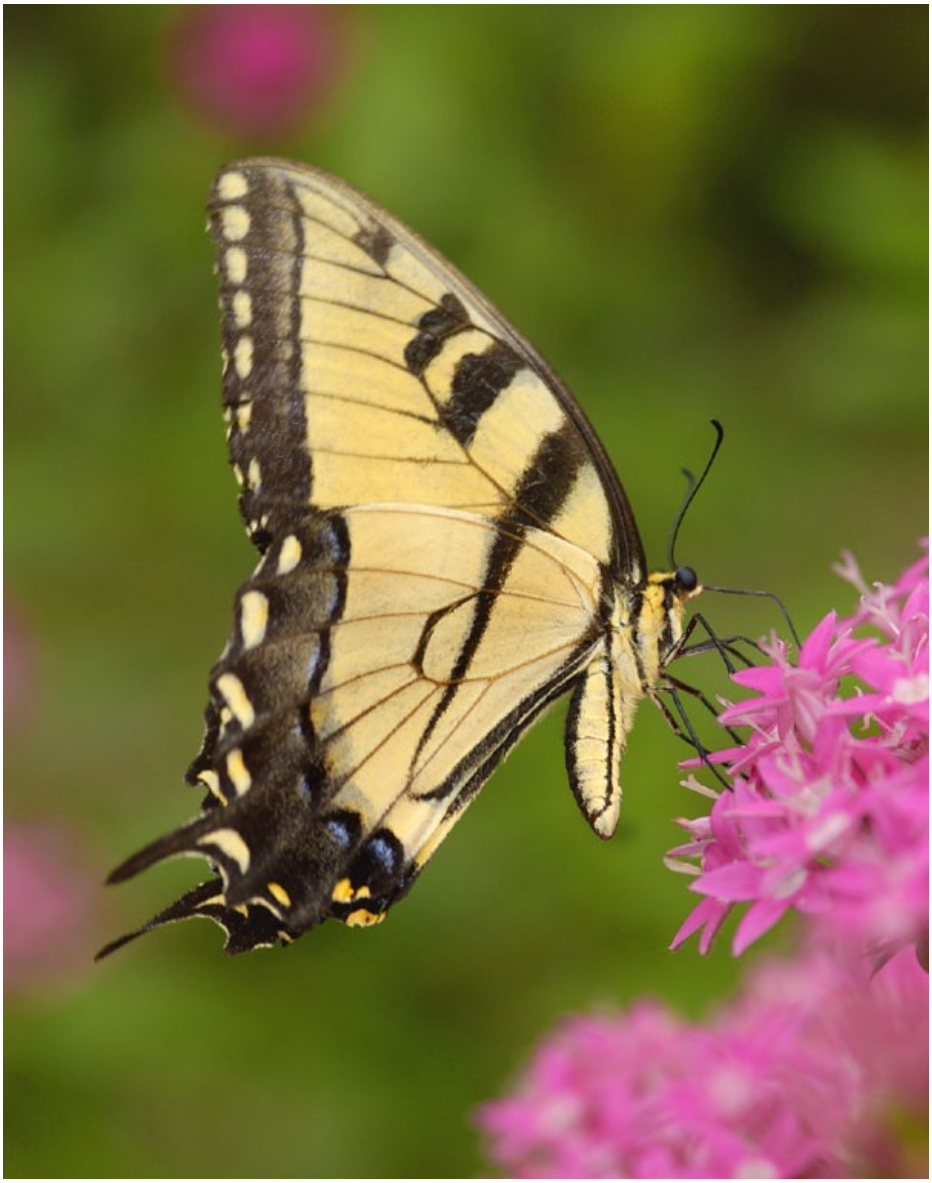
INTRODUCTION

This publication will help you get started in the amazing world of macro photography, its challenges and the techniques I use to overcome some of these challenges. Although not a complete guide, it provides you with the knowledge required to take beautiful images. You'll learn useful techniques that I have learned over the years, saving you time and frustration when shooting small creatures.

Most people entering this fascinating field of photography think there's only one way of doing things, but in reality you can accomplish the same effect using different techniques. Problem solving in the field will depend on many factors including the weather, your equipment limitations and your subject. That's the reason why there isn't a single and specific solution to most macro photography questions. My best advice is to familiarize yourself with your gear, learn as much as possible about your subject, even before you get out the door. Research plays a big role in successful photography. Preparing yourself to what you might encounter will increase your chances of capturing that unique image.

Obviously, equipment is a limiting factor in how close you can get and the quality of the image you obtain. We'll discuss some of the most commonly used equipment, their advantages and how to properly use them to get the best they can provide. Basic photographic techniques such as depth of field, focusing and exposure will be discussed in terms of their applications in macro photography. I have also covered few things that we can do to make our photography more affordable by building simple gadgets that will improve our photography with a minimal investment.

Finally, I'll emphasize the importance of learning about your subject and the environment in which it lives. How to approach those skittish subjects and how to deal with nature's obstacles will also be discussed. In order to be a successful nature photographer, you must first become a naturalist. Only through direct observation of the subject, one can learn about the natural world and that leads to better images. One final thought: practice makes perfect, and all good nature photographers are the result of many years of experience. Frustration is part of the equation, and without it, we can't learn.



Eastern Tiger Swallowtail, *Florida.* Nikon D70, 105mm, 1/250 sec. at f8

DEFINING MACRO

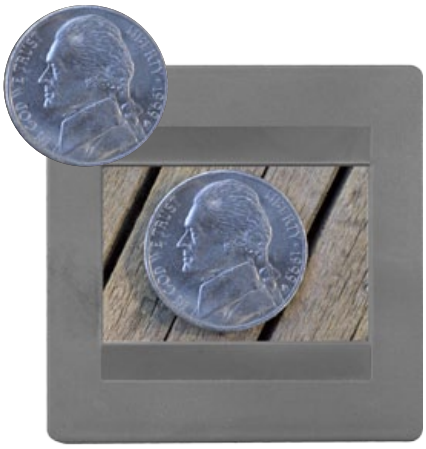
First, lets define macro photography, as there are several interpretations, but only one correct. This was caused in part to the marketing hype of many manufacturers that claim the macro capabilities of their lenses, in which cases were merely lenses that allowed for closer focusing, but not real magnification. While the term macro and close-ups have been used interchangeably over the years, there's a difference that sets them apart. The main difference is on the magnification rate. Macro photography falls in a category of the so called close ups in which the subject is magnified or enlarge to about 1X, a term also expressed as 1:1 that represents the size of the subject over the size of the image on film. The typical example is the macro photo of a coin. On 35mm photography, we reach 1X when the image produced on film matches the actual size of the coin. Twenty years back, a lens with a maximum magnification of .25X also expressed as 1:4 was considered a macro lens. Nowadays, a true macro lens is one that allows you to achieve at least a 1:1.

To further explain the concept lets start by defining the term magnification as the ratio between the image on film and the actual size of the subject. To give you an example, an image of a ladybug-about 1/4 inch at 1X, will render an image of the bug of about 1/4 inch on the film. The following table will help you understand how magnification ratios work and the two ways of expressing them as ratios and magnification power.

For a subject that is 1 in. long.

Actual Size on Film	Magnification	Ratio
1/8 in.	0.125X	1:8
1/4 in.	0.25X	1:4
1/2 in.	0.50X	1:2
3/4 in.	0.75X	1:1.3
1 in.	1X	1:1
2 in.	2X	2:1

For instance, an image captured at 1:2 is called half life-size while one captured at 1:1 is called life-size. Take, for example, the nickel coin below. If we shoot the coin at 1X or 1:1 ratio, the image produced on the 35mm frame will be the same size of the actual coin.



When looking for a macro lens, you'll find that those that can reach a 1:1 magnification ratio without any attachments are considered true macros.

Once the image size on the film exceeds the actual size of the subject, then we're talking about high magnification macro photography. This should not be confused with microphotography that covers magnifications of 100X and more. For most nature photographers, the magnification ratios and the calculations involved are irrelevant. They're happy with what they see through the viewfinder and pay no attention to the actual magnification, but for a photographer involved in research of insects or other small creatures knowing it can be a plus.

On this book, we'll cover not only how to shoot real macro images, but also how to get good close-up shots. As I mentioned before, most images considered macro aren't real macro shots, but merely close-ups. Most nature photographers are more interested on close-ups than true macro images, due to several causes including the difficulty of working at such close range with subjects in the wild, the weather and the light conditions that dictate your shutter speed. The closer you get to the subject, the more light you'll be blocking from it, plus you run the risk of the subject fleeing the scene. Extreme macro shots require additional equipment that can be cumbersome for field work or too heavy to carry for prolonged walks.

Nevertheless, there are situations in which you would love to get really close to tiny subjects, in which case you can use alternative methods to achieve the extra magnification. Some of these methods I will discuss in more details later in this book.

The basic and most recommended equipment for macro photography is the 35mm SLR (Single Lens Reflex) camera with TTL capabilities. With an SLR system, you see through the viewfinder exactly what will be captured by your camera when you press the shutter release. TTL stands for (Through The Lens) metering, a system in which the amount of light delivered by a flash or ambient light can be metered as the light passes through the lens. This system ensures better exposures without the guessing work. Before TTL systems hit the market, photographers had to use special exposure calculators to get the right exposure for the subject and to compensate for the magnification being used. Digital SLR (DSLR) offers the same advantages and, in some cases, larger magnification due to the cropping factor produced by the fact that their CCDs are smaller than the 35mm frame. Besides, they offer a handful of tools for the digital photographer, including instant previews, histograms and highlight warnings. Most SLRs provide you with the flexibility of interchangeable lenses, and an array of attachments for macro photography. Even today's compact digital cameras can produce impressive images, and the live previews through the LCD can help on framing the subject and overcome the parallax error found in non-slrs cameras.

Almost any SLR or DSLR system will do just fine for close-up work as long as you have the proper lenses and/or attachments. The brand of the camera is irrelevant, but its ruggedness, reliability and available accessories are very important points when selecting a system. The lens is probably the most important factor to consider. Buying good glass means sharper images, less distortion and better color rendition. For most of us it's better to save the money on the camera and invest it in a better lens. One other thing to consider is the weight of your setup. If you do more than just closeups, you'll probably carry few lenses in your backpack to cover all the focal lengths, then you know how heavy that can be. Since the quality of an image depends on the glass, I prefer to have a lighter camera and save the weight for the quality lens.

Most of my close-up photography was created while scouting a site for bird or wildlife photography. Being prepared can save you a lot of aggravation and frustration. Many times I've walked through a nature preserve full of macro and close-up opportunities to suddenly realize that I have left my heavy macro lens at home. But a knowledgeable photographer can actually solve this problem without having to come back later. If you plan to come back later, chances are your subject will not longer be there.

Among the things you want to have on your camera is the ability of shooting manual mode or at least, some way to override a programmed mode such as aperture or shutter priority. Being able to control the aperture settings will help you control the depth of field. Meanwhile, having control of the shutter speed ensures proper exposures and balanced exposures between your subject illuminated by flash and the ambient light over the background. Most macro and close up work requires the use of artificial light to compensate for the low light levels around the subject and to avoid blur due to slow shutter speeds. A flash unit is an essential tool that should be carefully selected to ensure total TTL capabilities. Let's discuss in detail the basic gear to get you started.

Camera Body

Any SLR or DSLR body will work as long as macro lenses or attachments are provided for the purpose of close focusing on the subject. Things to consider when buying a camera system and especially the body include:

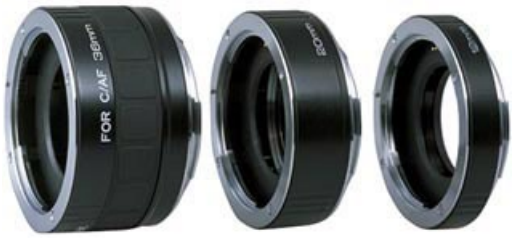
-Interchangeable lens capability.
-Manual exposure mode.
-Exposure compensation.
-Depth of field preview.
-Flash synch of at least 1/250 sec.
-Ergonomic design.
-Mirror-lockup.
-Light weight.
-Full range of accessories.

Lenses

I recommend using lenses that without any attachment or extension tubes can achieve at least a 1:2 magnification ratio. The ultimate lens for macro work is the true macro lens that gives you a 1:1 ratio without any attachment. Three basic focal lengths are available in the market: 50mm, 90mm and 105mm. Each one has a particular advantage over the others, even when they offer the same maximum aperture of *f*2.8. The main difference they all have is the minimum focusing distance at which they achieve the 1:1 magnification. The 50mm has the shortest focusing distance with

only 7.4 in., followed by the 90mm at 11.40 in. and finally the 105mm at 12.3 in. This distance is important especially when working with skittish subjects. Having to focus down to barely 7.4 inches from a jumpy grasshopper will prove to be an impossible task using the 50mm lens. The 105mm is the best choice to tackle this job as it offers you a better working distance. Most true macro lenses are heavy due to their construction and numerous elements incorporated into the barrel. You can achieve magnification ratios of 1:1 even without owning one of these lenses by using extension tubes.

Extension Tubes

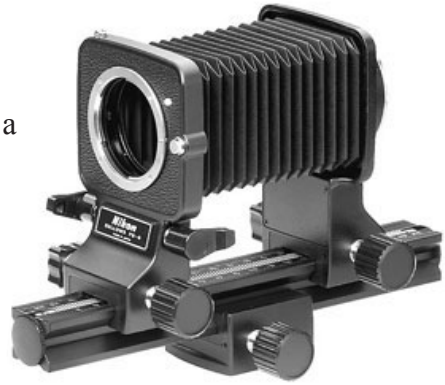


Extension tubes are similar to a teleconverter without the glass elements. They create magnification by separating the prime lens from the focal plane. They're usually sold as a set of three different lengths: 12mm, 20mm and 36mm. They can be used individually or combined, and produce similar quality as that of a macro lens, as long as the prime lens is of good quality glass. Nowadays, these extension tubes come equipped with electronic contacts that allow you to correctly meter the exposure. In the past, this wasn't possible, and the macro photographer relied on calculations to get the exposure right. Combined with the TTL capability for flash photography, extension tubes can be an affordable way to get into quality macro photography, with prices ranging from $100.00 US to $200.00 US for a set of three. We'll discuss them in more details later in this book.

Supplementary lenses

These are the so called close-up lenses or diopters that can be attached to the front of the lens in the same way filters do, and indeed many people call them close-up filters. They come in different strengths, measured in diopters such as +1, +2 and +3. The magnification obtained will depend on the diopter power and the lens being used. Most of these supplementary lenses are made of a single element lens that works by shortening the effective focal length of the lens in which they are used, thus allowing you to focus closer to your subject. They can be used singly or combined, but let me warn you about the degraded quality when combined. These lenses are inexpensive and easy to use, and can be a good way to get started.

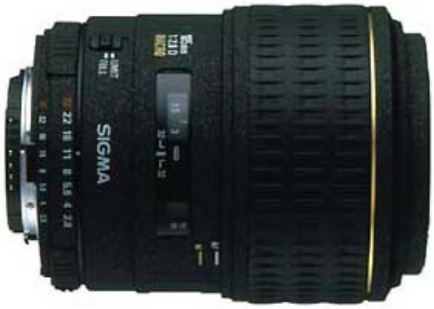
Bellows



A bellows is simply a variable length extension tube. Magnification can be changed by how much the bellows is extended and the focal length of the prime lens used. They are placed between your camera body and the lens. Extremely powerful magnification can be obtained from this setup, but unfortunately they're too bulky to carry into the field. Besides, they're not TTL capable and the aperture needs to be stopped down physically by moving the diaphragm or using a double cable release. Focusing can also be a challenge and requires to be mounted on a tripod at all times for effective use.

Macro lens

The macro lens is definitely the best way to do macro in the field. These lenses are especially designed to obtain maximum magnification with minimal distortion. A true macro lens can yield a 1:1 magnification without any attachment. Most of today's macro lenses



Sigma Macro 105 mm *f*2.8

are autofocus and work perfectly with modern TTL technology. Unfortunately, using autofocus on these lenses can be very frustrating at high magnification, as they tend to be slow and erratic. I personally do most of my macro work focusing manually anyway, so this does not bother me that much. The most common focal length of true macro lenses are 50mm, 90mm, 105mm and 180mm. While they all give you the same magnification, it's the working distance that varies. In terms of pricing, they are expensive, but worth every single penny.

Flash

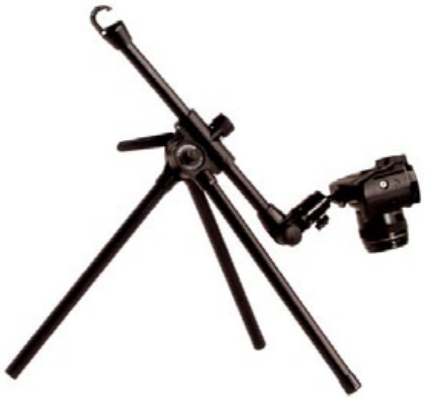
Most, if not all macro work, requires some flash to aid in stopping motion and softening shadows. A TTL unit will offer you the best results as long as it allows you to dial in exposure compensation. Smaller units are preferred because of their weight and size. Their small size makes them less frightening to your subject. They don't need to be powerful as your subject to camera distance will be short enough to use stopped down apertures in excess of *f*16 without using all the power stored in the capacitors. The selection of the flash should be based in compatibility and features, rather than size or value.

Flash Extension Cables

The top mounted flash is not very useful in macro photography because the subject might be too close to the lens. For this reason, it's preferably to have it off-camera and usually at a 45° to either side of the subject. The only way to achieve this is by using TTL flash extension cables. Many recent cameras offer wireless capabilities that remove the needs of these cables, but their performance at close range is questionable.

Tripod

The tripod is probably one of the most important pieces of equipment for any type of photography,



but when it comes to macro photography, you need a sturdy one that offers flexibility of motion. Meaning that you can move the axis in various directions and angles. A removable center column is a must, and if it can be positioned diagonally towards the ground, even better. A tripod to be used for macro work should allow you to extend the legs out, flat against the ground so that you can work with the camera upright. The idea of inverting the center column is awkward and risky to say the least. If you want to achieve maximum sharpness, I'll recommend using a tripod whenever possible. Also, there's no such thing as a lightweight tripod that is strong enough for nature photography. Heavier tripods are more stable and durable. Avoid those with many plastic parts; they won't survive the rough outdoors.

Flash Meter

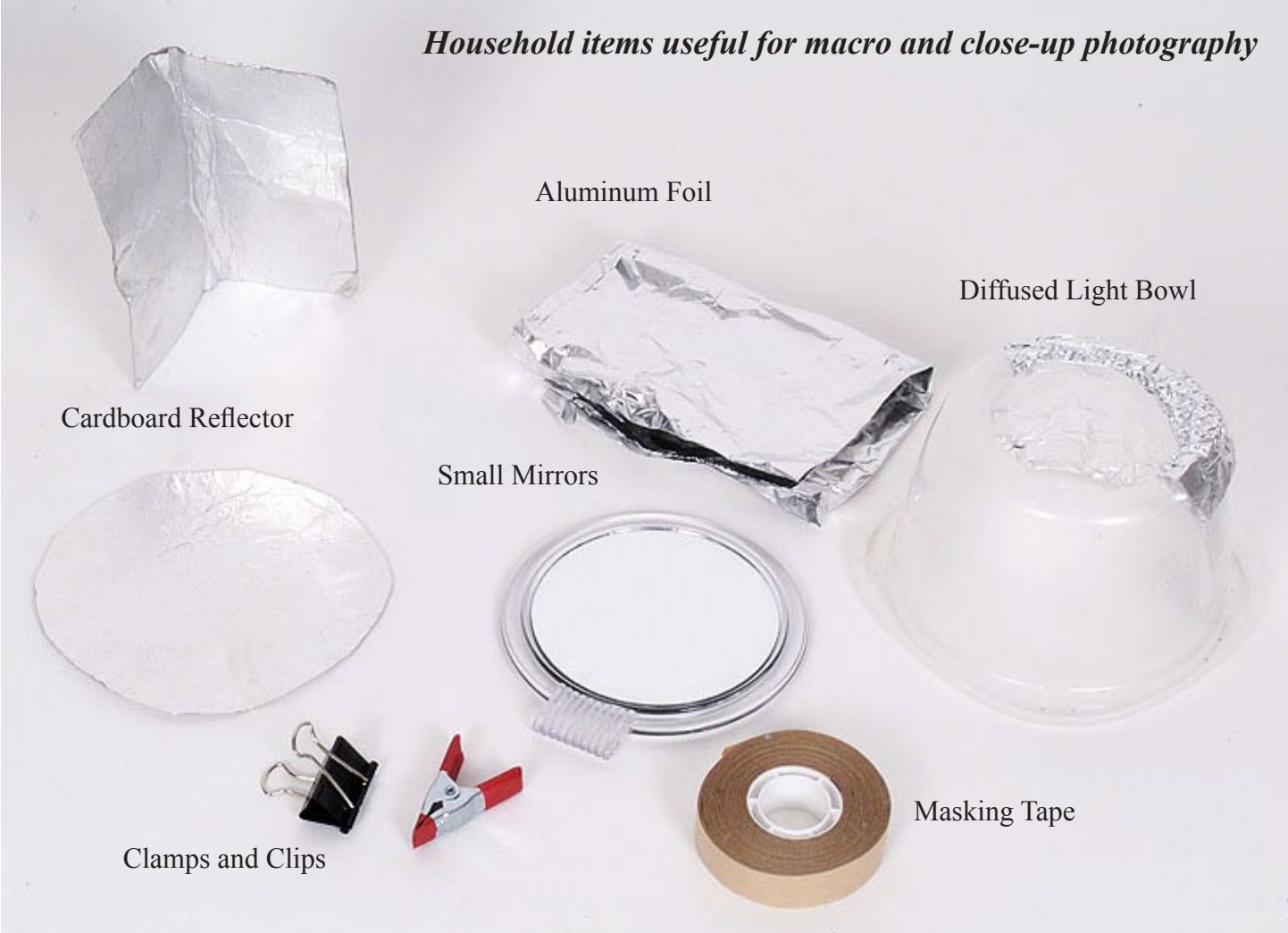
The flash meter can be a really helpful tool when using non-TTL extension tubes or bellows. By metering the available light or that of a flash exposure, you can then calculate the amount of light loss due to extension and get the right exposure. Remember when you extend the lens by any mean, there will be a loss of light.

Macro Focusing Rail

This device makes focusing at short distances a lot easier by keeping the camera over a moving rail that can be adjusted to move back and forth. When working at close to 1:1, focusing the lens might also change the extension of the lens. In other words, as you focus on a subject, the front element of your lens is displaced forward, changing the extension of the lens. This change in extension affects the magnification requiring you to recompose by moving the camera. No better way to do this than by using a focusing rail. They can be expensive and too bulky to carry on your backpack on long walks.

Macro Bracket

This item will be your third hand for holding a flash. While there are several designs in the market, I have used one simple design that can be easy to build and very flexible. With just one trip to Home Depot or Lowe's, and a quick stop by the local camera store, you're set to build your own flash bracket. More details on page 8.



Here's a list of some household items I used in my photography. They are cheap and very helpful.

Aluminum Foil

This highly reflective material can be used to bounce some light into your subject. Its malleability allows you to shape it in a self standing form around branches or the ground.

Cardboard Reflectors

I usually make this by cutting pieces of cereal boxes and gluing a piece of foil to one side. You can create different shapes to accommodate any situation.

Small Mirrors

Small mirrors serve the same purpose of the reflectors with the only difference that they can deliver a lot more light from even farther distances.

Masking Tape

Masking tape and wire ties can be used to tie obstructive vegetation away from the subject. They can also be used to hold reflectors or mirrors on branches.

Clamps and Clips

These useful tools work as a third hand for the photographer by keeping things together, such as reflectors or flash extension cables.

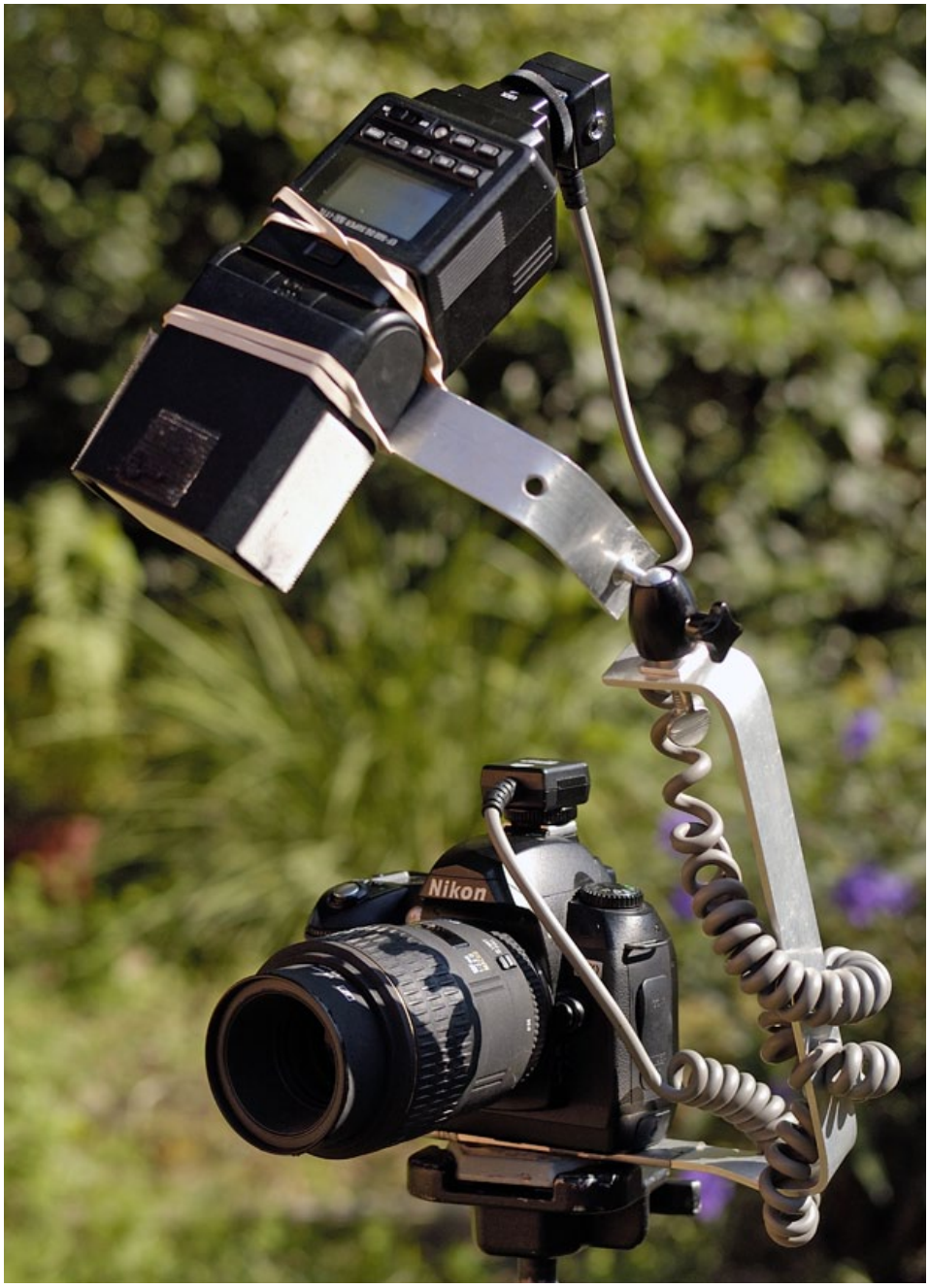
Diffused Light Bowl

Here's a way to create more natural light from your flash exposures by softening the light. It's very useful when available light is too low, and your only solution to get the shot is to use a flash. Any semi-transparent plastic bowl will work, but should be large enough to allow the lens to go through for really tight close-ups. Cut the bottom section of the bowl and glue a piece of foil halfway through the inside wall. You should end up with half of the bowl covered with aluminum foil.

When it comes to macro photography, the hobby can become expensive. Fortunately, you can reduce the cost by building some of your gear. I built this custom flash bracket for a fraction of the cost of the ones commercially available. By doing so, you'll be able to customize it to your liking and to fit your camera and flash needs.

This bracket idea came from John Shaw, a well-known nature photographer, who designed this rig to satisfy his macro lighting needs. Having spent many hours using commercial units, he was able to find all their flaws and came out with one of the most effective systems. Based on his idea, I decided to adjust mine to my needs, too. Most flash brackets mount the flash by the shoe. Over time, this can bring trouble to your flash unit due to increased vibrations and stress over this sensitive part. To reduce the stress on the hot shoe, I simply wrap two rubber bands over the flash body onto the metal arm. This has an added convenience. In the field, while walking through thickets and bushes, it's really easy to hit the flash, but the rubber bands act as a shock absorber. The flash arm is mounted on a dual function mini-ball head that controls the motion of the flash in almost any direction. Finally, the bottom section that attaches the bracket to the camera is fitted with a Bogen quick- release plate, allowing for easy and fast mounting of the system on a tripod. I have drilled several holes on the flash arm for additional accessories, including extensions and diffusers.

The construction of this bracket is very easy and reliable. The frame is made of a 1/8" in. thick by 1" in. wide aluminum strip. Your choice for the mini-ball head will depend on availability, but should be strong enough to hold the weight of your flash loaded with batteries. For the quick release, I used the readily available Bogen 3049. I wrapped some duct-tape on the bottom metal piece to avoid the camera from slipping during use. A piece of thin cork or rubber can be used instead, but since gluing it to the smooth metal surface can be hard and non-durable, I opted for using duct-tape. It works great and creates a good non-slip surface. At the end, I spent less than $50.00 dollars building this rig, and it works flawlessly. Now, if we can build a good macro lens, then we would have saved more than 50% off all the cost of macro photography. Well, there's a way to even save on that, by simply reversing a lens you end up with nice macro lens for a fraction of the cost.

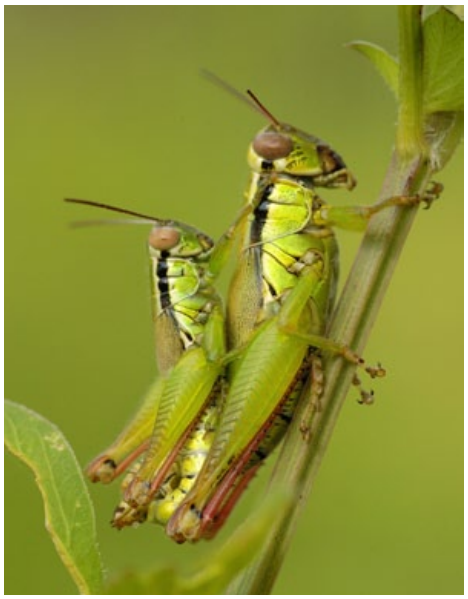


Close ups are exposed following the same rules you apply to any other type of photography, with the only difference that compensation needs to be applied when using non-TTL equipment. Every time we add extension to any lens, there's a loss of light associated with the extension. In a TTL system, these extensions are taken in consideration to adjust the exposure readings of the built-in meter in your camera. When using non-TTL coupled equipment, such as a bellows or extension tubes, then you need to calculate the right exposure using an external light /flash meter and compensating for the amount of light loss due to extension. Most extension tubes come with a chart that specify how many stops of light you lose when using them singly or combined.

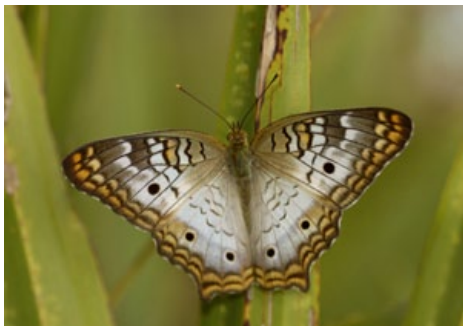
Determining the exposure requires the same procedure as a regular photo. Establishing the tonal value of your subject before shooting can make the difference, especially when working with animated subjects that can disappear in the blink of an eye. By defining the subject's tonality, you'll be able to make exposure corrections. Remember, your camera built-in meter is calibrated to see a middle toned subject, in which case it's easy to just go by the metered exposure. But if your subject is too dark or too light, you need to compensate to obtain the right exposure. When selecting the exposure, you need to pay attention to the background. Dark backgrounds will take away from the image and even more, if the subject is a diurnal animal. Black backgrounds will definitely enhance the color of your subject, but when it comes to be biologically correct, it's hard to accept a monarch butterfly spreading the wings over a black background. I treat subjects based on their biology. Some tree frogs, for example, will benefit from a dark background to imply their nocturnal behavior.

First, I meter for the background with the selected aperture I have anticipated for the depth of field I want. Since I use the flash at almost all times, then I proceed to determine if I need any compensation for the subject in the foreground. By adjusting the flash output, I obtain a balanced exposure in which the foreground is lit by a mix of ambient and flash while the background is lit by available light.

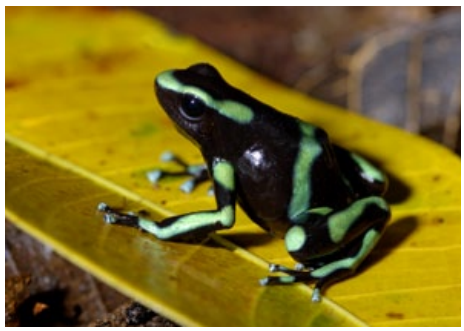
If the subject is not middletone, then compensation needs to be added accordingly. The image of the grasshoppers was a straight middletoned image in which no compensation was required. For the White Peacock butterfly, I needed to reduce the flash exposure to keep detail in the highlight areas. In this case, I dialed -1.7 EV on my camera to avoid blowing the highlights. Remember, your TTL flash is also calibrated to read middletoned subjects, and the darker background in this image would have fooled the flash to believe that more light was needed, thus overexposing the butterfly. In the case of the frog, I had to increase the flash output since the lighter leaf would have fooled the TTL system making the frog way darker. By dialing a +1 EV on the flash compensation, I was able to overcome this problem. Each image presents different problems, and there's not a single solution. By carefully studying each case as it happens, you'll be able to recognize problematic situations and implement a solution based on your previous experiences.



Mating Grasshoppers, *Florida*
Nikon D100 105mm f8 1/125



White Peacock, *Florida*
Nikon D70 105mm f4 1/125
with flash -1.7 EV .



Black & Green Dart Frog, *Costa Rica*
Nikon D70 105mm f8 1/250
with flash +1.0 EV .

DEPTH OF FIELD

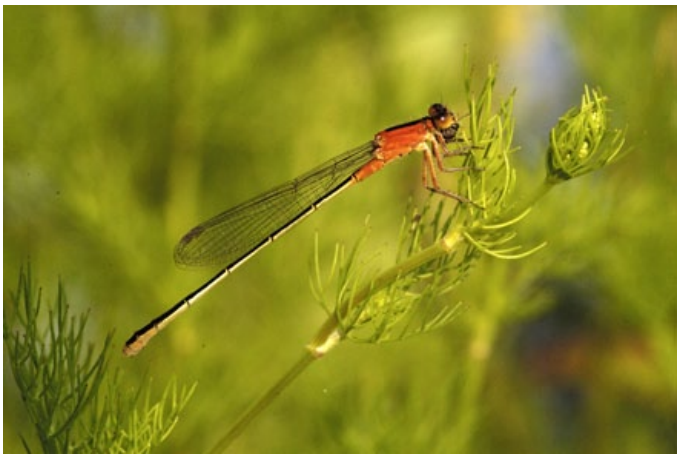
Depth of field (DOF) comprises the area of sharpness right in front and behind the focus plane. In other words, how much in front and behind the subject will look totally sharp. In theory, you can focus your camera in a precise area on your subject and that will define the focus plane. However, there are areas of relative sharpness that extent 1/3 in front of the focus plane and 2/3 behind. This zone of sharpness is what we refer to as depth of field. Depth of field varies directly with the aperture selected: the smaller the aperture, the greater depth; the wider the aperture, the shallower depth of field. At the same time, depth of field is shallower as you focus closer to the subject, regardless of the focal length of the lens. For example, when focusing on a large subject 10 feet away, the depth of field for a particular lens at *f*16 is almost infinite behind the subject and close to 10 feet in front of the subject. The same lens focus on a subject 10 inches away produces a depth of field of less than 1/2 in. in front and 2 inches behind the subject.

Focal length does not change the depth of field, it's the distance between the lens and the subject that matters. Shoot a subject with a 50mm lens at *f*8 and then shoot the same subject with a 100mm lens at the same aperture, but change the distance to create the same image coverage of the 50mm lens, and you'll end up with the same depth of field, regardless of focal length. Now if you maintain the same distance while shooting with these two lenses, then the longer focal length will render a shallower depth of field.

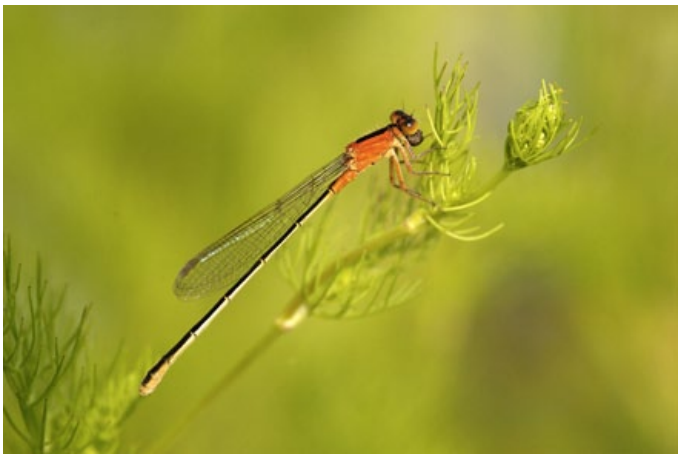
In the field, you need to pay attention to the depth of field. It's important that you determine the areas that you want to maintain in total sharpness. By doing so, you can establish some degree of separation between the subject and the background. Having a background that is too crowded and sharp can compete with your subject to the point that the subject loses impact. When selecting the right aperture for the desired depth of field, make sure that you include all of your subject whenever possible. Occasionally, depth of field is so minimal that some parts of your subject may render soft. As a rule of thumb when shooting insects, it's better to keep the area surrounding the eyes as sharp as possible.

To avoid the guessing work of how much to stop down the lens for the desired depth, manufacturers have incorporated depth of field previews in the cameras. Simply select the aperture and press the DOF preview to see how far the area of sharpness extends. Note that when using the DOF preview, your viewfinder will get dark as less light is passing through the lens. In low light situations, this method might not be as effective.

In the photo below, I have taken two separate exposures, one using f 11(left) and the other using f4 (right). Notice how the background makes the left picture too cluttered. The picture on the right makes the subject stand out, without sacrificing detail on its body. By simply selecting the right aperture, I was able to keep enough detail on the subject and less on the background. It's that easy, practice is all it takes.



Dragonfly, *Florida* . Nikon D70, 105mm, 1/250 sec. at f11

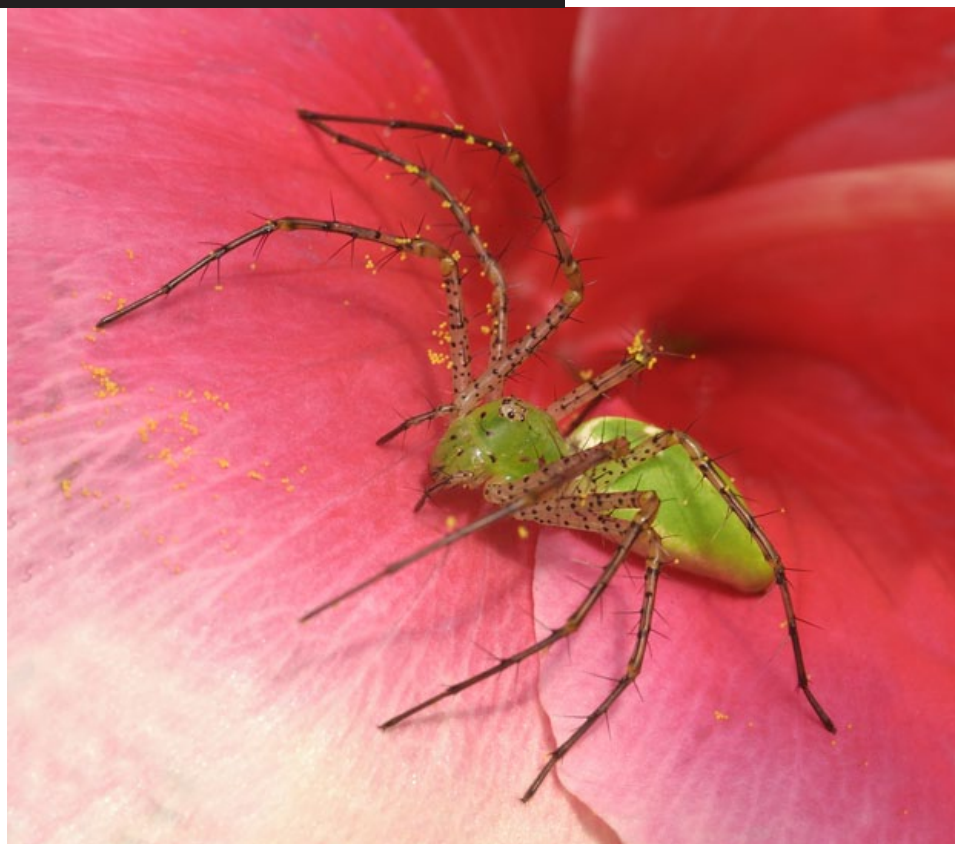


Nikon D70, 105mm, 1/1600 sec. at f4

MAXIMUM SHARPNESS

Sharp images are the result of careful planning and a good control of several factors. In order to obtain sharp images, we need to take in consideration the subject's movements, wind, camera shake and shutter speed. Some of these factors can be controlled by the photographer, but others are left for the subject to decide. Obviously, it's hard to control the fleeing instinct of a dragonfly as you get closer, or the leap for life of a tree frog, but there are things we can do to reduce the chances. The wind can, in many cases, be controlled by using your body to block the stream. A slight breeze can render your image blurred when working at such a close range. As a matter of fact, everything that affects the image quality on a normal picture will be intensified when working close ups and macro photography. Take, for example, low light. Low light can be an issue for regular photography, but with macro is even worse, as you reduce the amount of light hitting the subject when you get closer, and further reduce the light if using extensions. Camera vibrations can be disastrous in macro photography; a slight move, and your subject will come out soft. That's why most macro work improves with the freezing action of a flash exposure.

When composing a landscape shot, moving three feet to either side barely affects the composition. If you move 1/4 in. while shooting a macro, you left half of the subject out of the frame. This is why it's so hard to do handheld shots of tiny subjects. A tripod is your best defense against blurred images, but it needs to be stable and vibration free, especially when shooting



Green Lynx Spider, *Florida*. Nikon D70, 105mm, 1/250 sec. at f16 w/flash -1.

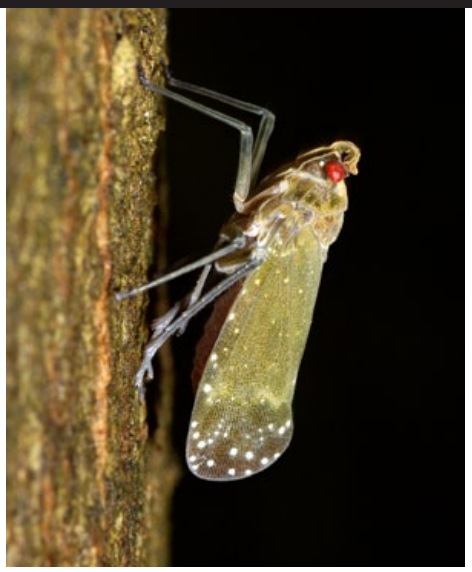
in low light situations that require extended exposure time. In such event, it's recommended to use a cable release or remote to trigger the shutter, reducing induced vibrations.

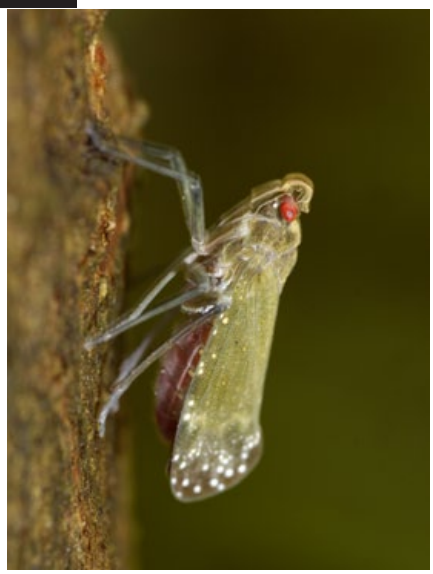
Selecting the right focus plane is important as the depth of field is so limited when working a few inches from your subject. The best way to reach the perfect focus is by actually moving the camera until the image is sharp, rather than focusing the lens, as this might change the magnification, and you'll find yourself moving the camera anyway. That's when a focusing rail comes handy.

Another factor to take in consideration is the quality of your lens, in the case of a macro lens or the prime lens used with extensions. Macro lenses offer the best quality in terms of resolution and by far less distortion than any other combination. If you use diopters to increase the magnification of a normal lens, you can expect a loss of sharpness that gets progressively worst as it reaches the edges of the frame. DSLRs with cropping factor of 1.5X will benefit a bit by using only the center area of the diopter, where distortion is less noticeable. As you can see, several factors influence how sharp your photos may look. Take also in consideration the aperture selected and the depth of field it produces. These will have a great impact on how much sharpness you get. The above image was focused on the eyes of the spider with the camera mounted on a tripod and an aperture of *f*16 to increase the apparent sharpness created by the increased depth of field.

As I mentioned before, flash is instrumental in close-up photography. As matter of fact, 95% of my macro work uses a flash one way or the other. Either as a fill or main light, using flash has many added advantages. The freezing effect of the flash is great for fast moving creatures. When using flash as your only main light source, you can obtain sharp images even when hand holding the camera. Since the duration of most flashes are between 1/10,000 sec. and 1/25,000 sec., any last minute movement will be frozen by the light. Now, this is true only if the available light exposure is fast enough to avoid ghosting. Ghosting is caused when the subject moves during a long exposure to balance the available light. A long exposure with flash is considered two separate exposures starting at the same time. The light emitted by the flash has a shorter duration than the shutter speed used on the long exposure. The flash exposure is controlled by the aperture only. When you fire a flash during a long exposure, the camera continues to capture light throughout the length of the exposure. If your subject moves during that time, the movement will be recorded as a blurred image that extends beyond that of the one created by the flash. Also, any camera movement during the ambient light exposure may cause a ghosting effect. Balancing the ambient light with your flash exposure can be tricky and, in many cases, if not handled correctly, can make your images look unnatural. Sometimes, macro images can look over-flashed if the background is too dark. The opposite occurs when the background is too light and the subject is too dark. If ever in doubt about the right exposure for the ambient light, then bracket the shutter speed and leave the aperture untouched. Remember that when using the flash, the exposure of the subject will be determined primarily by the aperture selected, so any changes to the flash exposure should be made by dialing compensation instead of opening or closing the aperture that will also change your DOF. For sure, the more natural looking images are those where the foreground was illuminated by flash blends perfectly with the ambient light of the background. Many things need to be taken in consideration when making your selection of shutter speed and aperture for a particular situation. Pay attention to your shutter speed, as this is the culprit in most throw-away macro images, but don't neglect the aperture, since depth of field depends on it. Every shot brings its own challenges. Practicing with unanimated subjects at home can improve your flash techniques.

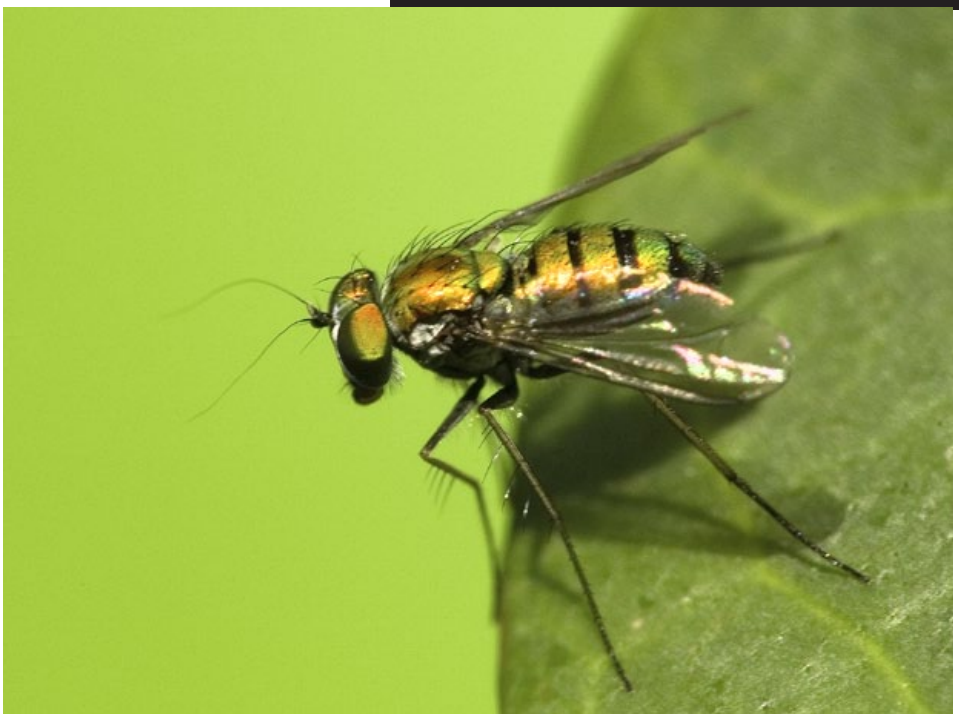
For most images, the flash should be positioned at 30° over the lens and facing your subject. This way, shadows will fall behind the subject. Using one single flash offers more natural light and less spectacular highlights, and only one eye catch light.





Cicada sp, *Costa Rica*. The shot on the left was exposed for 1/25 sec. at f8, creating a flash based exposure that rendered the background too dark. In order to balance the ambient light of the background, I used a slower speed of 1/2 sec. for the picture to the right that resulted in some ghosting of the subject due to camera or subject movement.

Clear Wing Butterfly, *Costa Rica. 50mm Macro 1/60 at f8. A main flash exposure shot.*



Garden Fly, *Florida.* This fly was photographed using a 135mm macro with a stacked 50mm len. The magnification is about 3X for this subject of less than 1/4 in. long.

The magnification required for macro photography can be obtained by utilizing different methods. In order to magnify, the front element of the lens must be displaced forward and away from the film plane of the camera. This is achieved by extending the lens. In essence, that's how all macro lenses work. As you focus closer, the front element is displaced forward. If you don't have a macro lens, then extension tubes will produce the same effect. A 50mm lens is considered a normal lens as its field of view is fairly similar to that of the human eye. This lens can produce great macro shots when used with extensions. Put a 25mm extension tube on a regular non macro 50mm lens, and you're ready to capture images at 1/2X or 1:2. If you add 50mm of extension to the same lens, the magnification goes to 1X or 1:1. The following formula can be used to determine the magnification factor when using extensions tubes or bellows with any lens.

Take for example a 100mm with a 25mm extension an you get 1/4 X or 1:4.

$$\text{Mag.} = \frac{\text{Extension}}{\text{Focal Length}}$$

$$0.25\text{X} = 25\text{mm}/100\text{mm}$$

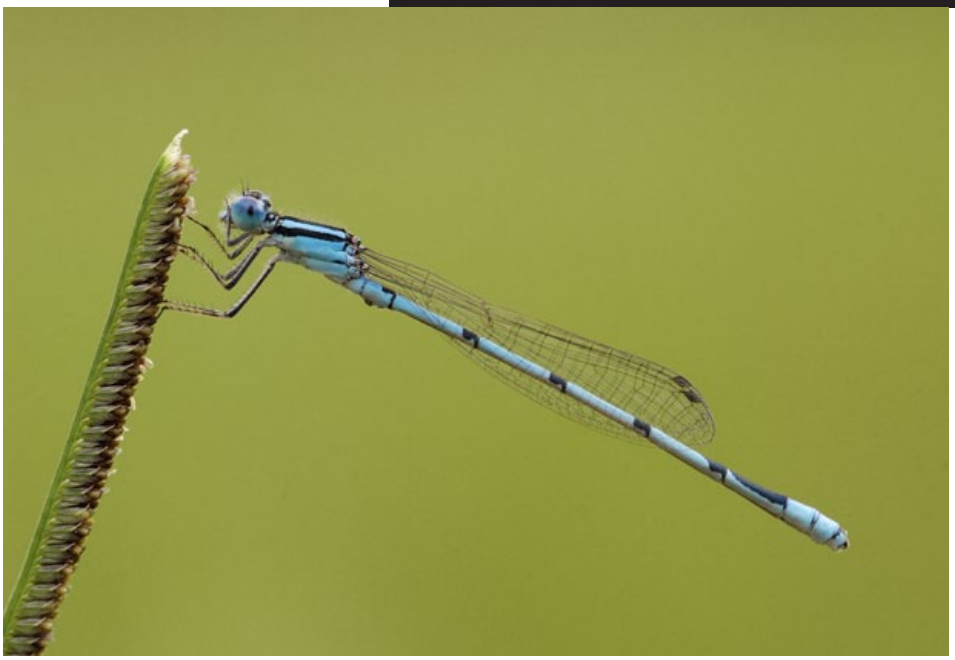
Another way to express 0.25 is in the fraction equivalence of 1/4X and in the ratio format of 1:4. When adding extension, the light that passes through the lens is reduced. In TTL systems, this loss is compensated by the metering system, but when you use a non-TTL extension tube, then you need to calculate the light loss. Most of the time, adding the same number of extension as that of the focal length results in light loss of at least 2 stops. Even though most extension tubes manufacturers include this information with their products, it's best to run a series of tests with your camera focused on a neutral colored surface under even light. First put on the prime lens, meter, and then record the metered exposure with a fixed aperture of f8.0. Proceed to take the image. Then, add the extension, and take a series of exposures using apertures that range from two stops over and two under of *f*8, and keep record of each one in reference to frame number. In a DSLR, it's easy to follow the serial number and time as they were taken. Review each one of those images and compare them with the original image with no extension. Say that the extension shot at *f*5.6 is the closest match to the exposed at *f*8 without extension, then you can assume that the extension produced a 1 stop of light loss.

Another way to achieve extreme magnification is by actually reversing a lens in front of another lens, also called stacked lenses. Put a 50mm lens in front of a 100mm lens by means of a reversing ring and now you have 2X magnification. In this case you can use the following formula to calculate magnification.

$$\text{Mag.} = \frac{\text{Focal length of prime lens}}{\text{Focal length of stacked lens}}$$

$$4\text{X} = 200\text{mm}/50\text{mm}$$

Stacked lenses offer great image quality and, when used with a TTL system, the metering works fine as long as the prime lens is coupled and TTL compatible. The stacked lens should be left wide open to avoid light loss.



Dragonfly, *Florida.* Nikon D70, 105mm 1/125 at f5.6. Paralleling the subject ensures the sharpness focus and enough depth of field, even with fairly large apertures.

Paralleling the subject

For increased depth of field without having to stop down the lens too much, try paralleling the subject as much as possible. By turning your camera until the subject is parallel with the film back or ccd, you will obtain the sharpest focus possible, even with fairly open apertures.

Early in the morning

While almost any time is good for macro work, the best time to shoot animated macro subjects is early in the morning, before they get too hyper. Most insects and reptiles are slow during the early hours and depend on sunlight to gain their normal body operating temperatures. Being there early will improve your chances of finding these creatures when they're still in slow motion, and even sleeping. Another reason to be there early is to beat the wind. An hour too late, and you'll be fighting and losing a battle with the wind. Cool early mornings are my favorite time for most macro shots, unless there's an overcast or I'm working under the canopy of a rainforest.

Focusing

When handholding a camera, it's better to focus by moving the camera forward than using the focusing ring. If mounted on a tripod, a focusing rail will give you the best results.

Better Backgrounds

The focal length you use will dictate how your background looks. Wide lenses will include more of the background than a tele. When using a 50mm lens with diopters, you'll get a lot more of the background in the picture than when using the same diopter on a 200mm lens. Also, by simply changing your position in respect to the subject, you can avoid having a dark or uninteresting background.

Softer Light

When shooting wildflowers and other unanimated subjects, you can soften the light by actually blocking the light with your body. The shade created will soften the light, making it look like an overcast. Also, by using the light bowl technique, you can enhance the shadow areas.

Working with amphibians

Amphibians are sensitive subjects and should be handled with care. Handling these beautiful creatures requires a little knowledge about their physiology as well as their behaviors. Avoid using insect repellent, perfume or lotion if you're planning on working with these animals. Always have distilled water handy to keep your subject moist at all times. Even the contact with your bare hands can take away the moisture of their skin.

Forgot the lens?

I normally carry a good assortment of lenses in my backpack. But over long distances, this can be a burden and can leave you with a back pain. To avoid this problem, I packed the lenses according to what I'm planning to shoot. Well, this approach had left me without my heavy macro lens in situations where I could have used it. One time, while shooting birds, I found a tiny and colorful cricket, but without the macro lens, I was doomed. I then realized the potential of reversing lenses. I took my lightweight 35-80mm lens and

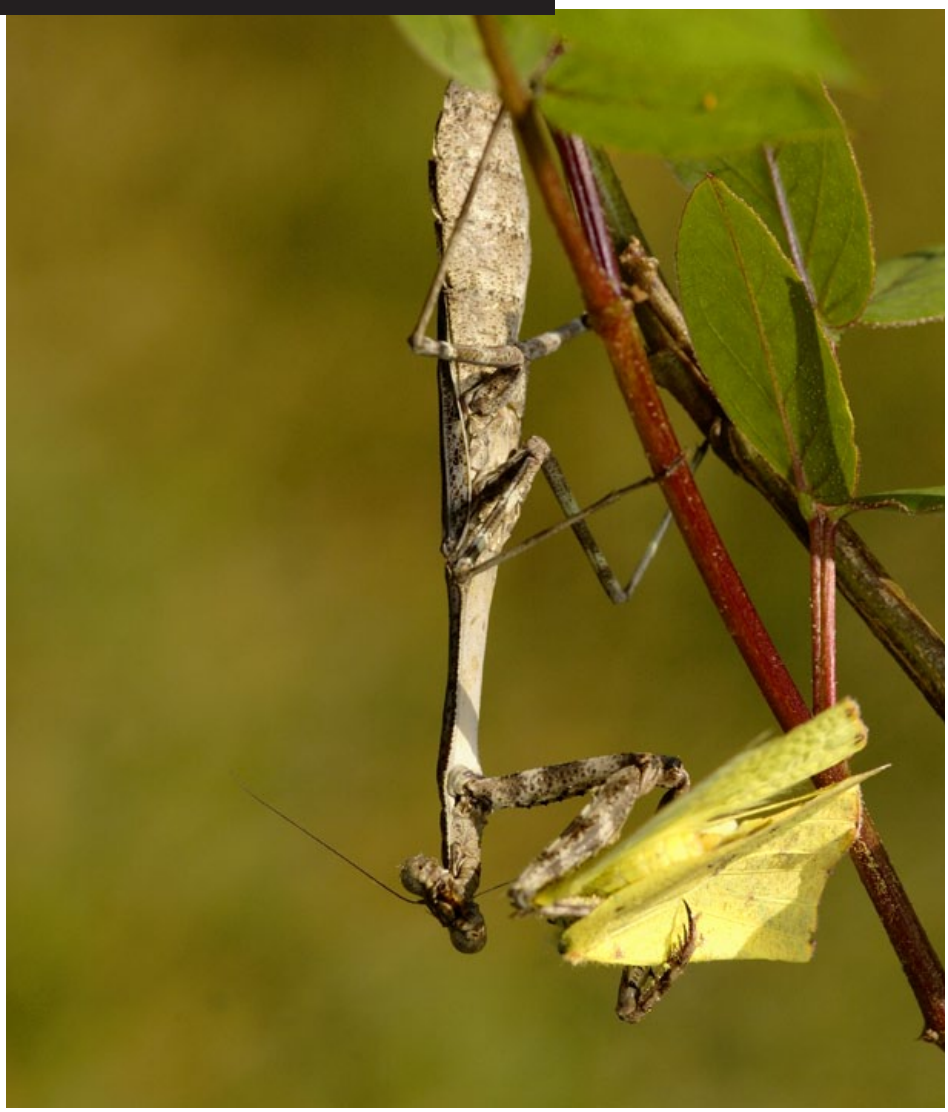
placed it in reverse in front of the lens mount of the camera. Voila! It worked. Then, I had to take a series of exposures to select the best, since all TTL capabilities are lost when the lens is not physically attached to the electronic couplings. The focusing is done by moving the camera, and the magnification can be changed by using the zoom. The Nikon D lens series are equipped with an aperture ring that can be operated even when the lens is removed from the camera. I could select any aperture I want prior to pressing the shutter release to get the right depth of field. Cool stuff that can save you when far from home.

Approaching the subject

Some macro subjects are easier than other. For instance, a flower won't move unless is blown by the wind, but a grasshopper will jump at the first sign of danger. Unfortunately, they don't know our intentions and our massive size when compared to them, doesn't help either. But there are ways we can get close without scaring them off. Watch your shadow as you move close to your subject. This can make them aware of your presence way before you get in position. Avoid making noises and sudden moves when working with reptiles and amphibians. Many insects including butterflies are easier to approach from a low level position, where your profile is less threatening.

Study your subject

There's nothing better than to be prepared for the subject you'll be working with in the field. Knowing about their behaviors can greatly enhance the quality of images you produce. While looking for insects, I found this praying mantis. Within seconds, a butterfly stopped on the same bush where the mantis was. The mantis showed interest on the visitor and, within seconds, was at striking distance. This time, the butterfly flew before the attack. I decided to wait for another try, and as I always say, those who wait, get the chance. The next butterfly that came by the bush wasn't that lucky and I was able to capture the event, on video and still. Opportunities for great shots are out there waiting for you. Take your time and enjoy.



Praying Mantis, *Florida.* Nikon D70, 105mm Macro 1/500 *f*8 w/ fill flash.

Respect nature

Photography is one of the best ways to promote the importance of all living things. Take pride on your work and share it with others. The knowledge that you gain by doing so is great and the benefits to others are priceless. Learning to respect and appreciate nature should be in any nature photographer's best interest. The welfare of our subjects should be our main concern. Only then, we can teach others about the beauty of nature and the importance of all the living things.