AN INTRODUCTION TO UNDERWATER PHOTOGRAPHY

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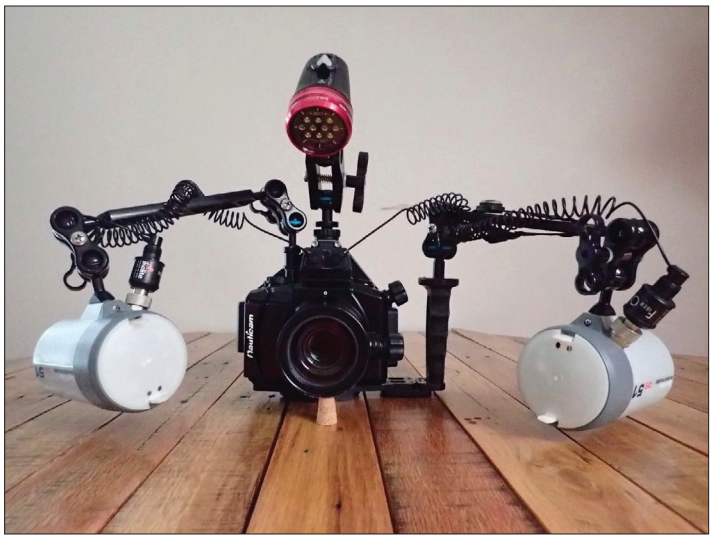
Underwater photography has been around for a long time. The first underwater photograph was taken off the coast of Britain in 1856 by William Thompson using a camera mounted on a pole and a cable to trigger the shutter. Louis Boutan, a Frenchman, was the first underwater photographer in 1893. The first color and flash photograph was taken in the Florida Keys in 1926 by Dr. William Longley and National Geographic staff photographer Charles Martin. But most of us are probably most familiar with fishes shot on film from the likes of Jacques Cousteau, Hans Haas, William Roston, and others from the mid- to late twentieth century. But it all changed in the mid-1990s with the advent of digital photography.

Being underwater is an alien, hostile place for humans, but that is where one has to go to take underwater photographs. To experience this environment one needs to be prepared both psychologically and physically to enter a cold, possibly dim place where there is no air.

Fortunately, most of our fishes can be found in relatively shallow water so that a snorkel can be used for viewing from the surface and wetsuits and drysuits are available for thermal comfort. But to get a better look at our subject we need to get off the surface and down to their level. Unfortunately, that can be quite a challenge while wearing neoprene or having too much natural bioprene, so some snorkelers wear a weight belt to achieve neutral buoyancy. I would not recommend this practice for anyone not confident around water and in their swimming skills, and I would never suggest doing it in water that one can't stand up in. Fins may or may not be appropriate depending on the depth, current, or distances involved.

I approach a subject from downstream (with my camera facing in an upstream or a quartering upstream direction) whenever possible to allow the area around my subject to remain clear of suspended sediment stirred up by my movements. Don't forget about what's going on downstream, though. By disturbing the substrate the snorkeler creates a buffet flowing downstream that can bring quite a few fishes in close for a possible photograph. When approaching a fish take it slow. This isn't a race. Find a place to settle in for a while and let the fishes come to you. When an approachable subject is found, get as close to the fish as it will allow, then get a little closer but maintain a good composition.

Since the mid-1990s digital photography has been the way to go. There is an amazing array of digital cameras available today from waterproof point and shoot (P/S) to



Bryce's equipment consists of an Olympus OMD EM-5 camera and two lenses: a 60mm macro lens with 1:1 capability and a 12–50mm lens with macro available at 43mm. The camera is in a Nauticam aluminum housing with ports. Flash includes two Ikelite DS51 strobes on ultralight arms and a Sola 800 focus light.

Photos by the author.

Bryce Gibson has been keeping fishes of all sorts since about the age of 10, about 46 years ago. At the same time, he started taking close up photographs of model cars and airplanes he built. He started taking underwater photographs in the early 80s with a Nikonos V film camera: 36 exposures and head to the surface. After taking some time off to raise a couple of beautiful daughters, he re-entered underwater photography in the digital age. He concentrates on native fishes and has been published in several magazines and websites. He lives in Knoxville, TN, with his wife Diane.

Bluefin Killifish (*Lucania goodei*), Manatee Spring, Florida.

Bowfin (*Amia calva*), Manatee Spring, Florida.

multi-thousand dollar digital single lens reflex (DSLR) cameras that require special underwater housings. P/S cameras, perhaps the most affordable, range in price from $200 upward to $500 or $600 depending on the manufacturer and included features. P/S cameras usually have a simple screen interface with few control buttons on the back; controls and options are usually limited on this type due to size and price. The images produced are usually .jpg (JPEG) files, but more about them later. DSLRs, on the other hand, start around $1,000 and top out around $6,000, exclusive of the lens, again depending on the manufacturer and required features. These cameras are much more complex in nature having an almost infinite amount of setup options, which is beyond the scope of this article. One thing all contemporary cameras have in common are different shooting modes designated as A for aperture priority, S for shutter priority, M for manual exposure set up, P for programmed exposures, which are set by manufacturer or the user, and V for video. More about exposure later. There are a few manufacturers building waterproof P/S and by and large they can be fairly good to about 30 feet or so, far beyond what we would need them to do in most of our waterways. None of the DSLR manufacturers build waterproof cameras or lenses so they have to be put in some type of waterproof housing. There are a wide variety of housings available, from heavy vinyl bags appropriate for shallow water to precision-milled aluminum housing rated to 300 feet. But not all housings come from a manufacturer, some people build their own quality housing that preforms exactly to their standards. Now that we have a camera and it's protected, it's time to hit the water.

Photography is capturing light—it literally means light writing. What happens to light in water? It changes. Red disappears first, at about 5–6 feet depending on water clarity. One after the other, orange, yellow, and green disappear. By about 100 feet blue is all that's left. Since the visible spectrum starts to shift at such a shallow depth, steps must be taken to make the best use of what light is available. These include finding clear, sediment-free water, staying shallow, and shooting when the sun is high in the sky for the best light penetration (usually between 10 am and 2 pm).

What if all the variables don't align for the perfect photo shoot? Artificial light must be introduced. Most P/S cameras have an onboard flash, but housed cameras need to have a strobe or two added to the housing. The strobes are attached to the housing by adjustable arms and connected to the camera's electrical system via electronic or fiber optic cables for proper firing of the strobes and a correctly exposed image. There are a couple of ways to use a strobe: TTL and manually. TTL (through the lens) metering allows the camera to "decide" when it has enough light for a proper and balanced exposure and quench the strobe(s) accordingly. Today's cameras are generally very good at making correct exposures in this manner. Using a strobe manually takes a little more practice, but allows the photographer more creative control. The photographer has to set the shutter speed and aperture on the camera plus the light output on the strobe. By manipulating those variables, the photographer can: 1) balance the artificial light to the natural light; 2) separate the subject from the background by using shadows, keeping the background out of focus, or lighting only the subject and letting the background go black; or 3) just about anything else the photographer wants to do—the possibilities are almost infinite. The only limit is setting the sync speed of the camera, which varies by manufacturer but is usually between 1/250 and 1/500 of a second and cannot be exceeded (but can be reduced). That opens a can of worms beyond the scope of this article.

Now that light has been added to the scene, it's time to make the image. With a P/S there are a few variables to account for, then just point and shoot. Things are a bit different with a DSLR, especially when shooting manually, which, in my opinion, is the best way to learn about the camera. The

first thing to be aware of is the ISO (International Standards Organization) setting, which sets the sensitivity of the camera's sensor to incoming light. This is a value set between 100 and more than 25,000, with the lower numbers indicating the least sensitivity to light but also the least grain and therefore a crisper image. Using a higher number increases the possibility of a grainier image. I use the lowest I can get away with; it varies by situation, there is no right or wrong. Now that the ISO is set it is almost time to take a photograph. There are two more items to take into account: the shutter speed and the aperture. The shutter speed is expressed as a fraction of a second, typically from 1/5,000 of a second to 60 seconds. The shutter speed is the length of time the camera will allow light to fall on the sensor, but the shutter doesn't act alone. The aperture (i.e., opening) is expressed as an f number, such as f2.8, f8, f25, and so on. The smaller the number, the larger the aperture; the higher the number, the smaller. The aperture is the opening within the lens that controls the amount of light it lets through to the sensor. Underwater I usually use a shutter speed somewhere between 1/1,000 and 1/60 along with the appropriate aperture depending on the situation and subject (and whether I have time to set both values manually).

There are ways to streamline this process, however. Setting the camera to S (shutter priority) allows the shutter speed to be set by the photographer and lets the camera select the aperture. This is a great way to capture fast action if there is plenty of light. If the light starts to change, the camera will flash a warning that the shutter speed needs to go up or down. An added benefit is that the camera can select intermediate apertures that are otherwise not available. If aperture is the setting you want to control, set the camera to A (aperture priority) and select the aperture you want to use and the camera will select the shutter speed. This is great if strong, consistent light is available so that reasonably fast shutter speeds are produced. Again the camera will flash a warning when lighting values are outside of a correct exposure. While in aperture priority the camera can select shutter speeds not available to the photographer. One last thing about aperture is that it controls the depth of field (i.e., what is in focus). When using a large aperture, say f2.8–5.6 the subject will be sharply in focus and the background blurry, making the subject stand out. Use a small aperture, say f16–f25, and more of the area in front of and behind the subject will be in focus, which may cause the subject to get lost in all the detail.

There are many ways to compose a photograph—far too many to cover here—but there are a few foundational elements, such as placing the subject at third points within the viewfinder instead of in the center, using diagonals for dramatic effect, or using rhythm and line. Often void space can be used to give an image a dramatic look. Another thing to keep in mind is that the subjects we want to photograph are, by design, cryptically colored to blend into their environment. The photographer has to find a way to separate the subject from the background. This can be accomplished by using light or shadow, changing your angle to the subject, or being patient and waiting for the subject to move to a different spot.

Lens selection is a very important decision; lenses make or break the image. Get the best you can afford. I'm going to touch on two different lens types: macro and wide angle. Macro lenses are used for close-up imaging to 1:1 magnification and beyond with special magnifiers.

Something to keep in mind when using a macro lens is that it has a narrow field of view, kind of like tunnel vision, so it's best to use this type of lens on small subjects. However, in clear water you may be able to get far enough away from a large subject to make a good image—just don't get too far

Gilt Darter (*Percina evides*) courting a female on the Hiwassee River, Tennessee.

River Chub (*Nocomis micropogon*) building a nest on the Hiwassee River, Tennessee.

Tangerine Darter (*Percina aurantiaca*) Hiwassee River, Tennessee.

Arrow Darter (*Etheostoma sagitta*) Capuchin Creek, Tennessee.

away. Macro lenses don't capture much of the background—usually just the area around the subject—so the subject can be quite large relative to its surroundings. Just make sure the subject doesn't get lost in the image. Wide-angle lenses are the polar opposite of macro, having a much wider field of view. Some fish-eye lenses are 180 degrees and beyond but they don't have much magnification. Wide-angle lenses allow the photographer to capture much more of the subject's surroundings, showing where it lives within the water column. With this type of lens, the subject can be quite small relative to its surroundings, but again make sure that the subject doesn't get lost in the image.

POST-PROCESSING

Digital cameras typically produce JPEG files of different resolutions and RAW files, which have different extensions based on the manufacturer. The JPEG image can be immediately viewed by or sent to other devices. JPEG files don't capture much information beyond what it takes to make the image, so processing options are limited. RAW files, on the other hand, need to be processed before viewing or printing. RAW files capture a lot of information and are consequently larger, but this allows the photographer to manipulate this information in the post-processing phase. If you are going to shoot digital, shoot RAW to get the most out of your time, effort, and camera. Post-processing is a very complex topic. I'm only going to highlight a couple of concepts here. There is a lot of information on this subject that can be found on the web if you're interested.

In post-processing, white balance is a very important setting that RAW allows the photographer to manipulate. The white balance tells the file what is supposed to be white or neutral and applies that information to all of the colors in the file so that a more natural image is produced. Some photographers that use available light like to use the custom white balance tool on their camera to get an idea of what the finished file may look like; this also may shorten the processing time. This needs to be reset as the water depth increases. Obviously this doesn't matter much in a shallow stream, but it's important to keep in mind in deeper waters. White balance's cohort in processing is the black point, which gives the image some depth and enhances the contrast. Color can be tweaked by using the color temperature slider, which adjusts the blue/yellow channels, and tint, which adjusts the green/magenta channels. By manipulating these two sliders the entire color scheme of the file can be changed. Exposure can also be increased or decreased in post-processing to allow the photographer to compensate for errors made in the field. Brightness affects the overall lightness or darkness of the image. There are also tools for correcting tones, individual colors, lens distortion, and special effects. The tools vary, a little, per software, but most operate as sliders and of course features always vary. Photoshop (PS) is perhaps the best known and most feature rich, allowing the photographer many creative options. It can be as simple or complex as you would like it to be. Lightroom (LR) is another popular processing software and is what I use. It's like Photoshop Lite—they're both made by Adobe. LR has all of the powerful development tools that PS has plus a great filing system, but not many of the creative PS tools, no layers, clipping, etc. This makes for a more streamlined workflow unless you are interested in making a photo collage. A lot of photographers use both PS and LR plus other plug-ins to develop their images. There are many other programs available—even some that are free—but make sure they will do what you need them to.

As a creative pursuit, underwater photography can be as simple or as complex as you'd like to make it. Like most things it takes some time and practice, but that is usually fun (as well as cold, tiring, and especially frustrating) and always challenging. In the end it's very rewarding.