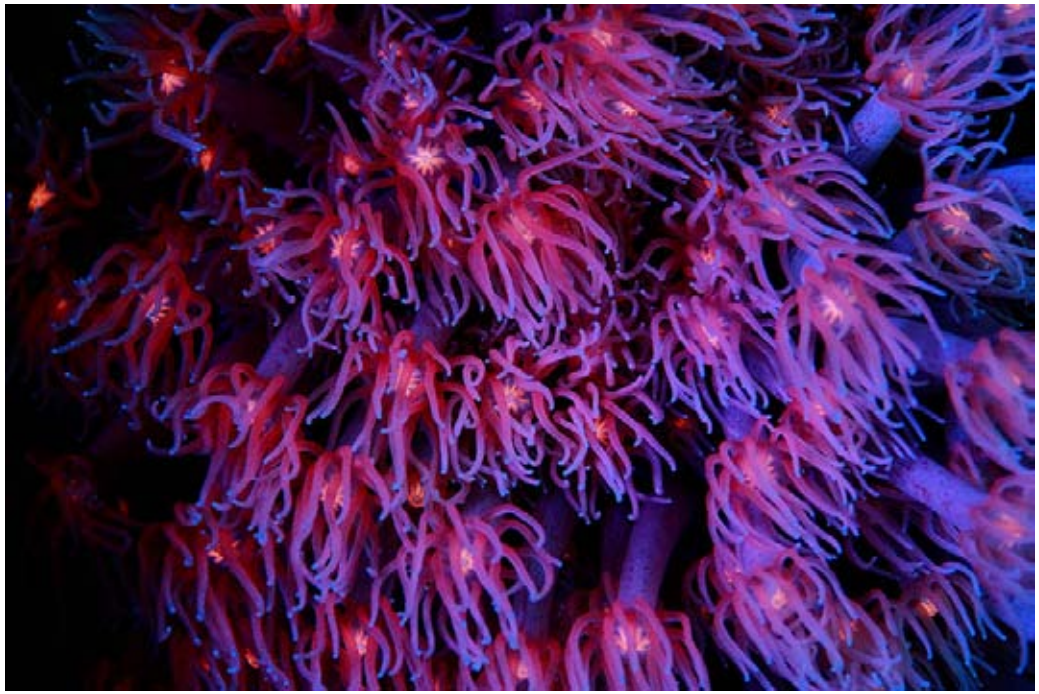
Ultraviolet photography

by Matej Simonic



My interest in ultraviolet (UV) spectrum began to develop more than ten years ago, when I found some underwater UV photos on the net and they looked very interesting. I immediately decided that I had to see it with my own eyes. At that time it was not possible to buy an underwater ultraviolet light so I decided to build one myself.

I took small black fluorescent tube (similar to the ones used in night clubs), made some electronics to drive it from a pack of batteries and sealed everything together in the transparent acrylic. I had no clue about needing a filter on my mask. I took it to Egypt, eager to experience UV fluorescence myself. On the night we arrived I went straight to the jetty, turned it on and it worked very well on the surface even though it was not very powerful. When I dove into the water, it leaked and I drowned my dreams for a long time …

Certain corals and animals emit fluorescent light, when lit by ultraviolet light. With the use of proper equipment they 'glow' in the dark which is very spectacular. Luminous energy at short wavelengths is absorbed by light-sensitive proteins and re-emitted at longer wavelengths. Some animals also see in the UV spectrum and so are able to find otherwise transparent pray, to find a mating partner easier and fluorescence probably plays a role in other processes. It was very surprising to me that some cave creatures are fluorescent since it would make no sense to me from a biological point of view, but they are. Biologists are slowly revealing the role of UV pigments in different species, however there are still more questions than answers on this field.

Ultraviolet (UV) photography has so far mostly been in domain of professional photographers. Probably the most influential was National Geographic article by David Doubilet, "A New Light in the Sea", published in August 1997. Stunning photographs were taken in the sea with a powerful HMI (mercury-halide) ultraviolet lamp powered by a generator on the surface. Unfortunately, the coral polyps retracted under strong irradiation. Slowly UV photography is also entering the domain of amateurs, since modern SLR cameras are equipped with very sensitive sensors that enable us to take photos at higher ISO settings.

To take a UV photo you need a source of UV light which has to be very powerful. This is usually done either by a powerful array of UV LED diodes (mostly for video) or by use of a high-pass filter, also known as excitation filter, that are put on the source of light (HID light, LED light or flash). These filters excite the fluorescence by removing wavelengths longer than blue. If we directly look at a scene lit by such a source everything looks violet or dark blue in color, therefore in order to better see the fluorescence we need additional low-pass filter which is placed on the camera and/or on the mask which blocks the excitation light but allows us to observe or photograph the longer wavelength fluorescence.

The best results are achieved in the dark nights (when there is not much light from the moon), and also any other unfiltered light must be turned off, since it is very distracting and prevents the fluorescence being seen. On the other hand a normal light should always be at hand in case of emergency.

There are multiple problems in the UV photography. When you place filters over your normal light and mask, very little light remains, so awareness of your surroundings

becomes very important, much more so than during a normal night dive since the visibility becomes very limited. In order to avoid damage to surroundings a very good buddy is recommended (with his own light and filters). A dive site should also be adjusted to avoid fragile areas. This is especially true if you try to take UV photos in overhead environments such as caves. Taking normal photographs in the caves is a high risk activity but taking UV photos is even more so. Buddy awareness, surrounding awareness and navigation are all difficult, therefore good training and diving skills (trim, buoyancy) are necessary. Luckily SPG and compasses are fluorescent so you can use them, however it is much harder to see the data such as dive time and depth on your bottom timer/computer. You can use one with larger numbers and an internal light or just use normal light to read them.

If a very powerful UV light is used (LED, HMI), some animals run away and coral polyps retract. Therefore you have to be very fast when taking photos of these subjects. On the other hand you will not have these problems when taking photos of hard corals so you can afford much longer times and even use of tripod if your source of UV light is too week.

Since the filters take most of the light away, the biggest problem is lack of light. We have to fight this problem with all known weapons. We mostly take photos of small macro subjects. You need to have a very sensitive camera which is good for taking pictures at high ISO settings and noise reduction turned on (in the camera or in post production). Many times you have to use a very wide aperture so good quality lenses are necessary that enable taking photos in low light conditions.

This of course means shallow depth of field therefore appropriate objects have to be selected. The use of 2 strobes as powerful as possible is recommended and it is better if you use the ones that have higher color temperature (as many Kelvins as possible). Usually autofocus is problematic, due to lack of light so either manual focusing or additional powerful focusing light shall be used.

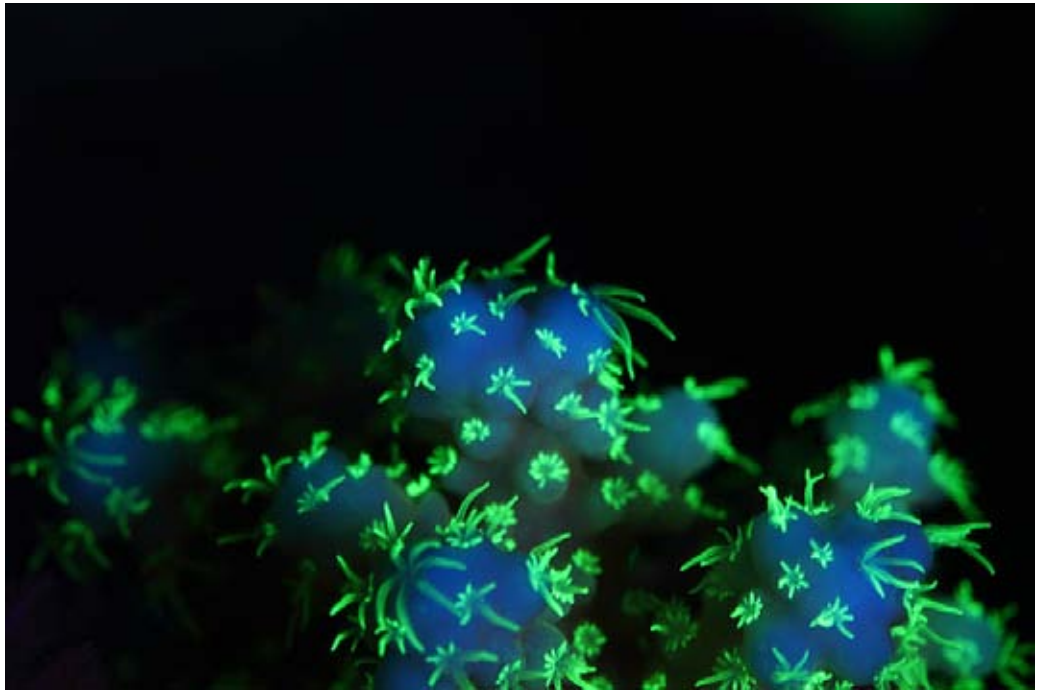
I will describe the equipment I have and the way I did it, just as an example. So far I have not done many UV dives but I have dived in Sudan, Egypt, Adriatic Sea and in Slovenian cave. That is not much, but enough to see what results can be obtained with this set up. The equipment I have can also be seen on enclosed photo. I should emphasize that I used the existing equipment that I already had. If I started buying equipment only for UV photography some choices (strobes) might have been different.

I use a Canon 7D camera and EF 100mm f/2.8 USM and EF-S 60mm f/2.8 USM macro lenses. I often shoot at ISO 1600 with noise reduction in the camera turned on. The results would probably be better if I used external noise reduction filters in Photoshop or similar noise reduction filters. The housing I use is from Sealux in Germany . It has three attachment points, two for strobes and one directly above the lens for a focus light which is in my case Halcyon HID 18 light. This light is very powerful and its main advantage over LED lights is that it is focusable. I keep it focused all the time to get enough light to enable normal operation of autofocus. I use Ikelite strobes DS161 without diffusers and with video lights turned on. This video lights, despite being 2 x 10W LED, are by themselves not enough powerful enough for the autofocus to work even with your strobes very close to the subject. They are intended for normal video work (non UV) but since they are dedicated video lights they are diffused and so are too weak.

I use Ikelite manual controllers, most of the time set to full power. I made the arms myself so that it was possible to adjust positions quickly and to mount the manual controllers close to the housing handles. The arms are very convenient and are made from Loc-line segments.

The filters used on the lens port, 2 HID lights, 2 strobes and masks have been supplied

by Nightsea. There was plenty of Do It Yourself work involved. I manufactured, arms and flanges for the lens filter, light filters and strobe filters and an adjustable mount for the HID light on top of the camera housing. Since I have all necessary tools available at my work (turning and milling machine) it was not a problem for me. Nightsea can manufacture filters of different dimensions and flanges that can fit on your ports and strobes. I manufactured all filters so that their flanges are equipped with elastic cords that enable them to be positioned or removed underwater from the lens port, strobes, light and mask. This gives me flexibility to decide during the dive if I want to take ultraviolet or normal photos and also to take photos of the same subject with and without filters to demonstrate the difference between normal and ultraviolet underwater photography. The other advantage is that in case of an emergency I can convert my HID focusing light into my primary diving light by removing it from camera housing, which is especially important for cave diving. The downside is that the low-pass filter can get damaged easily, but since they are not very expensive, they can be replaced. The other option would be to put the low-pass filter into the housing. You lose



versatility but it is more protected.

Ultraviolet photography opened a completely new world for me. Diving with only UV lights is very special. You have a very strange feeling that is hard to describe. You feel like you are in another world, like in space perhaps. This feeling is especially present on very shallow dives where you can relax (unlike in a cave, where you have to be focused on diving and caving all the time). You feel different, like a bit high, in a secret world. You see things that other people cannot see so it is probably similar to some drug induced state. The effect of a UV dive does not end with the end of the dive. My very good friend described it some time after the first UV photo dive in Sudan by the following words "I feel like a UV filter". He also said: "It is fantastic. It is like doing my first dive over again". And also for me it was like that. It is very nice that after so many years of scuba diving I could experience that feeling again. The world you see is very contrasty: it is either dark or it is glowing therefore pictures are somehow strongly burned into the memory. And sometimes when you close your eyes they come back, they return more often and more strong than normal pictures. Of course this is a very subjective effect which fades after a couple of days but I have experienced it and some of my buddies have also. It was also a very humbling experience for me. I asked myself: "This is just one layer of biology that we now see but do not understand yet due to our sensory and other limitations. Some animals see UV light with their eyes. How many layers are there? Will we ever be able to detect or even understand them?"

It is a beautiful and surprising world and I hope you will experience it.

Matej Simonic

My name is Matej Simonic, I live in Ljubljana/Slovenia/Europe. I dive for 15 years at a constant rate of 100 dives per year. I dive everywhere where water is. Tropical and Mediteranian sea, rivers, lakes, caves, wrecks. I am GUE Tech 2 and Cave 2 certified, and I also made a course of Underwater Cave photography held by JP Bresser this year in France. I take a camera in my hads for one or two dive trips per year, for the last 4 years.