Nemo Lighting

by Alexander Mustard

"We might as well give up underwater photography and all take up animation," was the reaction of Steve Warren, owner of Ocean Optics, on leaving the cinema at the end of the PIXAR's film Finding Nemo. Steve's cheeky quip succinctly summarises just how believable the superb underwater animation was in the film. As divers we should have been the hardest to convince because we are so familiar with the reality, but it was the divers that I know, and the photographers in particular, who were most enthusiastic about the film's watery world. The result was no fluke; it was the product of more than three years of hard work by PIXAR. "In the end, the animation has to be believable," comments supervising animator Dylan Brown. "You have to get into this fantasy world, forget about the technology and get sucked into the story."

Andrew Stanton, the film's director, explains PIXAR approach "Our starting point was to watch a lot of films with underwater scenes and analyze what made them seem like they were underwater. What made them not seem like they were in air?" The animators were set the task of trying to recreate real underwater sequences, in the computer. Dylan Brown continues, "The technical crew worked on it and eventually came back and showed us their work. We couldn't tell the difference between the re-created footage and the original. It blew us all away." All very interesting, but what has this got to do with underwater photography. Well, we can learn a lot from PIXAR. Buy the DVD and watch the special features and you will be blown away by the animators' understanding of what goes into making a image look like it is underwater. Stanton explains, "We came up with a shopping list of five key components that suggest an underwater environment - lighting, particulate matter, surge and swell, murk, and reflections and refractions." The descriptions of the characteristics of the different types of underwater light, on the DVD, are the most comprehensive I have heard in my time in underwater photography. Armed with this new knowledge, I dug out my own photographs and examined them. Few of my underwater images contained any of the characteristic lighting traits of the underwater world. Of course, they were all taken underwater, but it seems that my traditional photographic techniques (dominated by lighting from my strobes) blast away all traces of the real world. Clearly I had a lot to learn about underwater light! So I set myself the challenge of trying to take images that contained more of these components and therefore would look closer to reality. I hoped that such an image would be more persuasive in communicating the true feeling of being underwater. To achieve this goal I have had to come up with a new way of lighting my images. I have called this technique "Nemo Lighting". I'm not fully convinced by the technique, but I would like to share my experiences with you since the process taught me much about the nature of light in the ocean.

Underwater the main (key) lighting comes from the surface and casts a shadow below the subject. But seawater also scatters light in all directions that softens these shadows, giving them characteristic blurry edges and a blue colour. Nikon D100 + 16mm lens. 40CC Red filter. Subal housing. 1/100th @ f9.5.

Caustic lighting, the dancing patterns of light on the seabed, is very evocative of being underwater. This light pattern is created by refraction of the light at the surface and the type of pattern is determined by the sea surface state. A fast shutter speed is needed to capture clear patterns. Nikonos V + 15mm lens. 1/250th @ f5.6. EBX 100.

The Shopping List

The first step was to write a modification of PIXAR list to make it suitable for still photography. I have been back through the special features on my Nemo DVD and also spent time out on dives just watching the light. This is my Nemo Lighting shopping list that defines the types of lighting we get underwater:

1) Key downwelling light. This is the main light source: illumination coming down from the surface of the ocean, casting shadows beneath the subject.

2) Scattered light. Particulate matter in the ocean scatters light in all directions. This light partly fills and softens shadows compared with in air.

3) Caustic lighting. These are dancing light patterns on the seabed created by refraction of sunlight by waves on the surface.

4) Beams of light. The murk and the particulate matter in the water clearly show beams of light that are focused by refraction of light by waves at the surface.

5) Full colour. As divers we see plenty of colour everywhere, both in the foreground and background. Take an available light photo underwater and itwill come out blue, but are brains are smarter than film and compensate our vision for the blue light.

Lighting in theory

The big advantage I had over the animators is that I was not starting with a blank canvas (or computer screen). On a dive characteristic underwater light is all around. All I had to do was to figure out how to capture it. Colour was the only component that we see differently to it actually is and would probably be the trickiest to get right. The obvious solution for making the (1) downwelling illumination the key (main) lighting of a scene is to photograph using only available light. This will cast the main shadows below the subject that will also be soft and blue tinted as a result of scattering (2). Soft blue shadows disappear when an image is lit with a flash because the strong directional light from a strobe fills them and casts a black and clearly defined shadow (behind the subject) and fills the soft blue shadow created by the natural light.

Recording the dancing caustic lighting (3) on the seabed also limits the use of flash. Even a small amount will burn away the characteristic light and dark patterns from white sand. Sea surface conditions play an important role in defining the pattern of caustic lighting. A smooth, ripple free surface, is ideal for a well-defined latticework of light. An increase in wind speed increases the small ripples, which confuse the pattern and create a stippled lighting effect on the seabed. Larger waves create bigger blotches of light and dark with poorly defined edges. The type of caustic lighting does not concern me, after all each is characteristic of being underwater. What is important is using a fast shutter speed (1/125th or higher) to freeze the movement of the caustic lighting and to record the light and dark patterns in the final image.

Light beams (4) are also caused by refraction of light at the surface and seen because of the murk in the water. Not surprisingly they also need a fast shutter speed to freeze them, but strobe light does not lessen our chances with them.

Technique 1

Given the need to avoid strobes to capture factors 1-3, initially I planned to capture full colour (5) images using filters. Filters have become tried and tested technique since the proliferation of digital cameras (a fact well documented in UWP, not least because of the editor's enthusiasm for this technique). However, my first few shots highlighted a shortcoming with this as approach. Filters produced ideal lighting for the backgrounds and scenic shots: I could capture all the characteristic Nemo Lighting I wanted. Unfortunately it was too easy to loose the main subjects in these bright and colourful backgrounds (see the image of the barracuda). To be fair filters worked well when the main subject was set against open water or when over white sand that helped fill shadows on the subject and increased its contrast with the background (such as the diver and stingray shot). But when the background was the reef the subject was lost, along with the impact of the image. I needed a more robust technique, one that was more widely applicable than this predominantly shallow water method.

So it was back to the drawing board, well the special features on my Finding Nemo DVD! How did they solve the problem of not loosing their characters in the background? Their answer was by having individual fill lighting on each of the characters. To try to replicate this underwater I needed light coming from another angle, so I gave up on the filter and attached my strobes. But I knew I would have to try a new way of using them.

When shooting with filters in ambient light it is easy to loose the subject in a complex and colourful background. The upper barracuda stand out well against open water, but the lower fish are lost in the reef. For this reason I stopped using filters to achieve Nemo Lighting. Nikon D100 + 16mm lens. 40CC Red filter. Subal housing. 1/125th @ f6.7.

Technique 2

As underwater photographers we normally use strobes as the main (key) lighting on our subject. This is clearly true for macro, and I believe it is also true for wide angle. We often talk about using strobes to fill shadows in wide angle shots, but in reality this "flash fill" is most often the dominant lighting on the main subject and therefore I consider it the key rather than the fill lighting on the subject (in a studio sense). The secret to Nemo Lighting is to only use the strobes for true fill lighting at a much lower intensity than the available light, allowing the latter to act as the key lighting.

Of course the main reason we use strobes is to add colour to our

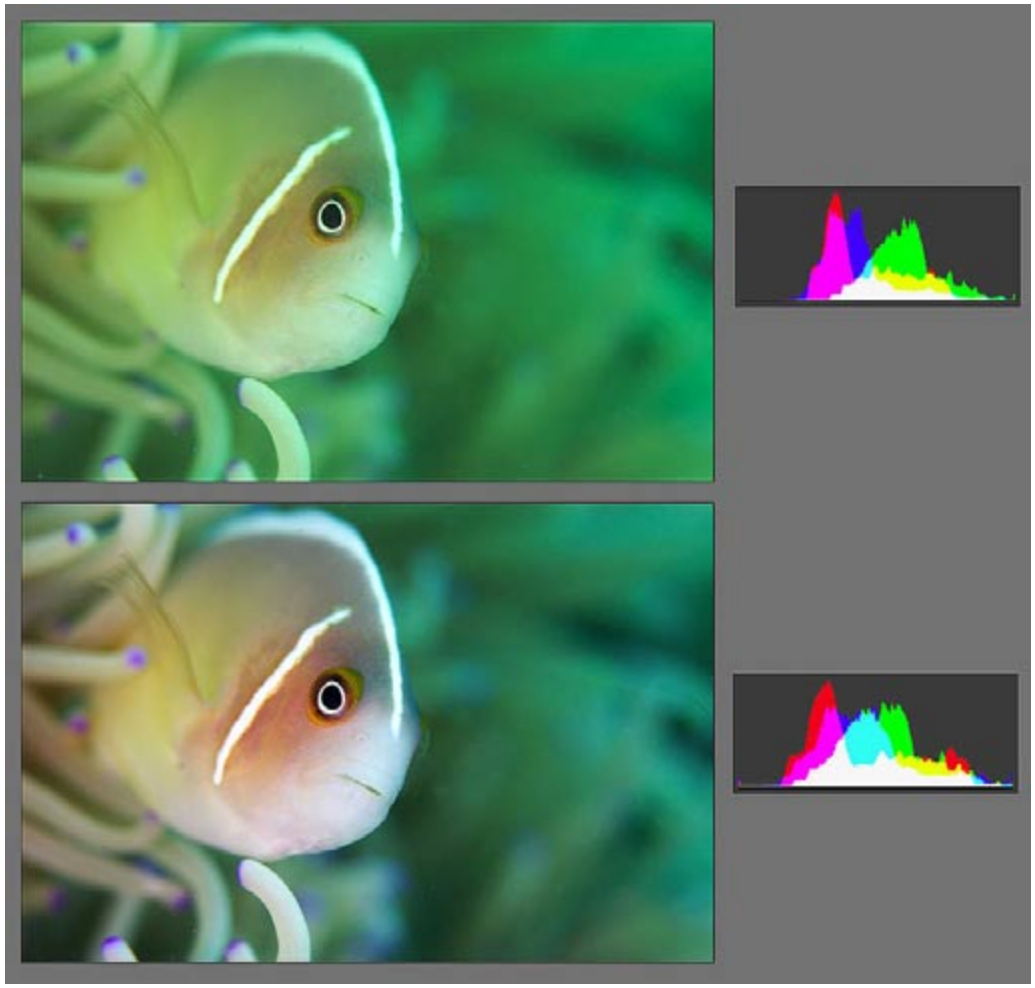
Beams of light are a characteristic and beautiful component of underwater light. Separate beams are created by refraction at the surface and we see them clearly because of the turbidity of water is much greater than air. Nikon F100 + 16mm lens. Subal housing. 1/250th @ f6.7. Velvia 100F.

images. In Nemo Lighting, using strobes for low intensity fill light does not provide enough light to fully colour the subject. The resulting images are too blue. This is not too much of a problem with a digital camera: so long as there is some red light in the RAW image I can adjust the colour temperature and tint of the RAW image and bring out the colours I want. It is not possible to bring back colours that aren't there, which is why there is a finite depth (the depth of red light) on filter photography. If a completely blue image is warmed up everything becomes too warm and even the water goes red! But in this technique, that tickle of strobe light importantly provides enough red light to bring out the desired colours.

In the water the photographic approach is also quite different from standard techniques. For example, normally when I shoot a typical reef scene I find a nice coral, choose a camera angle that silhouettes it, back lit by the sun, against blue water. I meter on the blue water, exposing at say 1/90th @ f8 and light the coral with my strobes at 1/2 power. Easy. To shoot Nemo Lighting I need to swim to the other side of coral so sunlight is illuminating and not silhouetting the coral. I expose for the coral, starting at say 1/45th @ f8 but actually open up the aperture to get a faster shutter speed, such as 1/180th @ f4, to capture

I felt that Nemo lighting would be effective in this image to show that it really was underwater and has not been put together in Photoshop. Note that the shadow of the model is soft and blue and falls beneath her. Also note how the reef and fish are full colour despite being far from the camera. Nikon D100 + 16mm lens. Subal housing. 1/180 @ f8. 2 x Subtronic Alphas on 1/8 power.

caustic lighting more clearly. Then I need to drop the strobe power by 2 stops (to 1/8th power) to account for the wider aperture and then reduce it by a further 2-3 stops (to 1/32nd-



Shooting with the flash underexposed by 2-3 stops and the image lit mainly with ambient light mean that images came out too bluey-green. This can be overcome by white balancing the camera in situ or more conveniently in post processing if shooting in RAW format (such as this before and after example from Adobe Camera Raw). Top image Colour Temp = 5000 K, Tint = 0. Lower images Colour Temp = 5250 K, Tint = 74.

1/64th power) to provide fill without competing with the ambient lighting. The wider aperture also helps increase the contrast between the subject and the background, by throwing the background out of focus. This works to enhance the impact of the otherwise naturalistic looking images.

Fish in Nemo Lighting. Note how both the foreground and background are colourful, but the background is thrown out of focus by the wide aperture. Not also how the backgrounds have soft shadows characteristic of being underwater, rather than the harsh shadows created by strobe light. All Nikon D100. 1/180th @ f5.6 with either 28-70mm or 105mm. 2 x Subtronic Alphas on 1/32nd or 1/64th power.

Conclusion

I am not completely convinced by Nemo Lighting. First I am very pleased that the technique embraces digital technology and produces a new type of image that could not be achieved on film. And at times I am also thrilled by the different look of the images. While at other moments their naturalistic look just confirms to me why photographers have developed the standard techniques of underwater photography! I feel the main shortcoming of many of my Nemo Lighting images is that they lack impact, so easily achieved when flash dominates the lighting!

So in conclusion I think that Nemo Lighting is a niche, rather than mainstream, technique. It is another string to my photographic bow: ideal for images where I want to overemphasise that the scene is underwater. But I must add that Nemo Lighting is still very much work in progress. One of the shortcomings of the images I have shown here is that most are not great shots irrespective of lighting - the case for Nemo Lighting would be strengthened by better composition and more interesting subject matter.

The best thing to come from the experience is the education from PIXAR on underwater light (that I hope I have shared with you in this article). Anyone familiar with the ocean knows to always expect the unexpected. But I never expected to learn more about light underwater from an animated film on DVD than many years listening and learning from underwater photographers.

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Alex will be giving a presentation at "Visions in the Sea"' a one day digital seminar organised by Ocean Optics on October 23rd in London. For details visit www.oceanoptics.co.uk/visions04.html