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## Films for Underwater Photography

High contrast for black and white; color reversal types for color; thinner film bases for both.

THIS DISCUSSION OF FILMS for underwater photography is going to be very short and, I am afraid, rather uninformative. The Eastman Kodak Company does not make any films specially designed for photography under water, nor to my knowledge, does any other photographic concern. On looking through the literature, I find that a great variety of products, both black-and-white and color, have been used. The particular product used seems to be based on the preference of the individual taking the photographs.

raphy through water is somewhat similar to photography when there is fog; there is a loss of contrast. The general recommendation, therefore, is to develop film to high contrast, or to use high-contrast films.

Photography with color films under water can produce very interesting results, but here again there is a basic fact, namely, that water absorbs the longer wavelengths. You begin to lose red light almost immediately. At a depth of about 16 feet you have lost all the red; by 30 feet or so you have lost the red and orange;

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*ABSTRACT: A great variety of films, both black-and-white and color, have been used for underwater photography. To my knowledge, no work has been undertaken to study the special requirements for films for underwater photography. It would appear that higher contrast films might be of some value. Such films would be of the aerial type. Some advantage might also be gained from using films which have a thinner base so as to be able to take more pictures before having to reload a camera. A basic factor is that water absorbs the longer wavelengths of light, and also light intensity diminishes rapidly with distance. It seems that color negative film should be preferable to color reversal film.*

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There are a few basic facts which I am sure everyone is aware of. First of all, the light intensity diminishes rapidly with depth, limiting the photography that can be done with a camera with a fixed exposure without supplying auxiliary light. Even with the best cameras and the best films we are still limited drastically by the water itself. The best solution with increasing depth is not faster films, but controlled light on the subject. This can be self-contained or surface supported. Photog-

by the time you get to 60 feet you have only blue and green, and at 100 feet you are left with just blue.

There is not much point in my continuing to talk about things familiar to most of you. I would prefer to speculate a little bit on the future and to suggest some things which might be helpful, and also to put forth some ideas on special photographic products which might be of some value. What can be done to improve photography with black-and-white films? First, it seems to me that a higher-contrast film would be definitely of value. The problem under water is similar to the problem of photographing the earth from high altitudes; therefore, aerial films might be suggested for under water. Aerial films are not

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tems in a fraction of the time normally required, and produce data having a much greater degree of accuracy than is possible to obtain at the present time.

WE HAVE A NEW frontier to explore under the sea and as with any frontier, we must make maps and charts to guide the generations who will follow us. Many serious and

industrious underwater men are ready to explore and chart this new frontier. But they cannot proceed without the proper tools, and these can only be supplied by the land-based researchers and manufacturers. Men have already begun to live in the ocean in spite of our relative neglect of it. However, if they are going to explore this underwater world well, then modern technology must be prepared to aid them in all possible ways.

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spooled for still or motion picture cameras. They could be, however, and I am sure we would be willing to submit samples to anyone who is in a position to conduct some tests and supply us with the results. There might also be some advantage to high-speed films that are sensitive to the blue and green only. It seems that there is not much point to panchromatic sensitivity if no red light is present. Also, there might be some advantage to use films with thinner bases. Such films are made for aerial photography. A thinner base means that a camera can hold almost twice as much film as it can hold with a film with a standard thickness ordinarily used for motion pictures. To summarize black-and-white photography I would say, therefore, that we might consider a film sensitive to the blue and green, having a high contrast, and on a thin base.

Now let's speculate a little bit on color films. First of all, it seems that a definite advantage would result from using a color negative film rather than a color reversal film. For example, with a film such as Kodacolor, when

making the prints one can use correction filters to restore the color balance. Because with a reversal film no color except blue and green exist at 25 feet, with a negative film one can make prints that are pretty good even if photographed down to about 30 feet. As with the black-and-white films, it seems that some advantage might occur from using a higher contrast film. Again, the aerial type films might be worth trying; also thinner base films might be worthwhile so that more film can be put in a camera. On color films, however, maybe we can go even further and state that there would be an advantage to some type of *special* color film, possibly one in which the red sensitivity is higher than it is with standard films. We are not considering making such a film at this time but it seems worthy of discussion.

This has been a very brief presentation only because so little can be said on the subject. We would welcome any thoughts and ideas that you may have.