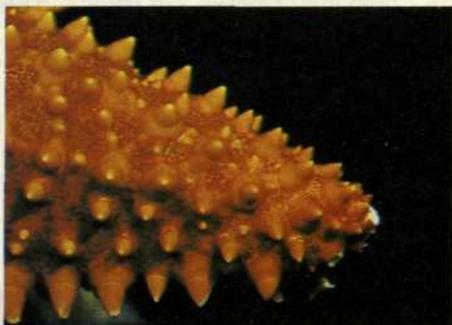


COLOR FILM

Open Water Comparison of 5 Kodak Films



1:2 Macro with flash

K25 at f11



K64 at f16



E64 at f16

Underwater photography is a vast and complex field. Besides all the scuba gear they must wear, divers must also concern themselves with cameras, housings, flash, uncooperative subjects and correct exposures. But of all the items necessary for underwater photography, film is the most important and often is not given much consideration. Many underwater photographers base their decision on recommendations of other photographers or trial and error. Some buy whatever film is available in their local camera store.

Because underwater photographers lack the proper information, a special film comparison was conducted to help them make that critical film choice. Most underwater photographers tend to use Kodak slide film, so our comparison centered on five Kodak films and how they differed when used underwater — Kodachrome 25 (K25), Kodachrome 64 (K64), Ektachrome 64 (E64), Ektachrome 200 (E200), and Ektachrome 400 (E400).

Several measures were taken to ensure accuracy. The color chart and gray card were not used as they were considered invalid for this comparison. They are basically used on land for testing film type versus light source. For example, daylight film is tested with this color chart in daylight and tungsten film is tested under tungsten lights. The light underwater differs from 100 percent sunlight at the surface to lesser amounts as you descend to the ocean floor. There is no accurate way for the general photographer to know exactly what colors are getting through at what depth.

This also applies to electronic flashes, which are daylight balanced. When flash is used in close for macro, there is some loss of certain colors. As



Wide-angle with flash

K25

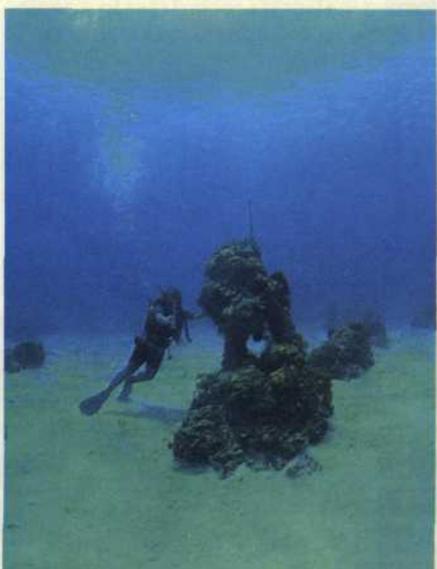


K64



Wide-angle without flash

K25



K64

UNDERWATER

Text and Photography by Jack and Sue Drafa

photos by Jack Drafa



1:2 Macro with flash

K25 at f11



K64 at f16



E64 at f16



E64



E200



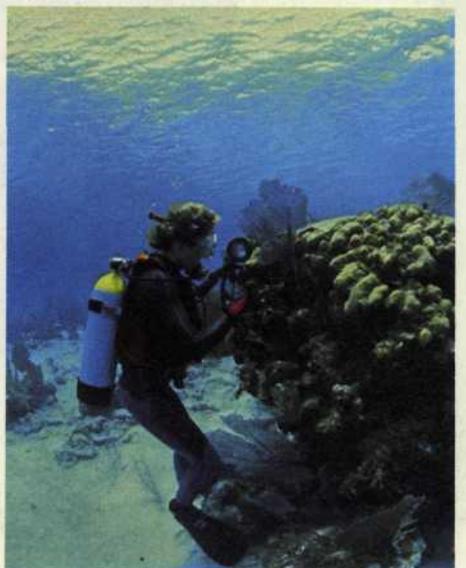
E400



E64



E200



E400

TEST RESULTS

Test	Kodachrome 25	Kodachrome 64	Ektachrome 64	Ektachrome 200	Ektachrome 400
Shadow Detail	Good	Poor	Excellent	Good	Poor
Contrast	High	Very High	Medium	High	High
Sharpness	Excellent	Good	Good	Good	Acceptable
Grain	Extremely Fine	Fine	Fine	Medium	Coarse
Exposure Latitude	+/- 2/3	+/- 1/3	+/- 1 1/3	+/- 1	+/- 2/3
Water Color (0-30 feet)	Blue-Green	Blue-Green	Blue	Blue	Blue
Water Color (30 + feet)	Deep Blue	Deep Blue	Deep Blue	Deep Blue	Deep Blue
ASA—Film Speed	Slow	Medium	Medium	Fast	Extremely Fast
Film Sizes Available	135	110, 126, 135	110, 120, 126, 127, 135 and Sheet	120, 126, 135	120, 135
Processing Available	K14 Commercial Process Only	K14 Commercial Process Only	E6 Commercial or Home Process	E6 Commercial or Home Process	E6 Commercial or Home Process
Macro w/Flash					
Red Reproduction	Excellent	Excellent	Excellent	*NR	NR
Macro w/Flash					
Green Reproduction	Good	Good	Excellent	NR	NR
Macro w/Flash					
Blue Reproduction	Good	Good	Excellent	NR	NR
Macro w/Flash					
Warm Pastels	Excellent	Good	Good	NR	NR
Macro w/Flash					
Cool Pastels	Excellent	Good	Good	NR	NR

Special Note:

Some animals react to electronic flash differently than others especially at the infrared and ultra violet ends of the color spectrum. This reaction is accurately recorded on K25 and K64, but not on E64. Underwater photographers will never know which animals react in this way until this film is processed. The purple tipped sea anemone found in the Bahamas is one example. On Kodachrome it recorded cream colored tentacles with purple tips, but on Ektachrome it recorded green with purple tips. Of the several hundred animals photographed for this film test, less than five reacted in this way.

*NR = Not Researched

This chart summarizes the performance of each color film in each area tested. The results show no single film is always best.

the flash moves further away from the subject, such as in wide-angle shots, a different portion of the light is missing.

The color chart is also designed to reflect the various colors in the visible spectrum — cyan, magenta, yellow, red, green and blue, when in actuality many of the underwater animals photographed reflect the ultra violet (UV) or infra red (IR) part of the spectrum. UV is at the blue end of the spectrum and IR is at the red end. Both IR and UV are not visible to the eye or to the color chart, but can be reflected or absorbed by the animal life on the ocean floor.

Color film reacts to UV and IR and this affects the photo's final color, so the only possible way to get satisfactory results is to test the ocean itself. We photographed typical underwater scenes, with different films — at the same time, using the same lighting, location, angle and proportion. Underwater photographs are generally divided into three groups: wide-angle with flash, macro with flash, and available light. Comparisons were run in each of these areas repeatedly by various photographers. Different processors were also used in order to eliminate the possibility of inaccurate processing. The photographer can now compare the results and pick the film that he or she feels recorded the scene most accurately.

SHADOW DETAIL

This should be considered one of the most important categories. Much of the detail found in underwater photographs is in the shadows or secondary areas. Without these areas many photographs would lose their impact. E64 seems to be the champ in this category as it has great detail in the shadows and yet still maintains good highlights. When K64 and E400 are correctly exposed for the highlights, they have almost no shadow detail.

CONTRAST

The amount of tonal gradation between the highlights and shadows is referred to as contrast. Many tonal grades indicate low or medium contrast, while few tones constitute high contrast. E64, with its medium contrast has the ability to pick up subtle tones much better than K64, with its high contrast.

SHARPNESS

Sharpness is the ability of a film to define an image clearly. Sharpness in a film also depends on contrast, grain, film speed and film thickness. Taking all these facts into consideration, you will find that K25 is superior. K64 and E64 come in a close second and should not be discounted.

GRAIN

Grain in color film is not the same as in black and white which has silver grain particles. In color film the final image is made up of three layers of color dye. These microscopic patches of dye are grouped together to form what looks like parts of out-of-focus grain particles. K25 has the finest dye grain pattern and therefore allows the largest possible enlargement. K64 and E64 are tied for second.

WATER COLOR

This was a special test showing how each film recorded the blue water background found in so many wide-angle photographs. Deep blue is considered by many photographers to be ideal. Since the Kodachromes are more sensitive to the warm colors they pick up more reds and yellows between 0 and 30 feet. This turns water blue-green at these depths. The less red sensitive Ektachromes produce a deep water blue.

EXPOSURE LATITUDE

A film's ability to accept over and under exposure and still be usable is called exposure latitude.

Correct exposure of film underwater can be difficult, therefore you need a film

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with the greatest exposure latitude. E64 has the greatest latitude of $\pm 1 \frac{1}{3}$ stops, while K64 with its $\pm 1 \frac{1}{3}$ stop does not allow any room for error.

ASA

This rating indicates just how sensitive film is to light. For example, K25 is not very sensitive to light while E400 is extremely sensitive. When plenty of light is available, as in a shallow dive, low ASA film such as K25 or E64 can be used. Deeper dives provide less light and may require faster films such as E200 and E400.

MACRO PHOTOGRAPHY WITH FLASH

This comparison showed how well the different film recorded red, green, blue and pastels when a flash was used for close-ups. E200 and E400 were not recommended for these tests as they are too sensitive to the light flash produced this close. E64 did very well; with reds, greens and blues, but had some difficulty with pastels. K25 and K64 did well with reds and pastels, but had some difficulty with blues and greens.

AVAILABLE LIGHT

This comparison showed how each film performed when filtered sunlight was the only light source. Again, the water recorded on Kodachrome tended to be warmer at the shallow depths. K25's low sensitivity to light restricted it to shallow diving where enough light was present to record an image. E200 and E400's high sensitivity allowed divers to go much deeper and yet maintain good exposure control with a lot less light.

CONCLUSION

After carefully looking at the results of each test, it should be clear that no one film is the winner. Some films perform better in one category. If you could only take one type of film on a dive trip, E64 would have to be your choice. It has excellent shadow detail, and its sharpness and contrast are good. Its water color is excellent and it works well with flash. You can process it yourself or have it processed while on your dive trip in order to see how you are doing. Its medium speed allows divers to work shallow as well as at medium depths. E64 can be found in all film sizes, especially important to $2\frac{1}{4}$ inch format fans, and it can even be bulk loaded for economy.

For the diver able to take several types of film on a dive trip, E64 is recommended for all wide-angle shots with or without flash. K25 is suggested for macro, if your flash is powerful enough to illuminate the scene. E200 should be

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taken just in case the light level is very low or your flash has very low output.

Of the two remaining films tested, K64 is contrasty and requires extreme accuracy in exposure. As for E400, if a photographer cannot get correct exposures using E200, then going to E400 will probably not help.

It should be understood that these comparisons are only valid underwater and should not be used as a basis for film selection on land.

For underwater photographers to get the most from these comparisons, they must first evaluate their own photographic film requirements. By comparing these requirements to the characteristics of each film, they should then be able to select the proper film and feel confident with their choice. 