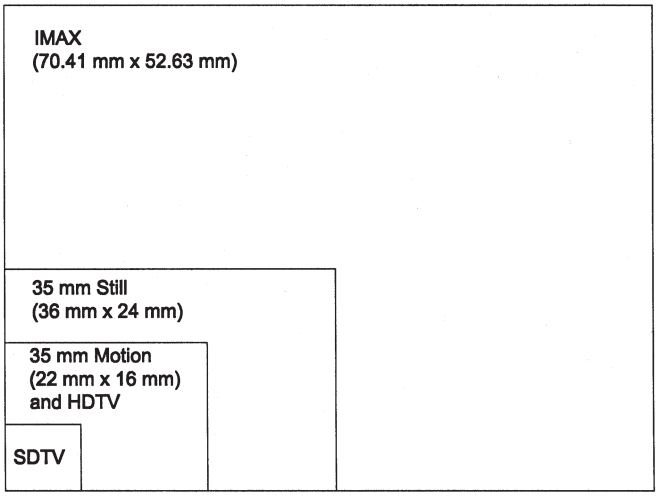
Carlos V. Girod, Jr., Provides Analysis for National Geographic Society

The staff at the National Geographic Society contacted Carlos V. Girod, Jr., P. E., SMPTE Director of Engineering for an analysis of relative quality factors for standard-definition television, high-definition television, 35mm motion picture film, 35mm still film, and IMAX format motion-picture film. The information would be used for an article entitled "Deep Sea Vents," which appeared in *National Geographic*, *the Journal of the National Geographic Society*, Vol. 198, No. 4, Oct. 2000, pp. 116-127, and the section on p. 124, "Capturing Deep-Sea Detail," with underwater photography using various television and film formats.

The analysis was based on the number of pixels for television, and as shown in the chart below, HDTV is about 6 times better than SDTV. For motion picture film, the analysis was based on camera image aperture area on the film: the more area, the higher the quality. If one accepts HDTV and 35mm motion picture film as being equivalent, and one assigns an arbitrary "quality number" of 1 to SDTV, then HDTV has a quality number of 6. That same quality number of 6 can then be assigned to 35mm motion picture film. Based on camera film aperture areas, 35mm still film can be assigned a quality number of 15, and IMAX-format motion picture film, a quality number of 63.

It is generally accepted that HDTV projection is equivalent to 35mm motion picture film projection. This has been demonstrated in a number of the digital cinema presentations in 1999 and 2000, including *Star Wars Episode 1—the Phantom Menace, Toy Story 2, Dinosaurs, and Space Cowboys*. Even as early as February 5, 1988, Vincent



Canby, film critic for the *New York Times*, wrote: "*Julia and Julia* ...proves two things: that Kathleen Turner has become the kind of star who can carry even third-rate fiction without losing her beautiful, voluptuous cool, and that high-definition tape (on which this was initially shot) can be transferred to film and look as good as anything shot on film to start with;" and "Giuseppe Rotunno was responsible for the crystal-clear originally taped photography."

The *National Geographic* article condensed the data to state, IMAX: With ten times the image area of 35mm motion film, IMAX yields more detail than other media. Conventional Video: Its resolution is one-sixth that of 35mm motion film or HDTV.

Comparisons of Television and Film Formats
(Analysis for National Geographic - Oct. 2000, p. 124)

Format	Specifications (No. of samples)	Image Width (No. of lines)	Image Height	Total Pixels	"Quality No."
SDTV (NTSC)	SMPTE 125M	720	483	347,760	1
HDTV	SMPTE 274M	1920	1080	2,073,600	6

Format	Specifications (mm)	Image Width (mm)	Image Height (mm2)	Total Area	
35mm motion picture	SMPTE 59	22	16	352	6*
35mm still	ISO 1754	36	24	864	15
IMAX (65mm 15-perf)	ACVL Handbook	70.41	52.63	3706	63

**Note: Assumes 35mm motion picture film projection and HDTV projection are equivalent*

Table prepared by Carlos V. Girod, Jr.