



Alma Mater Studiorum – Università di Bologna
Facoltà di Scienze Matematiche, Fisiche e Naturali

Laurea Magistrale in Biologia Marina

Insegnamento di
RICERCA SCIENTIFICA SUBACQUEA

A.A. 2001/2011

Prof. Marco Abbiati - Dr. Massimo Ponti

Fotografia e videoripresa subacquea



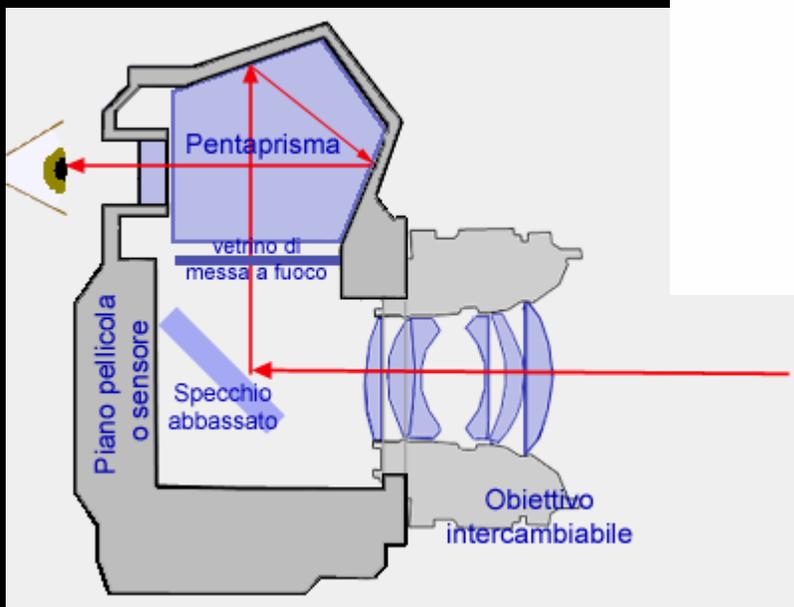
Fotocamere



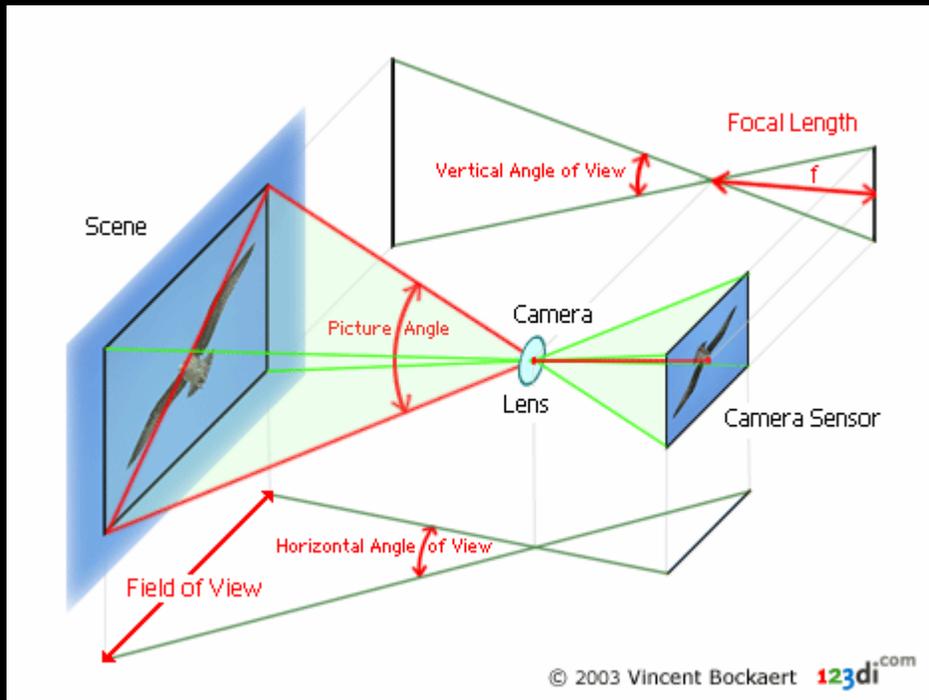
- Pellicola
- Digitali
- Compatte
- Reflex



Sistema reflex



Percorso ottico ed esposizione



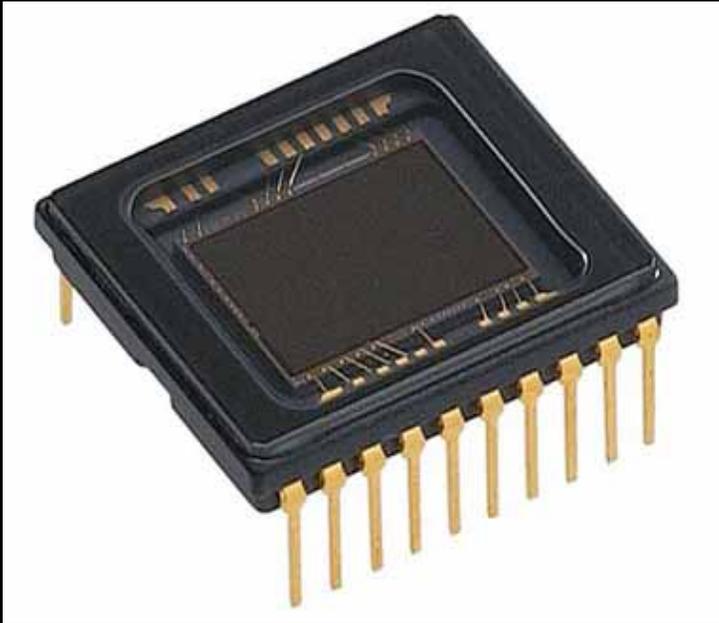
	Aperture	Shutterspeed	Sensitivity	Exposure Value (1)
Effect of scrolling up -> one step	doubles aperture (less DOF)	doubles exposure time	doubles the effect of incoming light (more noise)	-1 EV doubles the amount of light (3) collected by the sensor
Select here ->	<input type="text" value="f/8"/>	<input type="text" value="1/125s"/>	<input type="text" value="ISO 100"/>	<input type="text" value="13 EV"/> <input type="button" value="Calculate EV"/>
Effect of scrolling down -> one step	halves aperture (more DOF)	halves exposure time	halves the effect of incoming light (less noise)	+1 EV halves the amount of light (3) collected by the sensor

- Film
- CCD
- CMOS

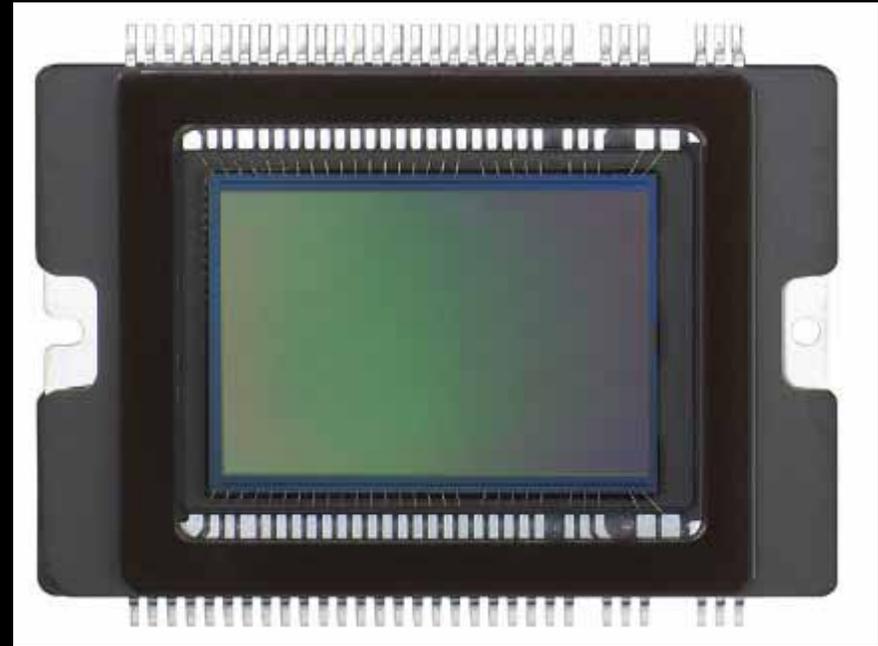


Pellicole e sensori

- Dimensioni immagine
- Risoluzione e dimensione di stampa



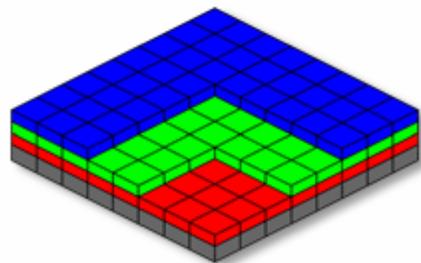
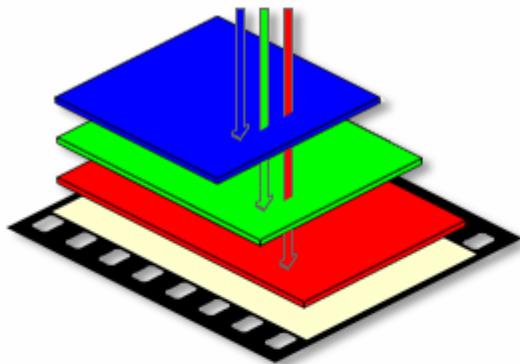
- Sharp RJ21T3AA0PT/ST
6Mp CCD sensor



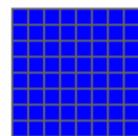
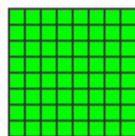
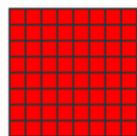
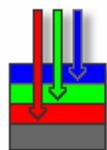
- 12 megapixel CMOS sensor

Pellicole e sensori

35 mm Color Film



Foveon Sensor

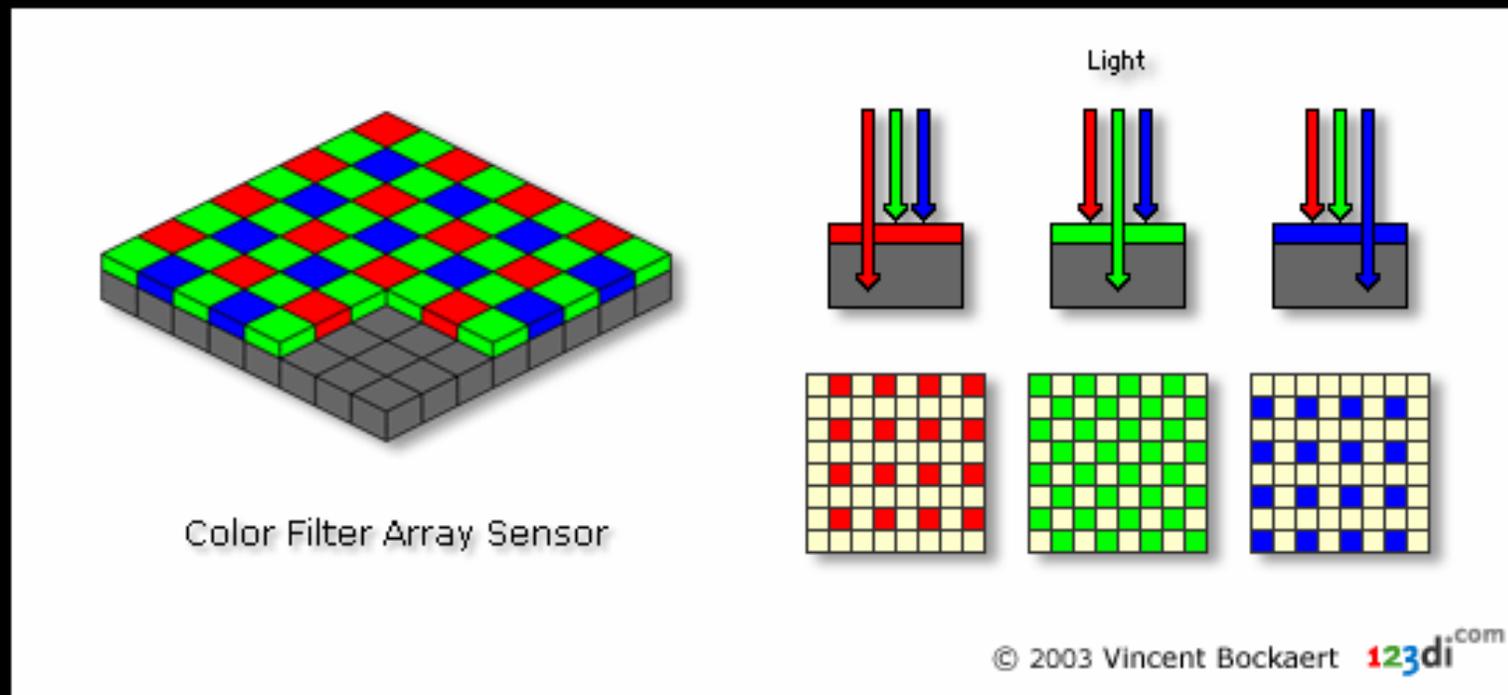


Color Filter Array

Contributed by 123di.com

By Vincent Bockaert

Each "pixel" on a digital camera sensor contains a light sensitive photo diode which measures the brightness of light. Because photodiodes are monochrome devices, they are unable to tell the difference between different wavelengths of light. Therefore, a "mosaic" pattern of color filters, a color filter array (CFA), is positioned on top of the sensor to filter out the red, green, and blue components of light falling onto it. The GRGB Bayer Pattern shown in this diagram is the most common CFA used.



Mosaic sensors with a GRGB CFA capture only 25% of the red and blue and just 50% of the green components of light.



Red channel pixels
(25% of the pixels)



Green channel pixels
(50% of the pixels)



Blue channel pixels
(25% of the pixels)



Combined image

As you can see, the combined image isn't quite what we'd expect but is sufficient to distinguish the colors of the individual items in the scene. If you squint your eyes or stand away from your monitor your eyes will combine the individual red, green, and blue intensities to produce a (dim) color image.



Red, Green, and Blue channels after interpolation

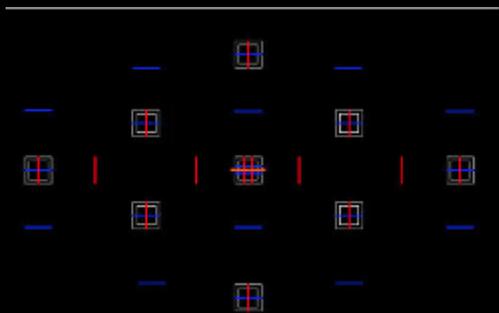
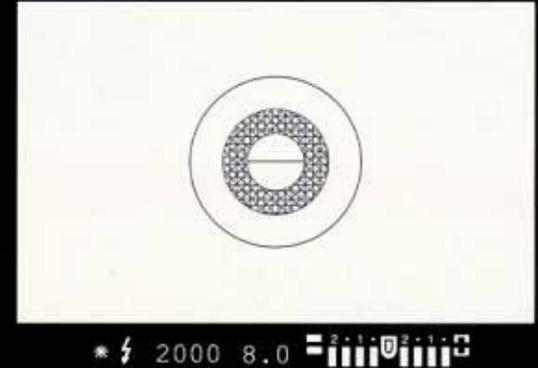


Combined image

The missing pixels in each color layer are estimated based on the values of the neighboring pixels and other color channels via the **demosaicing algorithms** in the camera. Combining these complete (but partially estimated) layers will lead to a surprisingly accurate combined image with three color values for each pixel.

Distanza del soggetto e messa a fuoco

- Manuale
 - Stimata
 - Telemetro
- Atomica
 - Singola
 - Continua
- Al centro
- Decentrata
- Priorità al soggetto più vicino



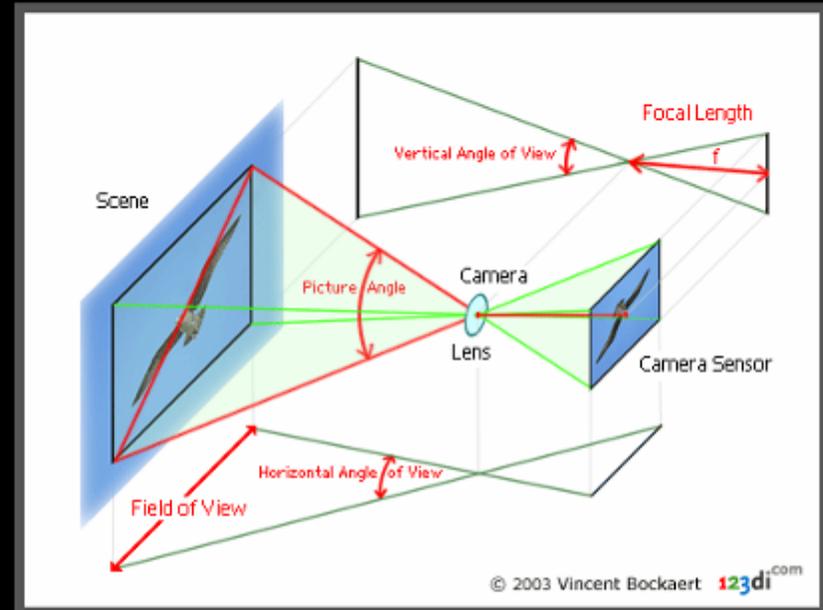
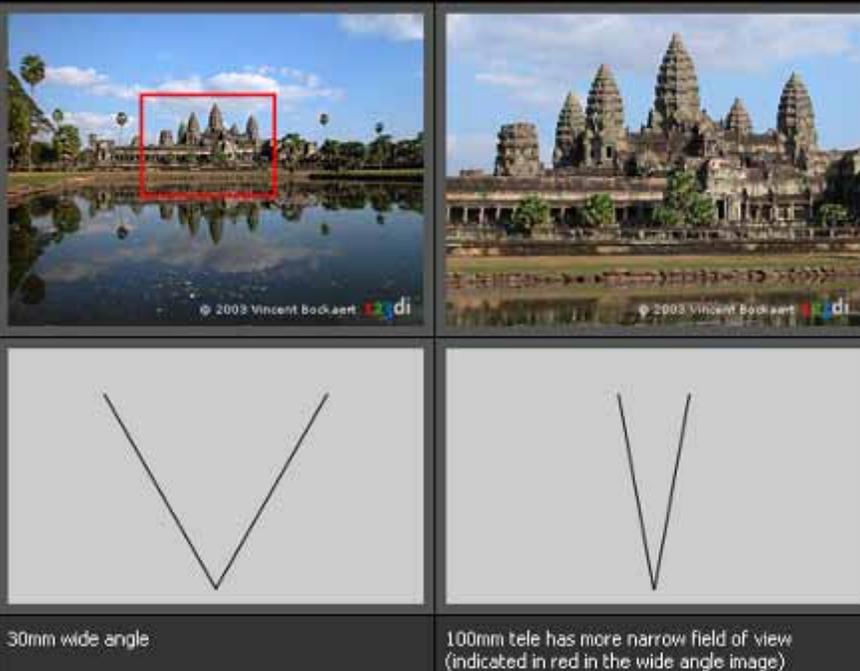
Lunghezza focale e angolo di ripresa

Focal Length

 Contributed by **123di**.com

By Vincent Bockaert

The focal length of a lens is defined as the distance in mm from the optical center of the lens to the focal point, which is located on the sensor or film if the subject (at infinity) is "in focus". The camera lens projects part of the scene onto the film or sensor. The field of view (FOV) is determined by the angle of view from the lens out to the scene and can be measured horizontally or vertically. Larger sensors or films have wider FOVs and can capture more of the scene. The FOV associated with a focal length is usually based on the 35mm film photography, given the popularity of this format over other formats.



In 35mm photography, lenses with a focal length of 50mm are called "normal" because they work without reduction or magnification and create images the way we see the scene with our naked eyes (same picture angle of 46°).

Wide angle lenses (short focal length) capture more because they have a wider picture angle, while tele lenses (long focal length) have a narrower picture angle. Below are some typical focal lengths:

Typical focal lengths and their 35mm format designations

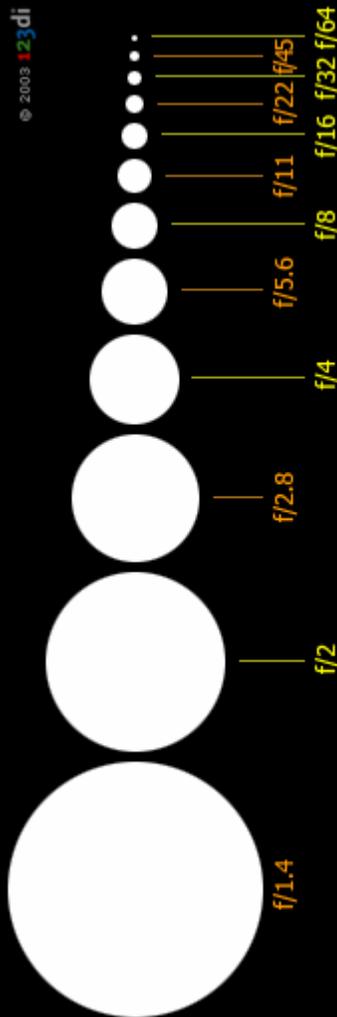
< 20mm	Super Wide Angle
24mm - 35mm	Wide Angle
50mm	Normal Lens
80mm - 300mm	Tele
> 300mm	Super Tele

Lo zoom digitale è solo un ritaglio dell'immagine!

A change in focal length allows you to come closer to the subject or to move away from it and has therefore an indirect effect on perspective. Some digital cameras suffer from barrel distortion at the wide angle end and from pincushion distortion at the tele end of their zoom ranges.

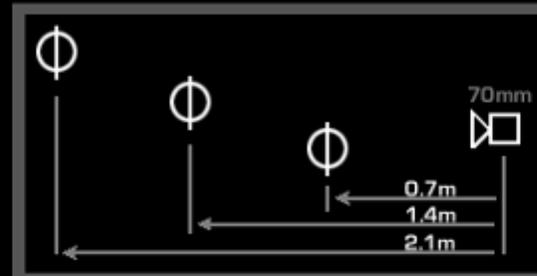
Diaframma e profondità di campo

© 2003 123di



Depth of field (DOF) is a term which refers to the areas of the photograph both in front and behind the main focus point which remain "sharp" (in focus). Depth of field is affected by the **aperture**, subject distance, **focal length**, and film or sensor format.

A larger **aperture** (smaller f-number, e.g. $f/2$) has a shallow depth of field. Anything behind or in front of the main focus point will appear blurred. A smaller aperture (larger f-number, e.g. $f/11$) has a greater depth of field. Objects within a certain range behind or in front of the main focus point will also appear sharp.



This setup was used to produce the example below. A picture was taken of three postcards 0.7m apart using a 70mm telephoto lens which was focused on the first card.



As you can see, at a large aperture of $f/2.4$ only the first card is in focus, while at $f/8$ the middle card is sharp and the distant card is almost sharp. Click on the image for a larger version.

Coming closer to the subject (reducing **subject distance**) will reduce depth of field, while moving away from the subject will increase depth of field.

Lenses with shorter **focal lengths** produce images with larger DOF. For instance, a 28mm lens at $f/5.6$ produces images with a greater depth of field than a 70mm lens at the same aperture.

Tempi e movimento



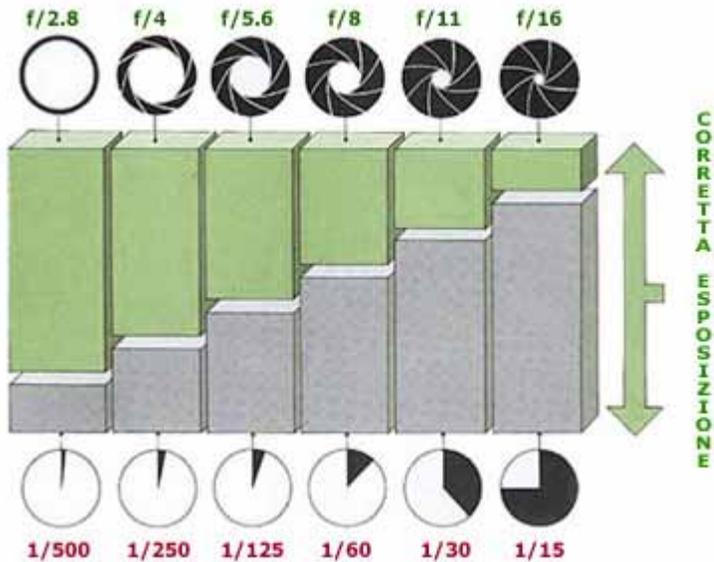
- 1/8000 s
- 1/4000 s
- 1/2000 s
- 1/1000 s
- 1/500 s
- 1/250 s
- 1/125 s
- 1/60 s
- 1/30 s
- 1/15 s
- 1/8 s
- 1/4 s
- 1/2 s
- 1 s

B (bulb) - l'otturatore rimane aperto finché il fotografo tiene premuto il pulsante di scatto.

T - l'otturatore rimane aperto fintantoché l'operatore non ri-preme il pulsante di scatto.

Corretta esposizione

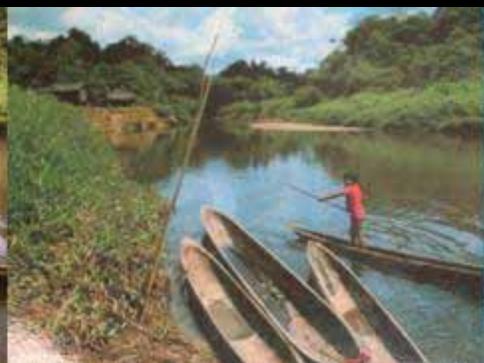
- Tempo
- Diaframma
- Sensibilità ISO (o velocità della pellicola) e grana o ISO noise



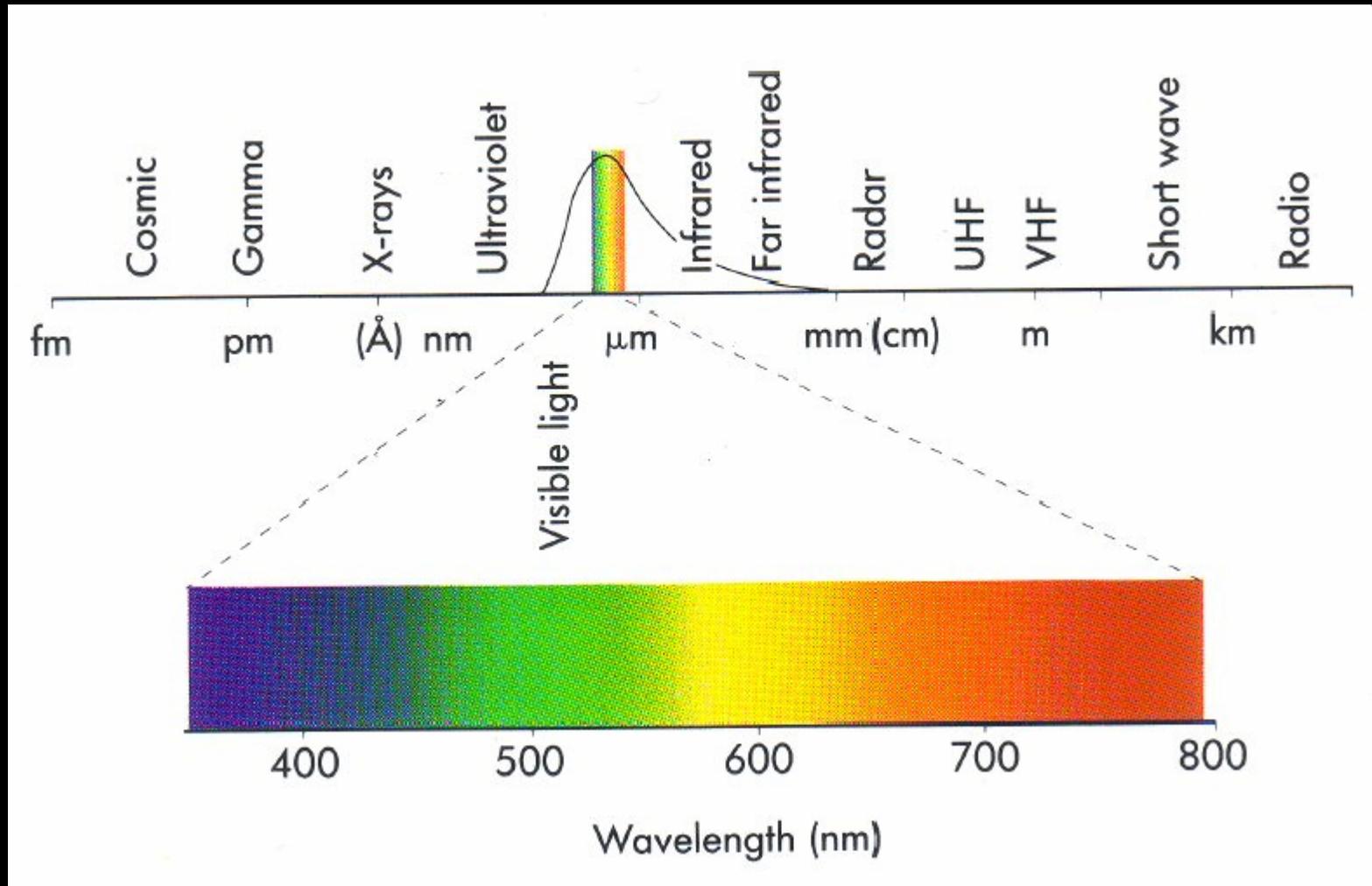
High ISO noise test. All images are 100% crops taken with a pre-production (beta) sample of the Canon EOS 60D
 (Note: This was a distant, moving, subject so no conclusions about resolution should be drawn from these images due to possible motion blur plus heat haze (it was hot!))

Colori e bilanciamento del bianco

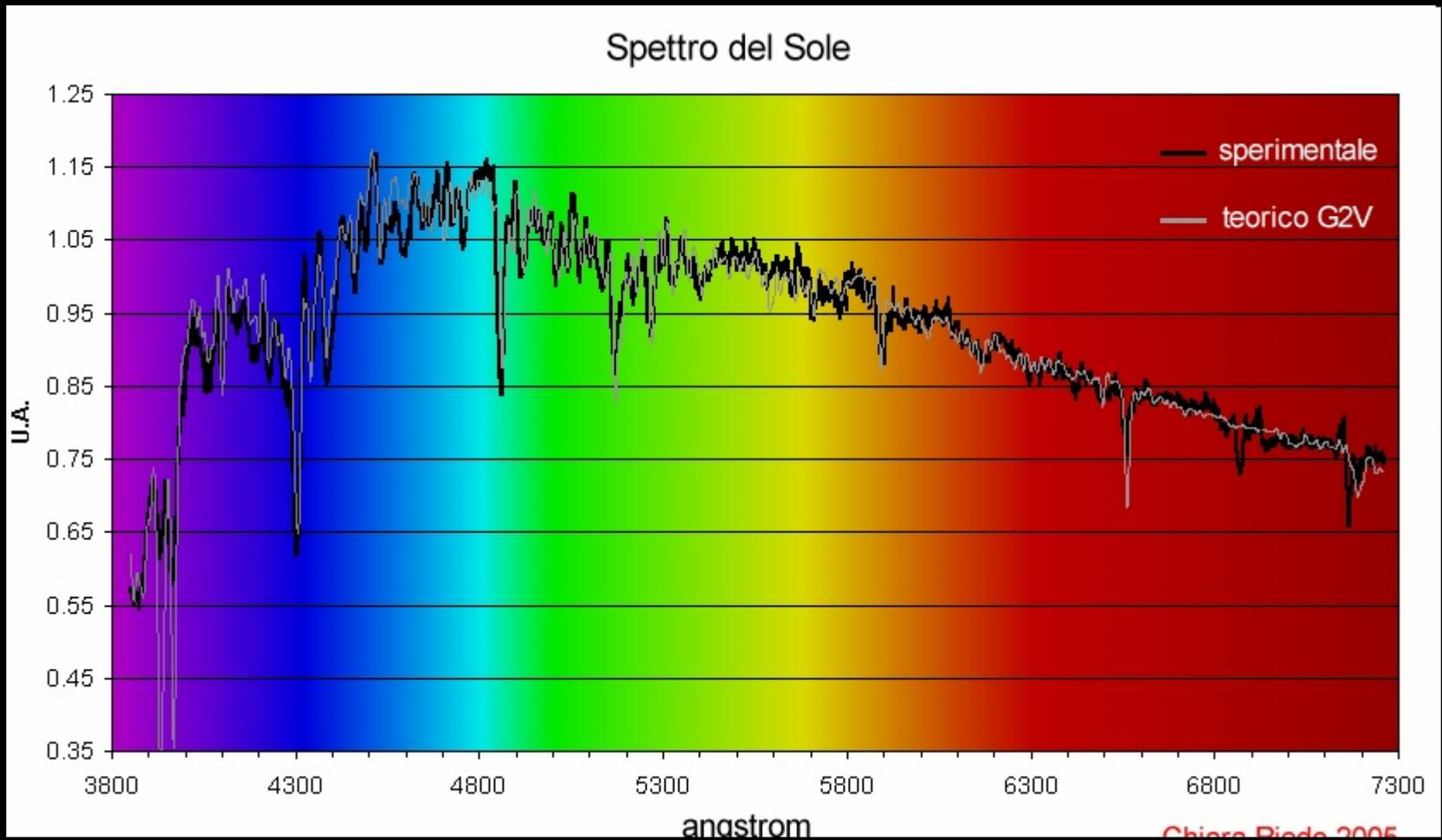
- Temperatura colore



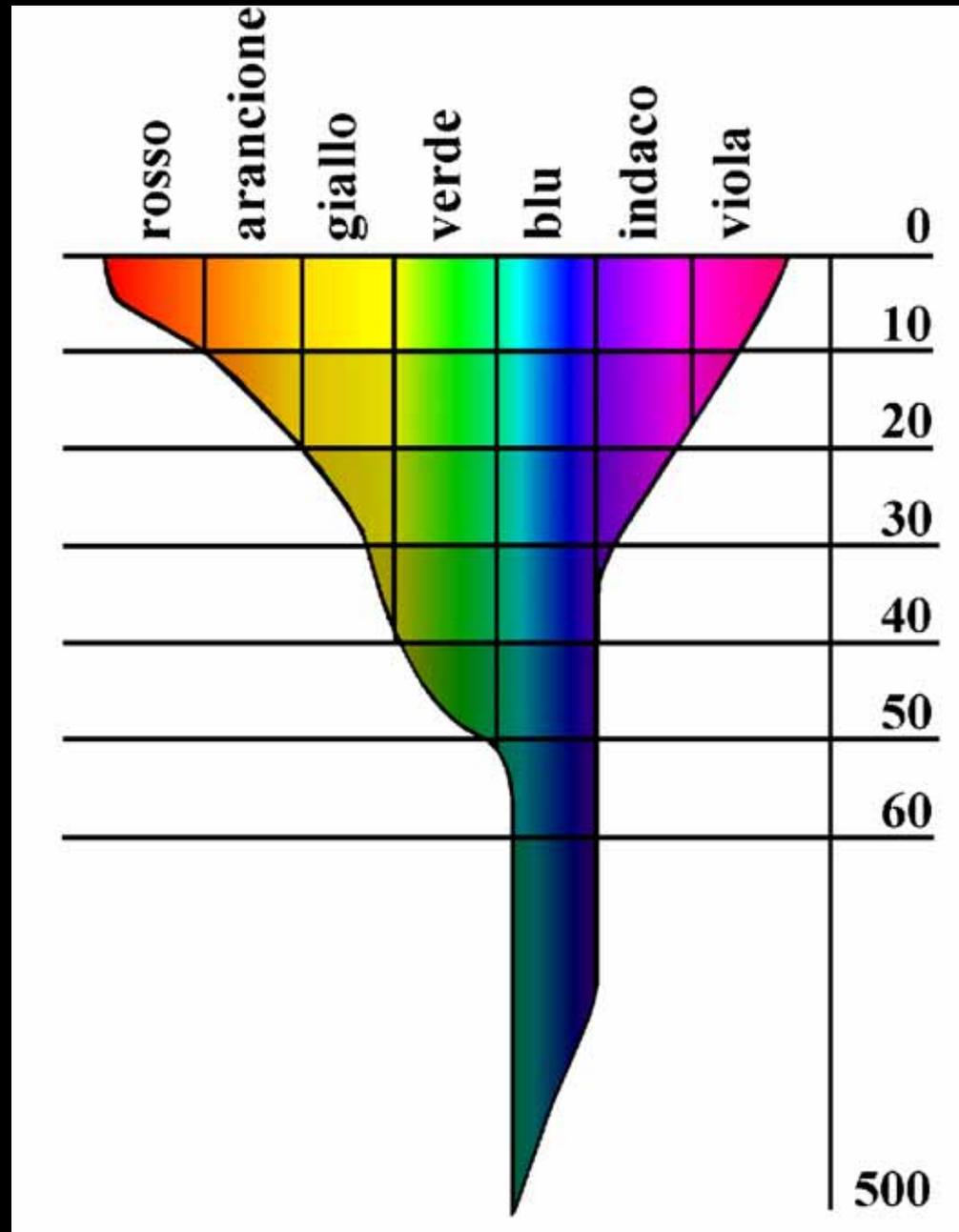
La luce naturale



La luce naturale



La luce naturale



Tipologie di fotocamere subacquee



ANFIBIE



INOQUADRA&SCATTA



EVOLUTE



IBRIDE



REFLEX

Tipologie di fotocamere subacquee



ANFIBIE



INOADRA&SCATTA



EVOLUTE



IBRIDE



REFLEX

Tipologie di fotocamere subacquee

FOTOCAMERE COMPATTE INQUADRA & SCATTA

Sono fotocamere compatte prive delle regolazioni manuali A (priorità ai diaframmi), S (priorità ai tempi) e M (tempi e diaframmi regolabili manualmente) e che, tutt'al più, hanno nel menù Scene regolazioni dedicate per la fotografia subacquea.



ANFIBIE



INQUADRA&SCATTA



EVOLUTE



IBRIDE



REFLEX

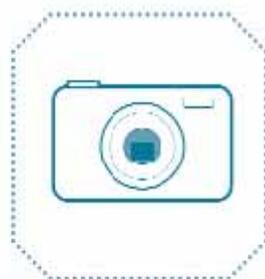
Tipologie di fotocamere subacquee

FOTOCAMERE COMPATTE EVOLUTE

Sono fotocamere compatte che consentono le regolazioni manuali A (priorità ai diaframmi), S (priorità ai tempi) e M (tempi e diaframmi regolabili manualmente): possono avere nel menù Scene regolazioni dedicate per la fotografia subacquea. Sono considerate utili anche per usi professionali (prosumer): spesso sono di dimensioni meno compatte e hanno dimensioni del sensore superiori rispetto alle inquadra e scatta. Alcuni modelli possono usufruire di custodie in alluminio e non soltanto in policarbonato, unico materiale utilizzato per le inquadra e scatta.



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INQUADRA&SCATTA



EVOLUTE



IBRIDE



REFLEX

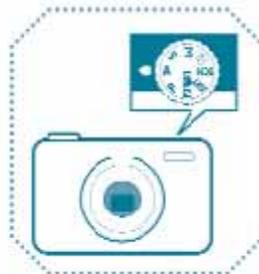
Tipologie di fotocamere subacquee



ANFIBIE



INOQUADRA&SCATTA



EVOLUTE



IBRIDE



REFLEX

L'illuminazione e le tecniche

- Luce ambiente
- Flash incorporato (TTL)
- Flash esterno (con/senza luce pilota)
 - wired (TTL syncro cable)
 - wireless (Slave)
 - Fiber optic cable (S-TTL)
- Fari video
 - Alogeni
 - Led
 - Hid



Flash mode

- Auto
- Auto with red-eye reduction
- Flash on
- Flash on with Slow Sync
- Flash off

L'illuminazione e le tecniche

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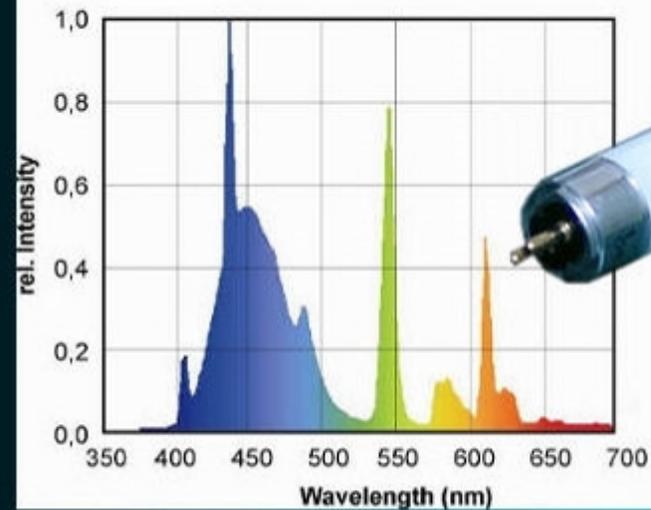
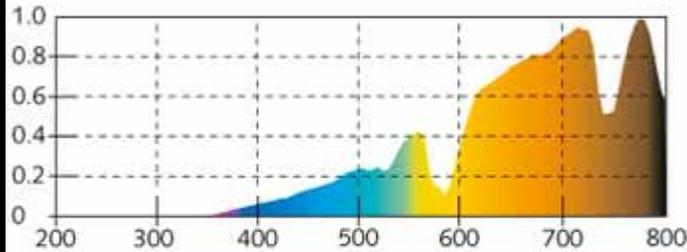
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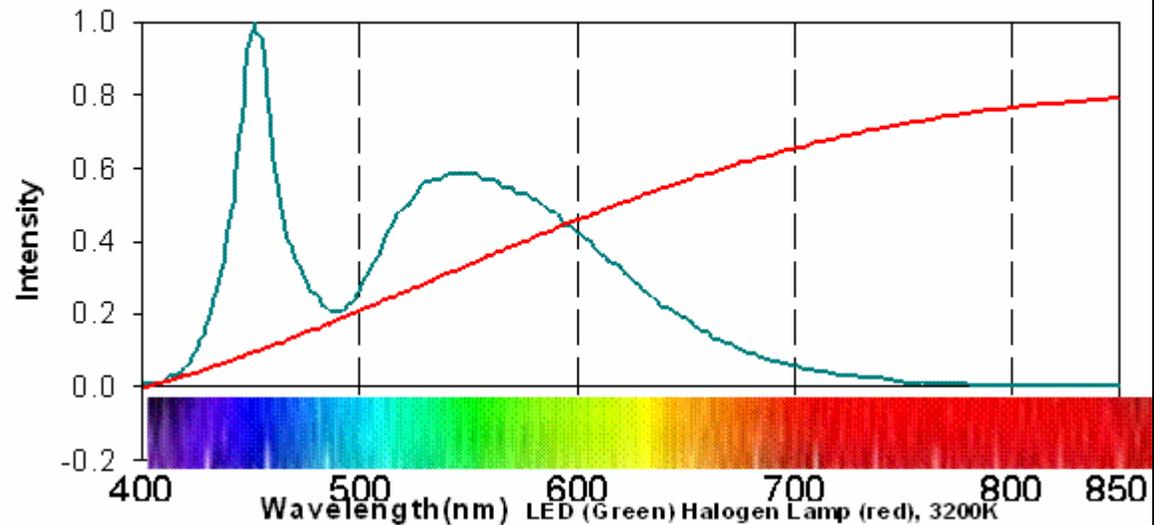


L'illuminazione e le tecniche

DAYLIGHT SPOT



LED Vs Halogen Lamp(Normalized)



Macrofotografia



- Ottiche adeguate
- Messa a fuoco
- Luce
- Profondità di campo
- Tempi

EXIF

Contributed by 123di.com

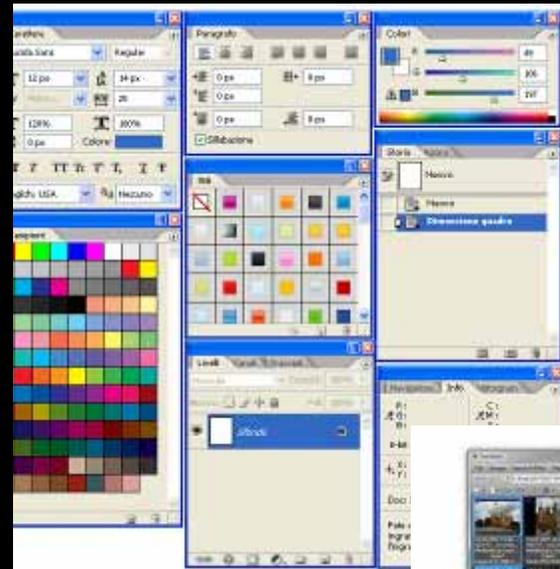
By Vincent Dockaert

Besides information about the pixels of the image, most cameras store additional information such as the date and time the image was taken, aperture, shutter speed, ISO, and most other camera settings. These data, also known as "metadata" are stored in a "header". A common type of header is the EXIF (Exchangeable Image File) header. EXIF is a standard for storing information created by JEIDA (Japan Electronic Industry Development Association) to encourage interoperability between imaging devices. EXIF data are very useful because you do not need to worry about remembering the settings you used when taking the image. Later you can then analyze on your computer which camera settings created the best results, so you can learn from your experience.

EXIF Metadata	
EXIF	
Camera	
Make	NIKON CORPORATION
Model	NIKON D70
Orientation	upper left
X resolution	300
Y resolution	300
Resolution unit	inch
Software	Ver.1.00
Date/Time	2004-04-03 10:54:56
YCbCr positioning	co-sited
Image	
Image description	
Artist	
Copyright	
Exposure time	0.0015625 s
F-number	f/10
Exposure program	Normal program
Date/Time original	2004-04-03 10:54:56
Date/Time digitized	2004-04-03 10:54:56
Component config	Y
Compressed BPP	1
Exposure bias value	0.000000
Max. aperture value	3.000000
Metering mode	Pattern
Light source	Unknown
Flash	Flash did not fire
Focal length	55 mm
User comment	ATO sample7000022
Subsec time	90
Subsec time original	90
Subsec time digitized	90
Colorspace	sRGB
Pixel X dimension	2000
Pixel Y dimension	3008
Sensing method	One-chip color area sensor
Scene type	Photographed image
CFA pattern	(00,02,00,02,02,01,01,00)
Custom Rendered	Normal process
Exposure mode	Auto exposure
White balance	Auto white balance
Digital zoom ratio	1
Focal length in 35mm film	82 mm
Scene capture type	Standard
Gain control	None
Contrast	Hard

Software

- Elaborazione e fotoritocco
- Archiviazione e catalogazione
- Georeferenziazione
- Analisi di immagine



Fotografia digitale subacquea

Digital Underwater Photography by Egidio Trainito et al.

<http://www.duwphoto.com>

Cameras Underwater

<http://www.camerasunderwater.co.uk>

Digital Photography Review

<http://www.dpreview.com/>