CENTRO STUDI ETOLOGICI
C. S. E.

corbaiola notiziario

Year 2 - Issue n. 4 - June 2004

A collection of information and curiosities on the most varied nature subjects

Oops!... those footprints belonged to someone else... so we have changed the name of our Magazine to: Corbaiola Notiziario.

The "perché,perché, perché" (why, why, why) section" is always ready to answer your weirdest questions. This time we will talk about toads, explore the eye structure of fish and find out how they see in the underwater world.
Remember to address your questions to:

The Editor, Corbaiola News,
Centro Studi Etologici, Convento dell'Osservanza 53030 Radicondoli (Si)
or email us at
notiziario@centrostudietologici.org
Don't forget to write your name, age and where you are writing from.

In this issue "The woodsman" will talk to us about how fire effects woodland areas. Our "Incredible" section looks into the invention of hot air balloons.

A warm greeting from all the Editorial Board.

Photograph of two Bottle Nose Dolphins (*Tursiops truncatus*)

CENTRO STUDI ETOLOGICI cultural association
"corbaiola", free electronic newsletter for children
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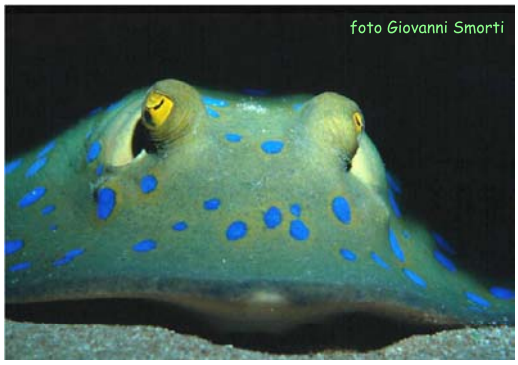
perché, perché, perché?

readers ask the questions

What colours are fish's eyes?

Federico (aged 6), **Haruki** (aged 6), **Konstanz** (aged 7) (Firenze)

The colours of fish eyes do not come in every colour of the rainbow but most certainly vary, although the black of the pupil and the red of the eye ground are predominant.
The structure of the eye of a fish is not unlike an human eye although there are a few substantial differences, one major deriving from the fact that a fish's eyes is structured for the underwater world. We will look into this later on.



Bluespotted ribbontail ray (*Taeniura lymna*)

The eyes of a fish are usually located on the side of their heads and are large in size compared the their head and body. Some species have eyes on top of their heads that look a bit like telescopes.
Eye-lids are usually absent or rudimentary.
The cornea, i.e. the convex transparent membrane that forms the anterior cover of the eyeball in man is shaped like a lens and helps focus whereas in fish its' role is purely protective being the same thickness all round. It is usually colourless but can sometimes vary from light yellow to a greenish colour. For this reason sometimes a fish's eye can take on colours that range from shades of yellow to shades of green. Sometimes the skin around the eye socket thickens and turns into different colours therefore giving the impression that the eye is coloured; sometimes seemingly gaudy colours.

Copper-banded butterfly fish (*Chelmon rostratus*)

Now for those of you who are a little bit older let's analyse the subject more thoroughly. The sclera, sclerotic coat, commonly known as the white of the eye in man, in the fish's eye functions as a sheath and on the foremost part, near the cornea is made up of cartilaginous lamina. The choroids is a spongy layer full of blood vessels, it surrounds the optic nerve and probably protects the retina from the pressure that arises when the fish dives into deep water. The crystalline lens is very tough and has the form of a ring whereas in mammals, man included, it is shaped like a lens, the convexity of which modifies so that images can be seen clearly. Fish put images into focus by

moving the crystalline backwards and forward like the lens of a camera; to do this they use a muscle called retractor. In bony fish (sharks and rays belong to the category of cartilaginous fish) the iris is a thick and hard membrane encased inside the crystalline lens (pupil) which does not adjust to light as in man, but remains dilated at all times. In front of the crystalline lens there is a watery fluid called aqueous humour, behind the crystalline lens there is a clear gelatinous fluid called vitreous body.

The pupil in fish's eyes is always dilated and therefore many fish with big eyes that are nocturnal by nature, have had to get used to living in the shade away from direct light. These fish in fact hide in the dark cavities underwater and only come out into the open sea when they are protected by nightfall. Since these fish have to protect themselves from their enemies and look for food in weak light conditions their eyes have developed consequently, therefore becoming much more sensitive like the eyes of a cat but not as adaptable as the eyes of a mammal. Being their iris very rigid, during day light these fish are practically blind and even in the best of conditions cannot distinguish the various colours of the reef. Their world is made up of tones of greys, whites, blacks and of faded images.

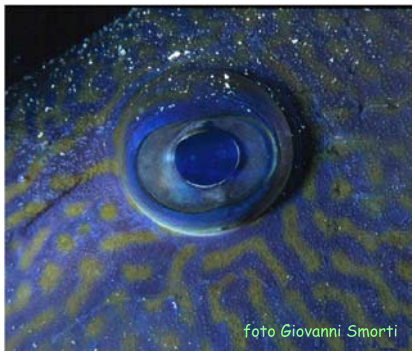
Naso tang (*Naso lituratus*)

Which devices have fish adopted to resolve the problem of seeing in a thick liquid such as water? You're right the question is another, how did other vertebrates' eyes adjust to air since life originated under water?

When we go underwater without goggles, the images we see are blurred, just think of what a life fish would lead if this happened to them, it would be terrible! When light enters a transparent medium the speed and direction changes according to: the refractive index; the mediums considered; (which in this case are air and water); to the angle of incidence between the light ray and the line perpendicular to the surface

Convict tang (*Acanthurus triostegus*)

separating the two mediums. (see also issue n. 2 of our magazine)
The refractive index of a medium depends on the speed of propagation of the light in air (1,00) and the speed of propagation of the medium considered. The refractive index of water (1,34) is higher than the refractive index of air.

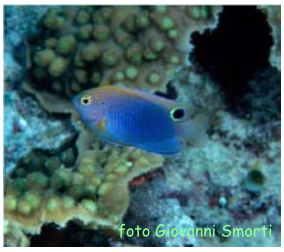


Blue-line surgeon fish (*Acanthurus bleekeri*)

The cornea in human beings' eyes is like an additional lens that helps us focus images, so what happens when we submerge our eyes underwater? Since our cornea has the same refractive index (more or less) as water, the light rays do not bend and therefore cannot focus properly and this is the reason why our vision is so blurred underwater.
In fish the cornea has a protective function therefore the optic strength is all in the crystalline lens, the latter has a high refractive index (1,65). Light and dark adaptation does not as in human beings occur thanks to the radius of the surface of the crystalline lens, but by movements: forward and backward with respect to the retina as in the lens of a camera.

Dusky grouper (*Epinephelus guaza*)

Some fish's eyes move and function separately; each eye is capable of seeing different images and each vision is registered by the opposite sides of the brain. These fish are able to look in two different directions contemporarily. Only when both the eyes look directly in front of the fish's head does the visual field superimpose giving an overall perspective. The perception of light and colour is present thanks to photoreceptors in the retina: cones and rods. The first are sensitive to light and colours, the latter are most sensitive to light and dark changes and are not useful for colour vision. Prevalence of one kind of receptor or another depends on the fish and their habitat; deep water fish and nocturnal fish have a higher number of receptors in their retina. Cones are of three types; photosensitive pigments, characterized by maximum intake of light and by different wave-lengths; blue, green and red. As is well known, colour in water tends to fade progressively, the first to be absorbed are the colours with the longest wave length, therefore reds, followed by greens and blues. The type of cone present in the retina depends on the depth in which the fish lives.
Two interesting curiosities.
Some fish from the Labridae family (damsels and wrasse) and butterfly fish present such a mimic coloration that it becomes difficult to distinguish their

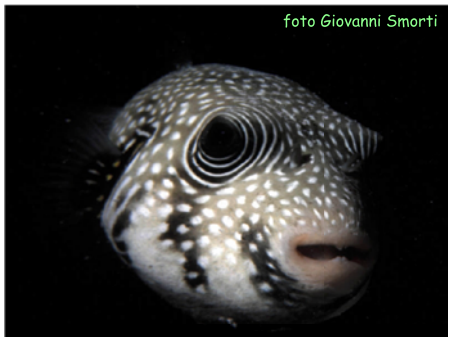


Ocellate damselfish
(*Pomacentrus vaiuli*)

Mediterranean rainbow wrasse
(*Coris julis*)

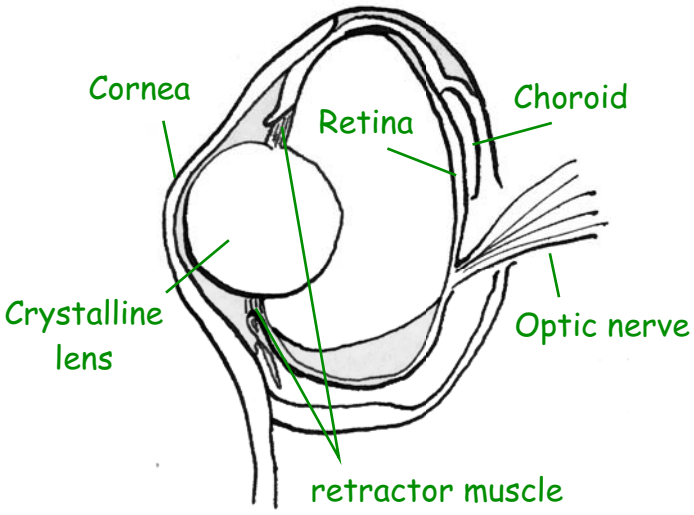
Crocodile flathead (*Cociella cocodrila*)

Oriental sweetlips
(*Plectorhincus chaetodontoides*)



White-spotted pupperfish
(*Arothron hispidus*)

eyes from the spots on the body and tail. Other fish, like the crocodile flathead have eyelids that remind you of fine lace-work. Fish, like human beings receive a lot of information through their eyes, perceive their world through this sense, although they use their other senses too.
Usually, when we look at fish out of their water it is not to observe them in heir natural world; we look into their enormous eyes for signs of freshness! To dive underwater with a mask and observe fish in their own habitat is a completely different story.



Eye structure of bony fish (teleost)

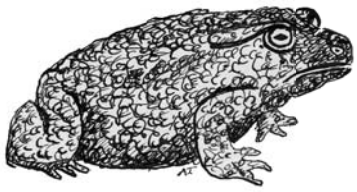
The question put by Federico, Haruki and Constanz was kindly answered by Giovanni Smorti, medical doctor, enthusiast of the underwater world; photographs by Giovanni Smorti; picture by Annette Tillmann.

perché, perché, perché? our readers' questions continued

Where do toads go when it's not raining?

Giorgio Cardi (aged 11, Formia)

Commonly called toad, the *Bufo bufo* is a nocturnal animal, during the daytime it digs holes in the ground where it hides, toads also make their hiding places under stones or in tree trunks. At night time the toad comes out of its hiding place to look for worms, butterflies and caterpillars. Toads can live in a variety of environmental conditions and, in scientific terms, we can say that toads have an high ecological valence. Amongst the amphibians toads have the longest span of activity; in a Mediterranean climate this can last from February to November. During the winter the toad stays in its hiding place and here the vital functions are reduced to minimum; therefore spending the coldest months and the period in which the temperature is hot and dry in the comfort of its hideout. After a rainy period followed by dry and hot weather toads tend to come out of their hiding places. It is during these damp evenings that our friendly toads come out in masses and are frequently seen around. From March to April, the reproductive period, toads start their journey toward ponds or water courses where they deposit their eggs. To get to the water they cross fields, hedges, and even busy roads where they risk getting run over by passing cars. In some areas where people have noticed an increase in this phenomenon, groups of volunteers actually go and help these little animals safely cross these busy roads, thus reducing by far the death rate. Apart from accidents the life span of a toad is about 35 years. Female toads lay thousands of eggs in water (in clumps called spawn), each egg is closed inside a ball of jelly that generally clings onto the aquatic plants. After about ten days the tadpole wiggles out of the jelly ball but stays inside the water where after the metamorphosis starts and lasts for a period of five months: first they lose their outside gills, then grow hind legs, develop lungs for breathing, their front legs grow and they lose their tails. At this stage they move away from the water into their winter hiding place. Toads have to be careful of rats, a variety of animals belonging to the musteline family such as weasels, badgers, otters, beech-martens, and last but not in the least, snakes. When in the tadpole form, their enemis are fish, birds and beetles. Unfortunately man has also become a dangerous enemy for these little animals because he is slowly destroying the habitats where they live. The only protection they have against their enemies is an irritating glandular secretion that they release when they sense danger, so if you happen to touch a toad always wash your hands well after.



Giorgio's question was kindly answered by Roberto Cozzolino;
picture by Annette Tillmann

The woodsman

FORESTS, WOODLAND AREAS AND FIRE

As soon as the hot weather begins it is not unusual to hear of fires that burn down whole areas of different vegetation communities (woods, garigues, grazing areas, cultivations). In our natural ecosystems the onset of fire is rarely a natural cause; fires are ignited by man and are usually fraudulent, causing severe damage. For a lot of us fire is seen as a harmful element, capable of destroying our surroundings, one of the worst catastrophes, if not the worst produced by mankind.

Constant repetitions of these disastrous events have made us forget the importance of fire; fire is one of the natural factors that has determined and determines the formation of different habitats.
Even since the Paleolithic era man has learnt to use fire for his survival, enabling him to conquer lands and move around inhospitable regions. Fire has always been the distinctive feature between animals and mankind, the latter being able to ignite a fire and use it appropriately. Man has always used fire, to adjust the surroundings to his needs, transform woods into grazing land or into cultivable areas.
The ashes derived from burning woodland areas were used, by our ancestors, as natural fertilizers for their cultivations; once the nutritive elements in the ground were consumed the populations moved on to other lands, creating a rotation in the vegetative system and a continuous change in the landscape.
Fire has always existed and has dominated vast regions of the earth in different geological eras, volcano eruptions and lightning have caused extensive fires in our latitude when certain climatic factors were favourable, i.e. prolonged high temperatures and absence of rainfall for a long period.
There are a variety of plants that either do not ignite easily or are not damaged completely by fire or simply the foliage and stems do not allow the fire to spread (meditteranean vegetation) thus impeding a forced evolution of the structure and diversification of the floristic composition.

It is appropriate to say therefore that man has changed the natural equilibrium by encouraging the number of fires and by intervening on the lands, changing their use according to his personal needs. On the other hand, the control of natural fires has also caused unbalance in the opposite direction;

The woodsman (continued)

regeneration and natural selection has been interrupted and consequently some species have been maintained instead of others causing a definite change in the vegetation.
Fires started to become a hazard for our woods when, after World War II, the country underwent social and economical changes. People abandoned the countryside especially when located on hilltops and mountainous areas, causing a drastic drop in the use of firewood therefore abandon of forestry practice and consequently an increase in dead trees, therefore inflammable material.

Development of industrialization, of tourism, mass mobility have all contributed to the onset of intentional fires. Today fires are not ignited in order to clear land for cultivation or for grazing, but simply because people are no longer used to living in contact with nature, because they are pyromaniacs or fraudulent. There is a need to identify strategies for the preservation of these woodland areas; their role is fundamental in nature for the protection of soil, of groundwater courses. Woodland areas are of vital importance for animals and vegetative biodiversity, these areas have a major role in the equilibrium of climate and in the immobilization of carbon dioxide in soil, not to speak of how our landscapes would change if we do not learn to protect and preserve our woodland areas.

Alessandro Ceppatelli is the woodsman; photograph from the CSE archive

Incredibile! But could it be true?

!!!Don't ever try this trick without an adult present!!!

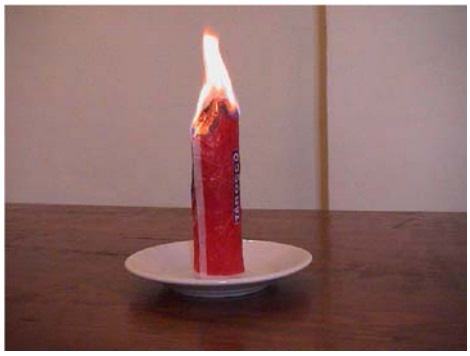
CHINESE DRAGONS

You will need a piece of tissue paper, orange wrappings are perfect. Roll the paper lengthwise into a tube shape. Stand the paper on a plate (always use china), carefully set fire to the top of the roll of paper. Once it has almost entirely burnt to charcoal the remaining piece of paper will shoot up into the air!

By burning the paper, the flame will have formed a column of hot air, which in comparison to the cold air present in the room is much lighter. The hot air will therefore go up forming a "vacuum" effect, forcing the paper into the air.

Already in the 5th Century b.c. the Chinese made beautiful paper dragons and sent them up into the sky by filling them with hot air.

In 1783 the Montgolfier brothers created a giant globe and filled it up with hot air by means of an enormous fire, when the strings holding it onto the ground were cut it went up as high as 1800 metres and travelled for about two kilometres. Thus the first demonstration of hot air balloons. (R.C.)



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