Impact of light pollution on aquatic organisms

Today, more than half of the world's population lives within 100 km of each other from coast to coast and half live near lakes or rivers. As a result, aquatic environments are exposed to artificial light from urban areas, leisure complexes, shops and industries [1],[2].

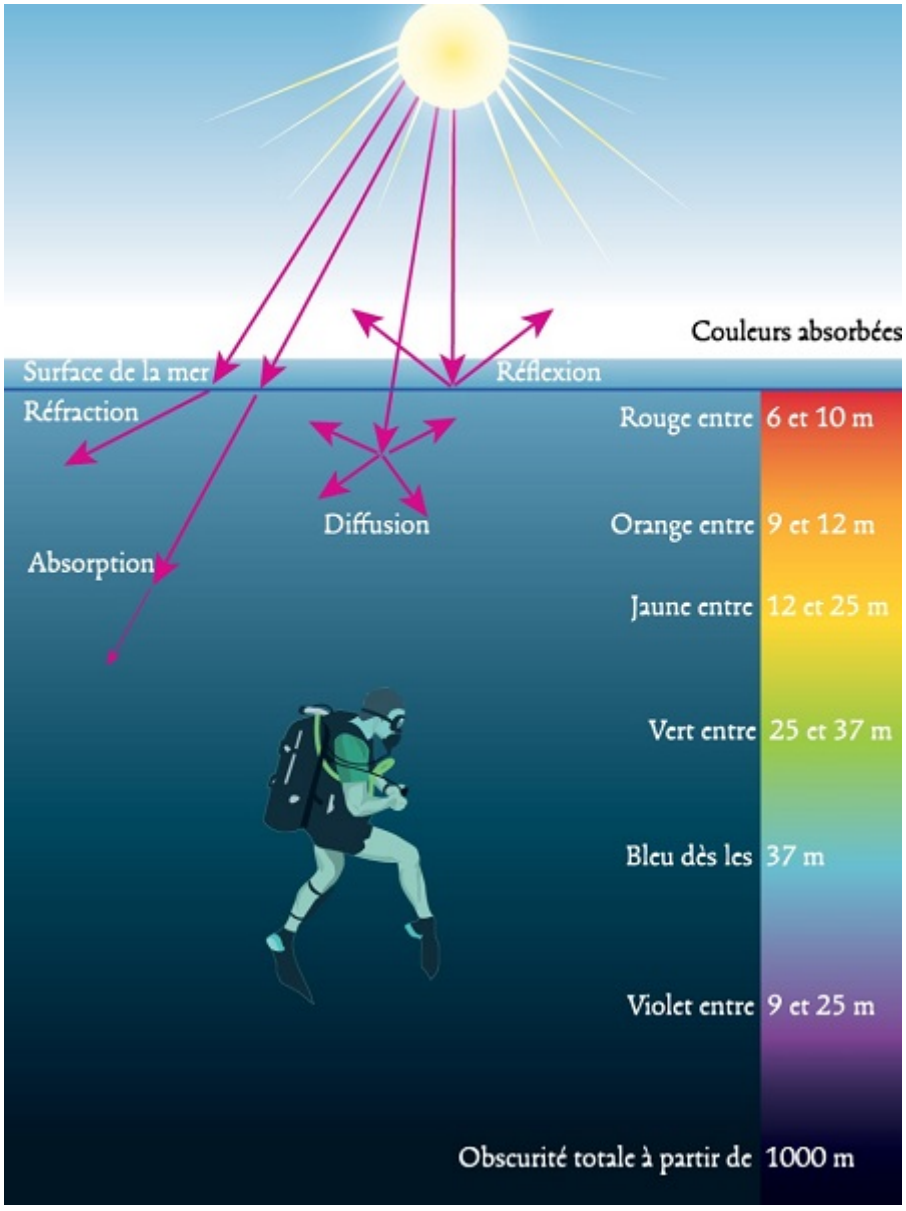

Figure 1. Natural light structures aquatic environments: as the depth of water increases, the intensity of light decreases and the spectral range of scattered light narrows. Water acts as a filtering agent that tends to select a single wavelength of the light spectrum (monochromator). Long wavelengths (red color) are the first to disappear. At a depth of 1000 metres, only a small spectral range centred on the blue remains, around 480 nm. [Source: Figure modified from Le Tallec, 2013 [see ref. 4]]

Natural light structures aquatic environments. As the water depth increases, the light intensity decreases and the spectral range decreases. Up to 1000 m deep, only the blue light is diffused. Above 1000 m depth, darkness reigns. The photosensitivity of aquatic organisms is therefore a function of habitat depth. Thus, the vision of surface fish is sensitive to red lights and that of fish living in deep water is sensitive to blue lights. At night, the only light that diffuses underwater comes from the stars, the moon and bioluminescent organisms. Light pollution therefore alters the intensities, colours and frequencies to which aquatic organisms are usually exposed [2],[3],[4] : (Figure 1).

In addition, the life of many aquatic species is linked to light intensity. In radiated fin fish, feeding, schooling and migration depend on specific light intensities. Changing these intensities can therefore change the behaviour of individuals. Zooplankton is also a striking example. Like many aquatic invertebrates, zooplankton move vertically in the water column during the day. This is the daily vertical migration. The plankton zoo avoids surface predators during the day and feeds on surface phytoplankton at night. However, in the presence of light pollution, the illumination of the environment remains important at night and during the day. Under these conditions, the number of zooplankton individuals to migrate and the amplitude of vertical migration decrease, leading to a proliferation of microalgae on the water surface. In the long term, these changes could have repercussions on the balance of aquatic ecosystems: changes in prey/predator relationships, impact on food chains and water quality [1],[2],[3].

References and notes

[1] Depledge M.H., Godard-Codding C.A.J. & Bowen R.E. (2010) *Light pollution in the sea*. Marine Pollution Bulletin 60, 1383-1385.

[2] Rich C. & Longcore T. (2006) *Ecological consequences of artificial night lighting*. Island Press.

[3] Perkin E.K., Hölker F., Richardson J.S., Sadler J.P., Wolter C.& Tockner K. (2011) *The influence of artificial light on stream and riparian ecosystems: questions, challenges, and perspectives*. Ecosphere 2, 1-16.

[4] Le Tallec T. (2013) *Lumière, vision et horloge biologique*. Espèces 9, 12-21. (in french)