MUSEOLOGIA SCIENTIFICA nuova serie • 14: 91-97 • 2020 ISSN 1123-265X
Museografia

Life in the Dark: a temporary exhibition at the Natural History Museum, London

Geoff A. Boxshall
Department of Life Sciences, Natural History Museum, Cromwell Road, London SW7 5BD, United Kingdom.

ABSTRACT
The recent "Life in the Dark" temporary exhibition at the Natural History Museum, London is briefly described. The central theme was to explore how animals that live in the dark are adapted to be able to find food, find a mate and keep safe from predation. This theme was illustrated by using a wide range of appropriate taxidermy and preserved specimens spread across three zones: nocturnal, cave and deep-sea. In keeping with the exploratory and experiential feel of the exhibition, visitors were encouraged to touch taxidermy specimens and feel models, listen to sounds, play interactive games, sniff smells, and watch videos and films. Installations used animations to take visitors into a forest at night and allowed visitors to experience the feeling of entering a cave full of fluttering bats. The deep-sea zone culminated in a light show that filled visitors with awe and delight while simultaneously showing how bioluminescence was involved in all kinds of behaviour patterns.

Key words:
temporary exhibition, Natural History Museum in London, dark adaptation.

RIASSUNTO
Life in the Dark: una mostra temporanea al Natural History Museum, Londra

Viene brevemente descritta la recente mostra temporanea "Life in the Dark" al Natural History Museum di Londra. Il tema centrale è stato la capacità di adattamento degli animali che vivono nell'oscurità, come sono in grado di trovare cibo, trovare il partner e proteggersi dalla predazione. Questo tema è stato illustrato utilizzando una vasta gamma di esemplari tassidermizzati in tre settori della mostra: la notte, la grotta e le acque profonde. In linea con l'atmosfera esplorativa ed esperienziale della mostra, i visitatori sono stati incoraggiati a toccare esemplari veri e modelli, ascoltare suoni, giocare a giochi interattivi, annusare odori e guardare video e film. Sono state utilizzate animazioni per condurre i visitatori in una foresta di notte o entrare in una grotta piena di pipistrelli svolazzanti. La zona dedicata alle acque profonde ha raggiunto il culmine in uno spettacolo di luci che ha riempito i visitatori di stupore e gioia, mostrando allo stesso tempo come la bioluminescenza sia coinvolta in tutti i tipi di modelli di comportamento.

Parole chiave:
mostra temporanea, Natural History Museum di Londra, adattamento al buio.

INTRODUCTION

As part of a rolling series of temporary exhibitions around a general theme of evolution and adaptation, the Natural History Museum in London opened "Life in the Dark" in mid July 2018. Like other exhibitions in this series it was scheduled to be open for nearly six months, and was due to close early in January 2019. It was aimed at family audiences but, unlike previous temporary exhibitions, it was decided that entry would be free for children, so only adults needed to purchase tickets and the original target was 100,000 adult admissions. Good reviews and strong admission figures resulted in the period of opening of the exhibition being extended for about six weeks, until after school half term holidays in February 2019. By the time the exhibition closed it had comfortably exceeded its target for adult admissions and, including children, it was estimated had been viewed by more than a quarter of a million people.

The high level objective of "Life in the Dark" was to demonstrate how animals are adapted to living in dark conditions. It was decided that the general feel of the exhibition should be experiential and exploratory, so interactive exhibits were prioritised to encourage participation from all age groups. The visitor journey was constructed to start with the familiar: the nocturnal world is inhabited by relatively well known animals that are active at night, but the journey moved into progressively stranger and less familiar settings, first into caves, then finally into the deep sea. These less familiar settings are inhabited by strange but superbly adapted animals. In all habitat settings, the central theme of the exhibition remained the same: all animals must do three things – they must find food, find a mate, and avoid being eaten. These are the imperatives of life and the question "How do animals meet these imperatives of life in the dark?" served as the central theme of the exhibition. So, there was considerable emphasis on the sensory and behavioural adaptations that enable animals to move around and find food, to locate a mate, and to avoid predators in habitats where vision is either less important or completely unnecessary.

A second visitor journey was defined by light. The intro took visitors from the well-lit public spaces in the museum into the shadowy nocturnal zone with its low light levels and night-time soundscape. Visitors then passed into the cave zone where they encountered animals adapted to life without light. Finally they emerged into the deep-sea zone, where light becomes important again even in the absence of sunlight, which only penetrates the top 1,000 metres of the water column even in the clearest oceanic water.

EXHIBITION DESIGNERS

The temporary exhibitions at the Natural History Museum usually use external 3-D designers selected by competitive tender. The 3-D design for the "Life in the Dark" exhibition was contracted out to Nissen Richards, a London based design studio that specialises in creating spaces that stimulate experiences. Their design for "Life in the Dark" won the Best Exhibition Design Award in the UK Design Week Awards for 2019. Nissen Richards commissioned Jason Bruges Studios to provide three special installations: the entrance zone or Intro, the transition from the nocturnal zone to the cave zone, and the final deep sea bioluminescence display.

The 2-D graphic work was produced by the small in-house NHM design team. Working together with Nissen Richards and Jason Bruges Studios, they were responsible the tone and feel: including designing wall coverings, selecting colour schemes and producing the graphics. The three zones of the exhibition each featured a different colour scheme and different graphics style.

EXHIBITION LAYOUT

Three zones were selected as the focus for the exhibition: nocturnal, caves and deep sea. However, early consideration of potential science content had included burrowing animals, and even internal parasites, but these were eliminated as marginal to the main themes of the exhibition. The visitor journey started with the Intro which featured a huge animation (a multi-layered projection artwork) back-projected onto one entire wall of the entrance gallery (fig. 1). This charming animation took visitors into a woodland habitat as night falls, featuring animated owls, foxes, badgers waking up and beginning their nocturnal activities. This installation was created by Jason Bruges Studio and can be viewed on-line (see website 1).

Nocturnal Zone

The nocturnal environment is not without light: on a clear night there is moonlight and starlight, and light pollution is a factor impacting many terrestrial habitats. The ambience in this zone was one of dim light and shadows while the emphasis in the displays was on the enhanced senses of nocturnal animals. The woodland feel included real tree-trunks providing

Fig. 1. A scene from the back-projected animation in the Intro.

structure in the gallery space (fig. 2), tree-themed wallpaper, and a lattice-work ceiling designed to throw shadows onto the floor of the gallery. The 2-D graphics enhanced the shadows theme. Major headings were created from cut out letters mounted perpendicular to the wall panel and lit from above to throw the heading as a shadow onto the wall (fig. 3).
The science content used as exemplars animals that are active at night and focused on how they were able to move about to find food, find mates and avoid predators at night. Adapted to low light levels, many nocturnal animals have much better vision than humans, although their vision is typically black and white rather than in colour. The specimens for exhibit were selected to demonstrate enlarged eyes, tapetal (mirror-like) layers in the eye, enlarged optic centres in the brain, and other important adaptations of the visual system. A lab-based video highlighted recent research suggesting the some frogs were able to "see" in colour at night. However, exhibits in the nocturnal zone were also selected to emphasise the importance of alternative senses, such as hearing, touch, and smell.
Sound is an important means of communicating at night and visitors could use headphones to listen to specific sounds against a nocturnal soundscape. Males of the kakapo (*Strigops habroptilus*), for example, excavate a bowl-shaped hollow in the ground and at night they make low-pitched booming noises to attract females. The shape of the bowl amplifies the sound of their mating call which can carry for up to a kilometre. Sets of headphones allowed visitors to experience a range of nocturnal sounds. Sound is also important for animals like the Aye-aye (*Daubentonia madagascariensis*), which was the star exhibit for the nocturnal zone. As well as having large eyes, it has large ears and sensitive hearing that allow it to detect the vibrations and motions of larvae and grubs hidden beneath tree bark.
The nocturnal zone featured interactive exhibits to encourage visitors to explore their senses other than vision: these included taxidermy specimens labelled with "Please touch" (fig. 4). All three of these specimens, a fox, a rabbit and a badger, proved very popular with children and survived for the duration of the exhibition with only minor repairs necessary. Duplicates prepared from sustainable sources were available but were not used.
A sense of smell is also vitally important for many nocturnal animals which use chemicals for communication or for detecting food. A wide selection of animals was displayed, including for example, the male sphinx moth (*Eumorpha anchemolus*) which produces a lemony-scented pheromone at night, which signals to the conspecific female that it is ready to mate. Another featured species was the kiwi (*Apteryx owenii*) which is an unusual bird in having its nostrils at the tip of its bill. It hunts for food at night, poking its bill into leaf litter to smell out the insects and worms it feeds on. The star-nosed mole (*Condylura cristata*) has a circular array of feelers covered in thousands of minute sensors which enable it to detect its prey in the soil. Visitors were able to smell a variety of chemicals linked to specific animals on display.
The flip-side of being active at night is the need to rest during the day. Birds such as nightjars are active at night and have superb camouflage for concealment during daylight. The exhibition included a video game testing the ability of visitors to see resting nightjars photographed against their natural background.
At the end of the nocturnal zone was an exhibit showing the diversity of bats using specimens from the museum collections. It stressed the diversity of feeding types and showed how facial morphology of the bat could be linked to its feeding behaviour. Moving forwards from the bat exhibit took the visitors into the cave zone via the second installation by Jason Bruges Studio. This installation served as the transition zone and was an enclosed, cave-like tunnel with bat-like shapes suspended from the ceiling, hanging below light tubes (fig. 5). The hanging bat-shapes were moved by a slight breeze (generated by a concealed, wall-mounted fan) and lights flashed along the light tubes creating flickering shadows on the wall of the tunnel. The installation was extremely atmospheric, so visitors would catch a glimpse of shadowy motions on the wall of tunnel out of the corner of their eye.

Fig. 2. The nocturnal zone featuring real tree trunks and ceiling creating shadows.

Fig. 3. Main headings in nocturnal zone were created by shadows.

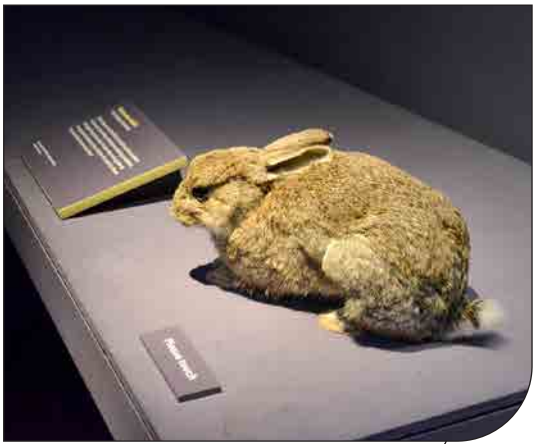

Fig. 4. Visitors were encouraged to touch specific taxidermy specimens.

Cave zone

Once in the zone, the exhibition stressed that deep caves are truly dark spaces and are inhabited by a variety of highly adapted species. Just inside the cave zone, the exhibition featured animals from the twilight zone in and around the cave entrance. A specimen of a Puerto Rican cave boa (*Chilabothrus inornatus*) was featured together with a video of the cave boa detecting a passing bat by its body heat and catching it on the wing. Adjacent to this was a thermal imaging camera pointing at the visitors, so they were able to see their own body heat map. Another key specimen here was an alcohol-preserved giant cave centipede (*Scolopendra gigantea*) together with video of it catching a bat on the wing. Witnessing an invertebrate capturing a mammal as prey challenged visitors to think differently. Moving further inside the cave zone, the theme switched more into an exploratory narrative. The cave zone had low ceiling to generate sense of confined space and low light. The exhibits were housed in caches in the walls, which had jagged edges, and the letters of the major text panel headings were excavated into the cave walls and back-lit (fig. 6). The colours also changed to browns and yellows. Penetrating deep into cave systems regularly leads down to flooded chambers and these cave lakes are home to numerous highly specialised invertebrates, including crustaceans, and even to fish. A cave diver in full kit including rebreather apparatus and equipment for isolating and collecting specimens was displayed (fig. 7) and his guide line extended out from the case, along the wall, and round a corner into a

Fig. 5. The bat cave installation in the transition zone between nocturnal and cave zones.

small enclosed cinema space. The film was a dramatic reminder of the excitement and the technical challenges of cave-diving, and the beauty of cave habitats and the animals that live there.

The live blind cave fish (*Astyanax mexicanus*) were a very popular exhibit. They were the only live specimens in the entire exhibition and silently demonstrated how they are able to swim around their habitat and find food without using vision. However, live animals bring specific requirements for feeding and maintenance. In line with museum policies, it was also necessary to obtain the fish from a sustainable source (they were bred in captivity), and provide a long-term home after the exhibition closed (in this case London Zoo agreed to accept the fish as a donation). In the total absence of light, eyes are superfluous, and blind cave fish have evolved independently in numerous large cave systems around the world. Their ability to locate their food using chemosensory cues and the presence of sensory hairs on the body surface that allow them to detect vibrations in the water column were used to reinforce the core narrative: using alternative senses in the dark to find food, find a mate, and avoid being eaten.

Deep caves are typically low energy (oligotrophic) environments and cave animals tend to be small. Given the total absence of light, they tend to be colourless or white, and usually lack eyes. This combination of small size and lack of pigment provides a serious challenge for exhibition – how best to display a small, blind, colourless shrimp to the public. To engage with tactile learners we included two models in the zone: a model of a remipede (a specialised class of crustaceans found only in flooded caves and first discovered in 1981) and one of a blind white crab (*Munidopsis polymorpha*) from the famous Jameos del Agua flooded lava tube in Lanzarote. Both could be touched (fig. 8). However, we did also display vials of small colourless shrimps including an undescribed new species of the amphipod *Rhipidogammarus* collected from caves under the Rock of Gibraltar. This helped to underline one of the secondary messages, that we still know very little about biodiversity in many habitats and that new species are continually being found.

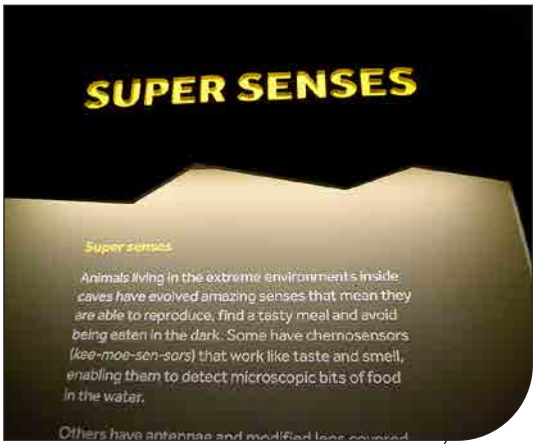

Fig. 6. Main headings in the cave zone were cut away and back lit.

The star specimen in the cave zone was the olm (*Proteus anguinus*). Olms are long, slender aquatic salamanders that inhabit caves in the Dinaric Alps in south-eastern Europe. They lack eyes but have evolved the ability to find prey by sensing its electrical field. Electrosensing allows the olm to navigate, to detect

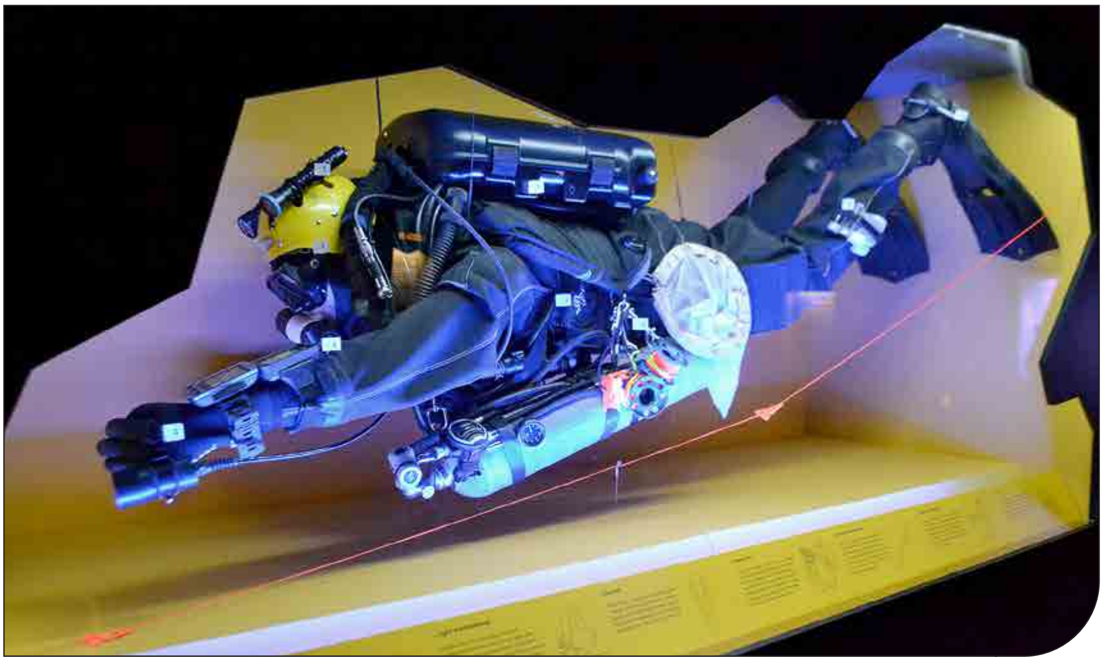

Fig. 7. A cave diver in full kit.

Fig. 8. A model remipede for visitors to touch.

aquatic snails and other prey, and even to detect other olms in the dark. An table-top interactive game allowed visitors to move their hand closer and closer to an olm until the motion triggered a response within the olm's within electrosensing field.

Deep sea zone

The deep sea is the largest habitable space on planet Earth. The average depth of the oceans is 3.7 km but no sunlight penetrates below the top 1 km, so everything living in this vast habitat must be able to survive in the dark. Even in these extreme conditions there is life, with animals scavenging for food and hunting prey at the seafloor and up in the open ocean.

One entire wall at the entrance to the deep-sea zone was covered with a graphic showing the depth profile of the ocean, with outline illustrations depicting the depths penetrated by SCUBA divers, by submarines, submersibles and bathyscaphes, as well as diving marine mammals. Seating in this area allowed the visitors to watch a film sourced with permission from the on-line feed of the ROV Nautilus operated by the Ocean Exploration Trust (see website 2). This film introduced visitors to a few of the strange inhabitants of the deep sea.

The exhibits in this zone continued the visitors' journey from the familiar to the strange by displaying specimens of some of the more unusual inhabitants of the deep sea, from giant 10-legged sea spiders (*Decalopoda autralis*) and sea cucumbers (*Oneirophanta mutabilis*) from the abyssal plain, to Pompeii worms (*Alvinella pompejana*) and blind vent shrimps (*Rimicaris kairei*) from hydrothermal vents. Here, as throughout the exhibition, the labelling stressed the role that alternative senses played in the biology of these animals. *Rimicaris*, for example, lacks eyes but has specialised pigment-containing organs on the back of its carapace that allow it to sense and avoid the areas where the hottest vent water is escaping.

The importance of smell in detecting food was highlighted by exhibits such as sixgill hagfish (*Eptatretus hexatrema*), which have sensitive tentacles around their mouths that can detect particles of food from great distances, enabling them to locate new food sources such as a whale carcass that has fallen to the seafloor. Chemical signals can also be important in mating behaviour. The oceans are a vast 3-dimensional space but locating a mate is one of life's imperatives. Female seadevils (*Melanocetus johnsonii*) release pheromones to attract a mate. When the male follows the chemical trail and finds the female he attaches permanently, obtaining all his nutrients from the female and providing sperm in return.

Unlike many cave creatures, most animals in the deep sea still have eyes, but if there's no sunlight down there then why do they need them? The finale of the deep-sea zone answered this question for visitors. In the deep sea an astonishing 90% of animals create their own light by bioluminescence and deep-sea animals can use this bioluminescent light to illuminate prey, to scare attacking predators, and to communicate with potential mates. In the deep ocean producing light is a key survival strategy and for the final gallery in the exhibition the visitors were taken into the beautiful world of bioluminescence.

The graphics in the deep sea zone were etched into Perspex and illuminated with blue light to enhance the visitor's awareness of light (fig. 9). A graphic wall display explained the mechanism of generating bioluminescence and the colour schemes changed again to blues.

The highlight of the whole of "Life in the Dark" was this final gallery housing the third installation by Jason Bruges Studio. Above the heads of the visitors was an array of 3,000 LEDs providing a light display mimicking various kinds of natural bioluminescence

Fig. 9. Main headings in the deep-sea zone were etched into Perspex and lit.

(fig. 10). Half of the LEDs were single points of light and represented the light organs (photophores) of individual organisms which might luminesce singly in response to nearby vibrations, but were also capable of flashing as a wave passing through a shoal of shrimps or krill. The other 1500 LEDs formed various shaped motifs that were inspired by specific organisms. The deep sea jellyfish *Atolla wyvillei*, for example, has photophores around its rim and they flash to produce a swirling circular pattern. Individual LEDs flashed only briefly but were computer-controlled to ensure that the overall installation was constantly varying while maintaining a random element. The majority of the LEDs matched the predominant blue wavelengths of natural bioluminescence, but there were occasional red lights representing fish such as the Stoplight loosejaw (*Malacosteus niger*), which can see red light and produce red bioluminescence from photophores on their heads. This installation used the whole height of the gallery but on the gallery floor were stand-alone display cases containing specimens and models of bioluminescent deep-sea species. Associated text explained how bioluminescence was used either to find food (or attract food in the case of anglerfish), to deter or confuse predators, and to communicate with potential mates. Models in this area included a delicate siphonophore and an *Atolla*, both of which had photophores that lit up. The only touch model here was a vampire squid (*Vampyroteuthis infernalis*) displayed adjacent to a preserved specimen.

The Outro

The Outro featured three new species that were recently discovered or as yet undescribed; a nocturnal insect from a back garden in London, a cave crustacean and a deep-sea worm. A science film showed the scientists working on these animals; taking photographs, making drawings down the microscope and taking tissue samples for DNA analysis. The aim was to show that we still have a lot to discover about biodiversity and a lot of new species to describe. Visitors were provided with pencil and blank cards and were encouraged to make their own drawings, a selection of which was posted on the wall of the Outro each week.

ACKNOWLEDGEMENTS

I would like to thank Natalie Latham for allowing me to use her photographs of the exhibition.

Websites (accessed 09.06.2020)

1) https://www.jasonbruges.com/design#/life-in-the-dark/

2) www.nautiluslive.org

Submitted: June 11th, 2020 - Accepted: June 20th, 2020
Published: December 11th, 2020

Fig. 10. Final gallery with bioluminescence installation.