

Bird and Bat Mortality Reduction Using High Intensity Ultraviolet Lights

Donald Ronning^a, Steve Pelletier^b, Trevor Peterson^b

^aLite Enterprises, Inc, Nashua, NH 03063, USA

^bStantec Consulting Services, Topsham, ME, 04086 USA

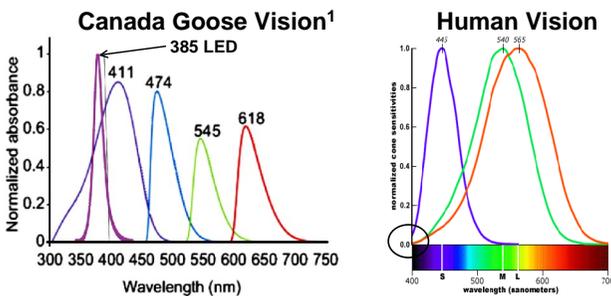
Introduction

Studies are currently underway to test the efficacy of a high brightness uv (ultraviolet) light deterrent system to reduce bird, bat, and other animal mortalities. The recently developed light system utilizes high brightness ultraviolet LEDs (light emitting diodes) that are 'eye safe' to humans. The technology could be potentially applied at wind facilities, airports, airplanes, antenna towers, and hazardous waste sites. Current investigations include field tests of various prototype designs to determine the efficiency as a deterrent system. The involuntary stimulus response from the bright light source is similar to when a person touches a hot surface or when a bright light is suddenly flashed into the eye. The effectiveness of UVLED of voluntary behavioral response can range from avoidance, attraction, or indifference which is dependent upon the animal species involved and the circumstance under which the illumination occurs. The study and analysis is ongoing.

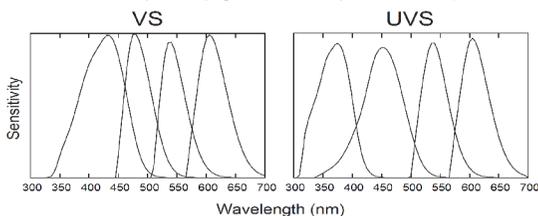
Objectives

Avoidance behavioral responses may be either voluntary or involuntary. The behavioral response to a source of bright light may also be quite different between species, conditions of illumination, intensity contrast to the apparent background intensity, and the suddenness of the illumination. A variety of bird and bat species are being studied to: 1) identify their ability to 'see' ultraviolet, 2) assess involuntary avoidance response, and 3) observe whether the voluntary behavioral response is one of avoidance, attraction, or indifference.

Methods



The Canada goose has four (4) color cones with peak photo pigment absorption (normalized data) at 411, 474, 545, and 618 nm (ultraviolet, blue, green, red). Humans color vision differs from the Canada goose. Human vision consists of three (3) cones with peak spectrum sensitivity at 445, 540, 565nm (blue, green, red). The UV-LED studied has a peak emission of 385 nm which is easily seen by the Canada goose. Humans ability to see the 385 nm UV-LED emission is limited to the 'tail' of the blue photo pigment absorption curve (black circle).

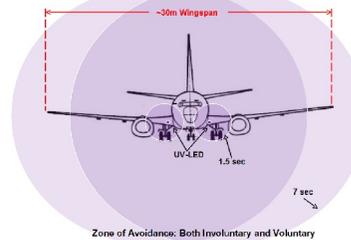


Most species (estimated at 80-90%) within the animal kingdom have four (4) color cones and are capable of sensing ultraviolet light while humans are considered to not possess the same capabilities². From genomic DNA and published molecular sequence data³, the passerine phylogeny (4-color cones) falls into two discrete classes (illustrated above): violet sensitive (VS) and ultraviolet sensitive (UVS) color vision.

Results

The high brightness UV-LED does not share the same risk of eye damage commonly found with lasers. The involuntary deterrence effect is dependent upon the spectral sensitivity of the animal to the UV-LED light.

'Hardened' Airspace Protection- Boeing 737



'Hardened' Airspace Protection - Wind Turbine



The high brightness UV-LED light source projects a cone of light which decreases in intensity as the distance increases. As a bird or bat enters a 'hardened airspace' created by a high brightness UV-LED light source(s), the animal will exhibit an involuntary deterrence response. As the intensity of illumination decreases, the response transitions to a voluntary avoidance of the light. The voluntary behavioral response is dependent upon the conditions of exposure to the ultraviolet light and the conditioned behavioral response of the animal.

The rotor sweep area and the 'down-wind' airspace of a wind turbine are illuminated with a cone of high intensity ultra violet light which creates a 'hardened airspace'. The utilization of high brightness UV-LED lights as a deterrent is applicable for a wide range of situations.

Conclusion

The high brightness LED emitting at 385nm was observed as a dark violet color by humans in dim light conditions. A 'hardened' airspace in birds and bats within which an involuntary deterrence response can be induced is potentially of great economic and social importance. Individual species voluntary response to ultraviolet light is influenced by the ocular vision system and the behavioral responses of the species. The effective range of a standardized UV-LED light source to induce the involuntary response is influenced by the brightness of the sun and surrounding light sources. The voluntary responses observed range from avoidance, nervousness, indifference, and even attraction which varies for each species.

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References

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