Spectral sensitivity in the harbor seal *Phoca vitulina*: Facts and open questions

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On their way back to an acquatic life style, the ancestors of marine mammals experienced an environment with a spectral composition shifted towards shorter wavelengths with increasing water depth and a much stronger light attenuation than air. In order to improve gain of visual information, the visual system of marine mammals should have adapted to the spectrum dominating their under-water environment. In fact, selective pressure caused a loss of functional SWS-cones in pinnipeds and cetaceans but in the latter group, it has been shown that the absorption maximum of the remaining MWS-cones is shifted towards shorter wavelengths. Such a blue shift of sensitivity is still questionable in pinnipeds. Molecular biological analyses revealed that the spectral tuning of the MWS-cones of the harbor seal is equivalent to that of most terrestrial carnivores with λ_{max} ranging from 550 to 552 nm. Contrary to this finding flicker-photometric ERG indicated that λ_{max} is shifted towards 510 nm.
We investigated spectral sensitivity in one harbor seal by means of color intensity adjustment. Experiments were conducted in air under an illumination of 9 lx. Stimulus pairs consisted of circular blue or green and grey discs of different intensity that were presented on a TFT monitor. The seal was trained to indicate the position of the brighter stimulus in a two alternative forced choice task. The observed point of equal brightness of the colored stimuli was compared to their point of equal brightness calculated from spectral sensitivity functions that were generated using the Govardovskii template.
Preliminary results confirm a blue shift of spectral sensitivity in the harbor seal, with λ_{max} at 510 nm. However, a detailed investigation on spectral tuning as a function of luminance is necessary in order to exclude that the observed blue shifts are resulting from mesopic rather than photopic vision.

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