DEMONSTRATING RETINAL CELL DENSITY TOPOGRAPHY

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Optometry WESTERN AUSTRALIA

SEEK WISDOM

Figure 1: Morphological features of *Sillago schomburgkii*. The diameter of the right eye. Measured with a 30cm ruler with 1mm minimum measurements

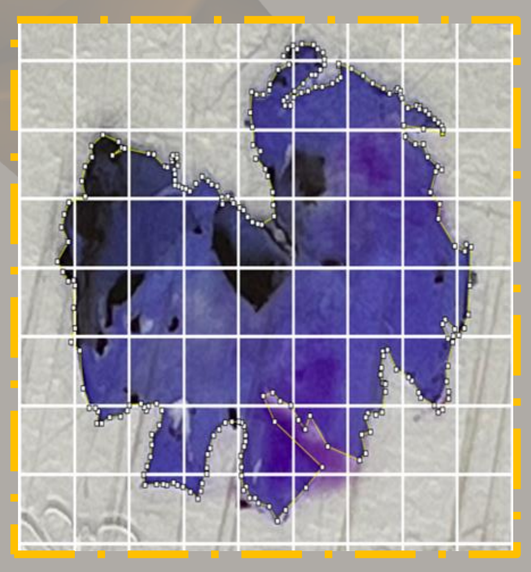

Figure 2: An image of the stained retina used for sampling with 7x7 grid. The black scale bar is 5mm, both photos are matching in size.

Figure 3: Photoreceptors in the retina of *Sillago schomburgkii* A) (Rods. Photos captured on a light microscope at 400x

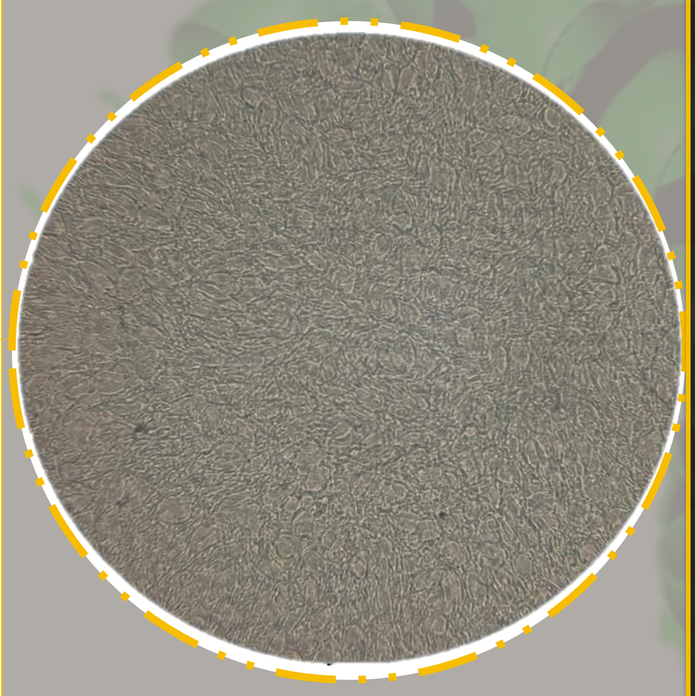

Figure 4: Photoreceptors in the retina of *Sillago schomburgkii* (Cones). Photos captured on a light microscope at 400x

Introduction

The eyes adapt to the habitat of their species and specialise to assist in evolutionary niches; and therefore, vary greatly between species even of the same genus; finding more similarity in species that fill similar niches or environments.

This poster highlights the findings of retinal ganglion cell density of the common yellowfin whiting of the Swan River. It highlights the construction of a topographical map of cell density from a dissected specimen.

Methods

Species Location: 3 specimens of *Sillago Schomburkgii* (Yellowfin Whiting) were collected from the Swan River, Western Australia.

Fishing: The fish were caught using a 10-12mm gauge mesh net. Fishing occurred in accordance with the guidelines and laws of the Government of Western Australia, Department of Fisheries.

Ethics: Before dissection the specimens received a lethal dose of 0.1% clover oil. The experiment and protocols were approved by the University of Western Australia animal ethics committee, number: RA/03/200/576.

Dividing Wholemount: The area of the retina was measured using Fiji A grid was taken dividing the retina by 0.75mm^2 boxes in a total 14x14 grid of 196 squares. (Fig 2.)

Counting Wholemounts: Each square was measured at 40x magnification randomly using a 1mm graticule for measurement and further divided into 0.01mm^2. The cell counter tool on Fiji was utilised for assistance in counting (Rueden et al., 2017).

Wholemount Calculations: The average of 3 randomly selected 0.01mm^2 were multiplied by 100 to give an estimated density of the sampling grid, which contained 100 squares in total

Wholemount Processing: The wholemount image was produced with RStudio. Sample data was imported into the program, to create a topographical heatmap of the distribution of ganglion cells within the retina. An important note that due to the significantly high density of a single sample square, the data was converted into a logarithm scale to better visualise the entire retina within RStudio (Cohn et al., 2015).

Results

Observations: As demonstrated on figure 5, a retinal topography map of the left eye from a specimen of *Sillago Schomburgkii* demonstrates an area of high visual acuity located medio-nasal, the high-density region continues medially with a second minor area centralis temporal to the centre, with no significant density observed outside the horizontal medial line.

Primary Area Centralis: This region contained the highest density measured 13333 cells in a 100mm^2 area, its surrounding region containing similarly high numbers, comparatively the second area centralis contained 9324 in 100mm^2.

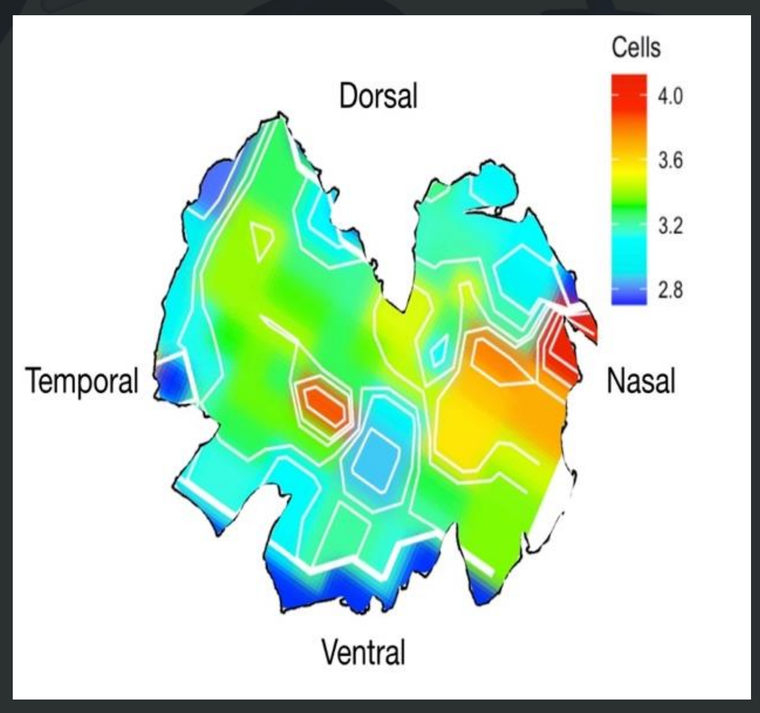

Figure 5: Retinal Topography Map of the Left Eye of *S. Schomburgkii*. Logarithmic Scale to highlight the rich and highly dense area centralis location nasally, with a secondary area centralis located temporally

The clown triggerfish is a shallow-water benthic carnivore like the yellowfin. It contains a dense area centralis in the medio-nasal portion of its retina, similar to the yellowfin. Its environment and niche is similar and justifies a connection in benthic shallow fish for the need of an area centralis; this is a likely an adaptation used for hunting which will be further discussed later. But, the triggerfish has a denser visual streak an adaptation that does not present within the yellowfin whiting. This difference can be explained by the fact that the clown triggerfish is a primarily territorial and solitary species. To avoid predators it hides within reef caves and likely uses its visual streak to scan the opening of its cave for danger (Collin & Pettigrew, 2008)

References

Adapted from ANIM3320 Comparative Neurobiology Retinal Density Assessment by Bordes M. (2024).

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