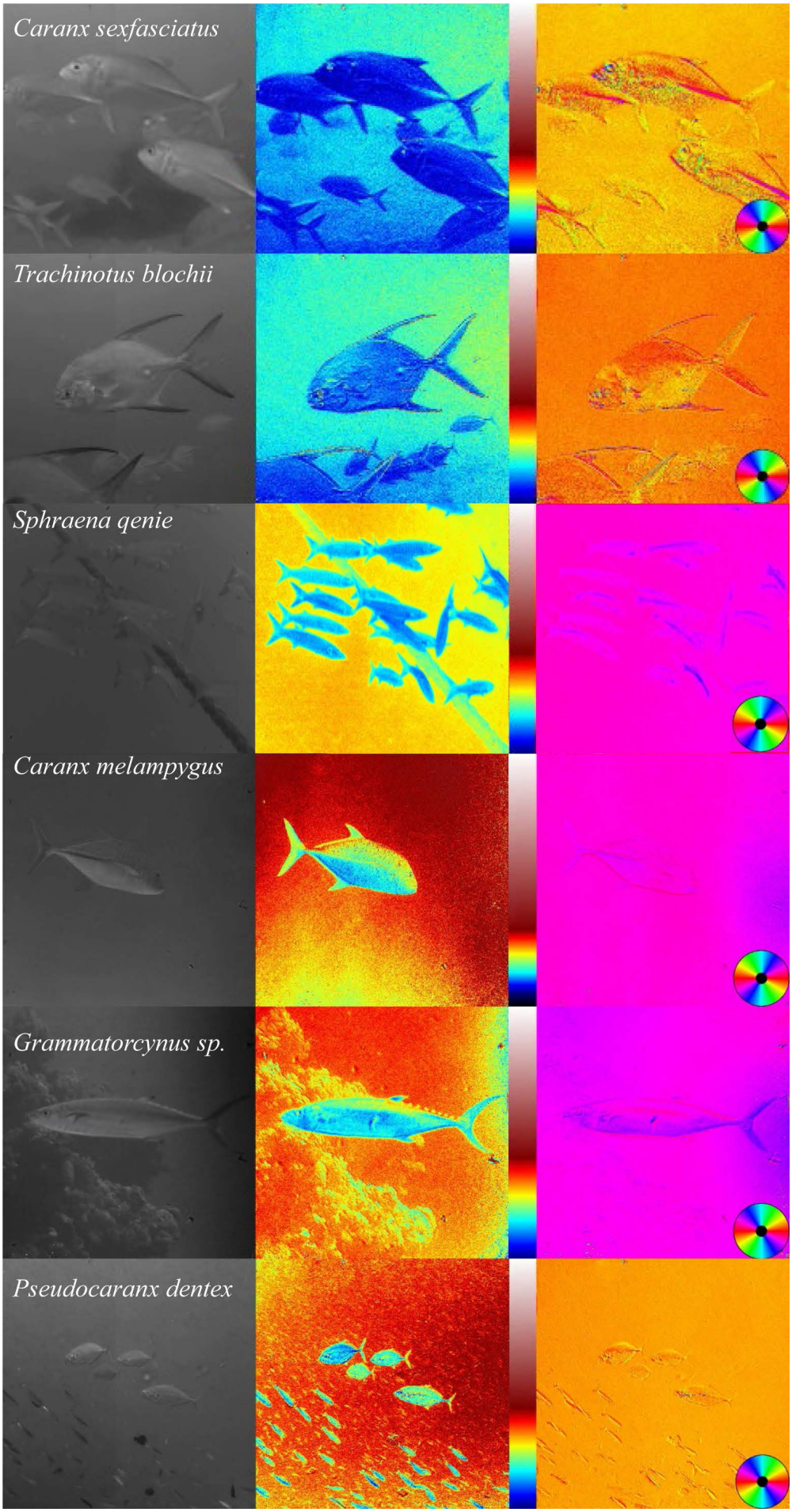
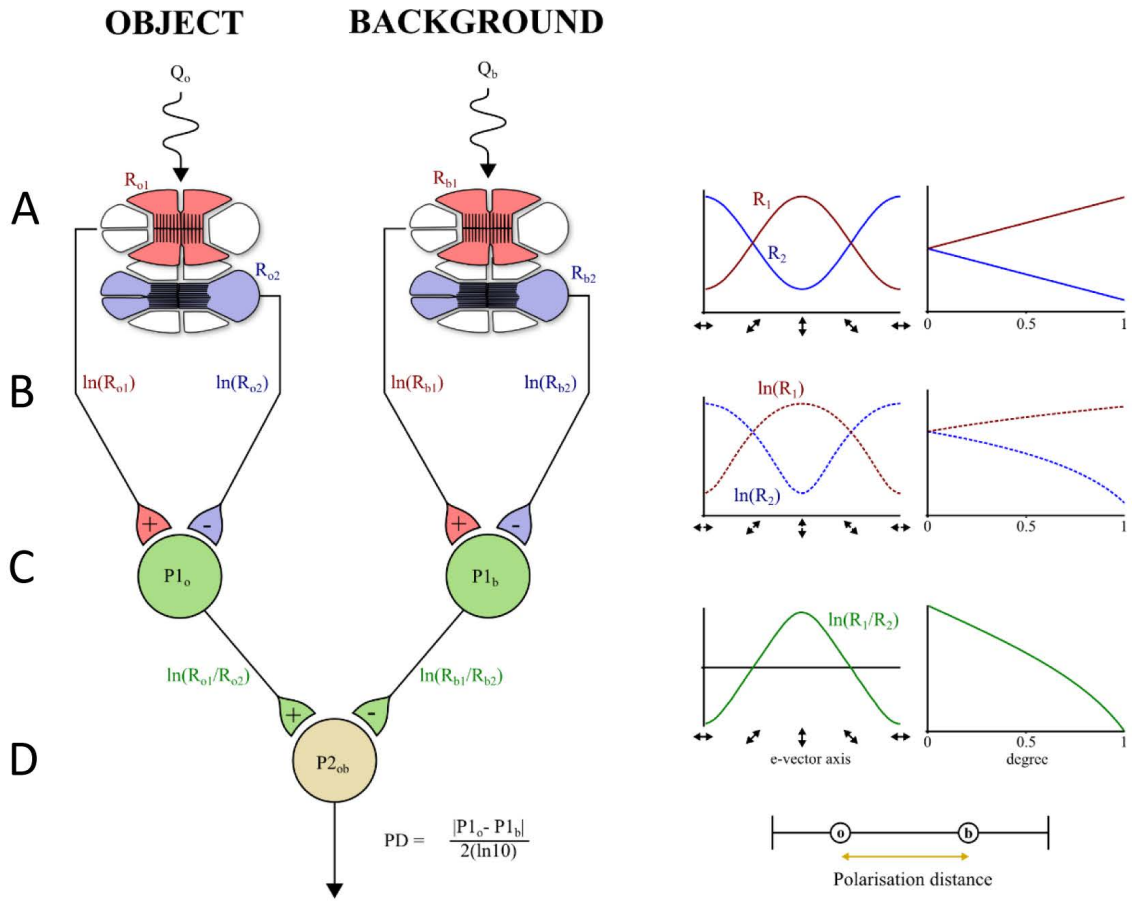
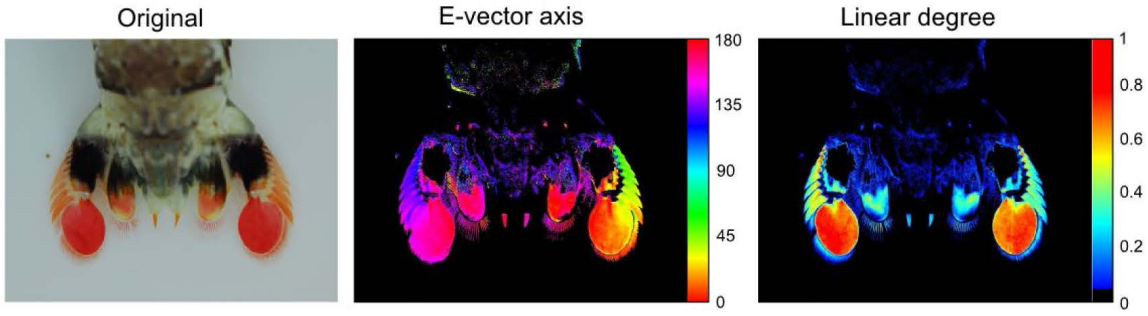


**Figure S1** – Polarisation camera images of 6 of the 11 silvery fish species examined by Johnsen et al., 2016 and in Fig. 8 main text (with images and degree(%) and angle scales explained in main text Fig. 1). Note that against a variety of background water % polarisations, the silvery fish skin never reflects polarisation (above very low levels of polarisation) while being more effective at matching intensity (Denton and Land, 1971; Jordan et al., 2012).




Polarimetry of stomatopod tail, similar to Figures throughout text.




Polarisation distance from above images using equation below

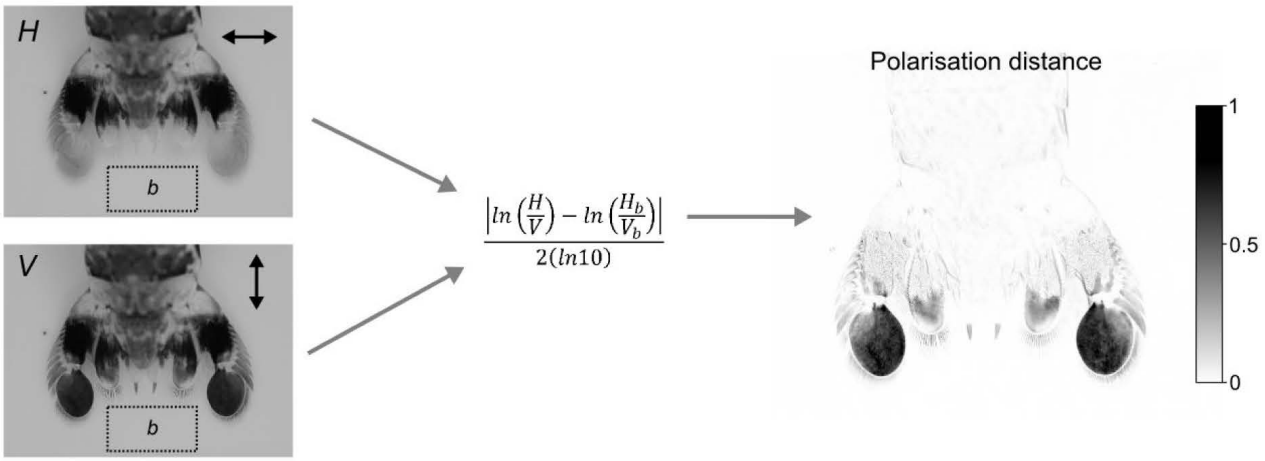


**Figure S2** - Details of hypothetical neuronal processing of polarisation in a 2D, H-V polarisation system and from this how polarisation distance, similar to colour distance, might be determined (modified from How and Marshall, 2014). Top – A schematic view of a two-channel crustacean-like polarisation vision system. (A) Polarised light from background and object detected by receptors in different eye regions. As often found in crustaceans or cephalopods and insects, each receptor contains two cell populations with orthogonally arranged angle sensitivity (Fig. 2 main text), V – red, H – blue. Receptor response modulation to changes in e-vector axis (0-180º) and normalised % polarisation or degree (0-1) are shown in graphs to the right. (B) Opponent interneurons pass inhibitory and excitatory signals on to secondary interneuron at (C), equivalent to the lamina ganglionaris neuropil in arthropods (e.g. Glantz, 1996). At this level, polarisation distance as defined by How and Marshall is calculated by next level P2 interneuron as a normalised measure of activity in the interneurons P1. Graphs on right show schematised activity at each level.

Bottom – Polarimetry of stomatopod (*Odontodactylus latirostris*) tail region – similar to that shown in Supplementary Video. Here still photographs through V and H linear polarising filters have been used to estimate e-vector axis and degree or % polarisation and are then used to calculate a polarisation distance image according to parameters defined in How and Marshall (2014). The discriminability of polarised objects is based on a just-noticeable-differences (JNDs) scale (similar to colour – Vorobyev and Osorio, 1998) and converted to a greyscale from 0-1.

One conclusion is that horizontal and vertical arrays are ideal for detecting differences in degree and not e-vector axis. One corollary of this prediction is that polarisation vision of small objects rarely needs to step beyond a two-channel (dichromatic equivalent), especially if background polarisation is predictable or if there are ways of optimising channel differences through eye or body movement (Daly et al., 2016). Even stomatopods appear to employ multiple two-channel systems rather than combining their full set of eight sensitivities over two wavelength ranges to analyse polarisation from every angle.


**Movie 1** – A female and a male (in burrow) mantis shrimp (*Odontodactylus havanensis*) display to each other with polarisation reflections from antennal scales and uropod region of tail. The flashing regions indicate areas of polarisation shown through a polarised switch-plate filter that alternates vertical and horizontal filter conditions at alternate video frames. As a result any area in the scene that polarised is seen flickering. The male appears either to court or to drive away the female; however, the information content of the signals in either direction is unknown. (Video by Alex Cheroske).