Topic Summary: Dynamic body pattern behaviour of squids
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ZOOL567

Other animals that can change their appearance generally take minutes to months, whereas squids can change the colour and pattern of their skin almost instantaneously (Mäthger & Hanlon, 2007). Through chromatic components of their skin such as chromatophores (pigment organs) and iridophores (light-reflecting cells) (Mäthger & Hanlon, 2007; Mäthger et al., 2009), squids can change into a wide variety of patterns depending on if the change is for communication or crypsis (Bartol et al., 2007; Mäthger et al., 2009; Liu & Chiao, 2017). This behaviour was observed through video recordings of body pattern changes in squids in laboratory (Hanlon et al., 1999; Staudinger et al., 2011; York & Bartol, 2016; Liu & Chiao, 2017) and natural conditions (Hanlon et al., 1999; Hanlon et al., 1990; Rosen et al., 2015).

While not studied directly, what was found through multiple studies on different species of squids was that the spatial and temporal control of the squids' patterning varies with their surrounding environment (Barbato et al., 2007; Mäthger & Hanlon, 2007; Mäthger et al., 2009; Rosen et al., 2015; York & Bartol, 2016). The optical appearance of the squid is correlated to habitat characteristics (Barbato et al., 2007) and how incoming light strikes their skin (Hanlon et al., 1990; Mäthger et al., 2009). Species that live in coral reefs, rock reefs, and kelp habitats show the most chromatic components thus, a combination of patterns (Barbato et al., 2007; York & Bartol, 2016) suggesting the need to match the colour and texture of these substrates to blend in with their environment effectively. In contrast, species that often travel to well-lit areas of the ocean have fewer chromatic components, relying on the timing of their colour change to mimic the sunlight hitting the body of water instead of mimicking benthic objects (Rosen et al., 2015). Additionally, colour matching becomes less important for species that live in depths with reduced sunlight and instead, these species reflect colours that are most prevalent in their environment (Mäthger & Hanlon, 2007).

Due to the lack of defensive structures such as spines and shells, soft-bodied squids are prey animals (Staudinger et al., 2011), and thus, body patterning evolved as a defensive mechanism against their predators (Barbato et al., 2007). Researchers interested in squid anti-predatory behaviours found through trials of predator-squid interactions that a banded patterning was displayed when encountered with a chase predator (Staudinger et al., 2011; York & Bartol, 2016). However, they did not rely on body patterning and instead fled when encountered with an ambush predator (Staudinger et al., 2011). What they found suggests that disruptive body pattern (such as banded) was commonly used for squids to conceal themselves as it served to break up the longitudinal outline of the squid, making them harder for predators to detect (Hanlon et al., 1999; Staudinger et al., 2011; York & Bartol, 2016) and to aid them in escaping (Hanlon et al., 1990). This demonstrates how external stimuli may affect the decision to use specific patterning as a defense or not; however, whether experience influences this decision-making process is unknown (Staudinger et al., 2011).

Patterns used for communication, primarily for reproductive purposes, differ from crypsis as the former is conspicuous (Rosen et al., 2015) and does not share similarities with other species (Hanlon et al., 1999). Through observing squids during their reproductive season, researchers correlated patterns to specific behaviours (Hanlon et al., 1999). They found that body patterning as sexual signals are species-specific (Hanlon et al., 1999), suggesting that body patterns' specificity for sexual selection prevents interbreeding of closely related species inhabiting the same area (Barbato et al., 2007).

It is known that squids change colour because of both the coordination of their movement and how they sense the environment (Liu & Chiao, 2017). However, how squids perceive colour to camouflage or communicate is not widely understood as it is thought that squids are colour blind (Hanlon et al., 1999; Mäthger & Hanlon, 2007; Mäthger et al., 2009). Therefore, the perception of colour in squids could be further explored to understand how squids can match colours in their environment and receive colour signals from other squids (Hanlon et al., 1999; Mäthger & Hanlon, 2007; Mäthger et al., 2009).

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