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**Introduction**

This activity is intended at describing the unique senses of non-human animal—the cuttlefish—based on the rational grounds of research-based literature. In the first section, it will be defined that why was cuttlefish selected as a matter of interest, what are its versatile biological and familial characteristics, what unparallel capabilities and senses make her distinctive of other animals and even humans. After deliberate analysis, three research articles will be selected, explaining the phenomenon they studied along with the hypothesis, methods and results. In a nutshell, this paper will provide the reader with the research based information about the capabilities and functional characteristics of cuttlefish.

**Selected animal—the cuttlefish**

**Brief introduction, why was it selected?**

Cuttlefish is a marine mollusk belonging to the order Sepiida and class Cephalopoda. Their striking anatomical characteristics include cuttlebone and internal shell. They prey on crabs, shrimps, mollusks and worms. For securing their prey, they are having W-Shaped pupils for better vision, eight arms with two tentacles having denticulate suckers. Their average size ranges from 10-50 centimeters whereas weight is 5-10kg. They are having one of the largest body-brain size ratios (Reid et. al., 2005). In the Greek-Roman world, this animal carries immense significance due to the reddish-brown pigment *Sepia* released by it while encountering attacker (Reid et. al., 2005). Most of the cuttlefishes are temperate and tropical marine shallow-water inhabitants. However, they are potent enough to move at about 600m depth. Their bio-geographic patterns are quite unique in a sense that they reside along the coasts of Western Europe, Mediterranean, East and South Asia, Australia and Africa but are entirely absent from the American coastal areas (Young et. al., 1998).

**Senses and capabilities**

1. **They use decoys as defense tools**

When encountered with predators, their chromatophores release a black or brown dense ink for deceiving and ensuring their survival against predators. These inks are also used as clothing dyes and as food in some European and Chinese cuisines. These inks are made up of ammonia (NH3)—a chemical nitrogenous substance (Derby et. al., 2007). In case, simple mirrors and smoke renders unsuccessful in getting the predator out of the hook, they prefer mixing their decoys/inks with the mucus for creating a little yet denser cloud-like texture around their bodies—similar is shape and size. These chemical defense tools serve as a way to distract and nervous the predator while cuttlefish finds time to scoot away (Zhang et. al., 2015).

1. **They have the ability to hypnotize their prey**

Cuttlefish are often described as “sea chameleons” due to their ability to alter their skin color—within the seconds. They change colors encapsulating polarization of light waves and shape of their skin for communicating alarming signals and stimulating other fellows to undergo same alterations. Their continuously altering and pulsating skin colors have imminent potential to create coercive hypnotizing field which interferes with the consciousness of prey—disabling them to move and making it easier for the cuttlefish to capture them (Chubb et. al., 2010).

1. **They have W-shaped Pupil:**

Cuttlefish is having W-shaped pupil in the daylight whereas it becomes circular in shape when there is insufficient light. The rationale behind its W-shaped pupil with brightness-dependent transitions is to balance upcoming light throughout the visual field for having improved vision even when there is no sufficient light. Vertically uneven light field is balanced by W-shaped pupil whereas entrance from the dorsal part of visual field is reduced by the constricted pupil. Additional amount of light is hence cut down and scattered, improving the dimmer parts of visual field (Lydia et. al., 2013).

1. **They have manual control over their buoyancy**

Their hydrostat-driven, dual-mode propulsive systems having paired fins and a pulsed jet is the key apparatus for self-controlled buoyancy and turning. Their angular velocity is powered by jet flows whereas asymmetric fins play reduced role in turning performance. Their wrapping arms put additional directional force for centralizing weight and facilitating turning through reducing pressure on the lateral body sides. In this manner, they exhibit manual control over their buoyancy (Jastrebsky, 2016).

1. **They are color blind**

Cuttlefishes find it hard to differentiate between green and other colors e.g., blue, grey, yellow and red. Their colorblindness was verified by Mathger and his colleagues (2006,) where cuttlefishes demonstrated non-disruptive movements when subjected to checkerboards with different color combinations. Despite being colorblind, they have the ability to view and process polarized light that allows them to adjust their vision of the surrounding objects and environment (Mathger et. al., 2009).

1. **Mimic the size and shape of object for hiding**

Cuttlefish are excellent at camouflaging—not only acquire color but also size and shape of the surface. For example, when passing through the grey-green rocks, their skin develops rough texture, size and shape parallel to the rock ground, making it hard for predators to capture them (Hough, Case & Boal, 2016). It is easier and simple mechanism for coral animals to camouflage the color but replicating texture and shape of the proximal seaweed or coral is quite laborious job—giving the cuttlefish an additional layer of Camouflage. Retraction and extension of tiny bumps around the cuttlefish body—the papillae—enables them to have quick and dramatic change in the skin size and texture. Estimation indicates that for the accurate determination of optimal position, cuttlefish respond instantly to the visual cues. This ability enables them to arrange their arms synchronizing with the hiding objects e.g., plants and rocks—which is something much more advanced that just matching texture and color with the ground.

1. **Females store multiple sperm packets and choose desired one to fertilize**

Cuttlefishes are innately programmed to select desirable genetic makeup for their off-springs, for that matter, they store multiple sperm packets within their mouth from multiple mating candidates. Males then use various tactics to get closer and shoot a jet water stream in their mouth to vanish the previously stored sperms. Once desired mating is accomplished, eggs are then laid, fertilized and stored in the balloon like wrappers for further development around the rocks (Hanlon, Ament & Gabr, 1999).

1. **Males cross-dress to enhance proximity with females**

Male cuttlefish utilize their changing color patterns for acquiring conductive mating conditions. This is because they are having competitive courtship scenario with respect to the number of males available for mating. Under these circumstances, they actively apply challenging gender-bending camouflage. One half of the body is disguised as female whereas other part is patterned to attract females; allowing them to mimic the muted female tones and not to captivate the attention from potential mating males. Instances in which colossal defensive males are surrounding female after mating, cuttlefish male not only completely disguises himself but also tends to hide his 4th tail (usually absent in females), moreover, they acquire such a position that demonstrates them “females carrying eggs.” This is the most effective mating strategy and almost half of the males render successful in getting the female for reproduction (Hanlon et. al., 2010).

1. **They have over 120 species with shorter life spans**

Cuttlefish have over 120 species ranging from bright colored flamboyant structure of 3 inches to super-colossal giant bodies grown up to 20 inches. Their average life-span ranges from 2-3 years (Reid et. al., 2005).

 **10. Cuttlefish babies have more enhanced mathematic skills than human babies**

A radical experimental study conducted by Yang and Chiao (2016) demonstrated that one month old cuttlefish babies have excellent counting skills than human babies of same age. One month old 57 hungry baby cuttlefishes were introduced with the two compartments with 1-2, 2-3, 3-4, 4-5 shrimps. Nearly all the babies selected the compartment with more shrimps even with minute difference. It was thought that they might figure the number of shrimps from the more densely populated compartment and not by counting them. Further series of experimentation were designed to test this hypothesis; in a small compartment five shrimps were placed so closely whereas in the other compartment 4 shrimps were placed in scattered manner leaving the impression as if more shrimps were present over there. Hungry cuttlefishes were left to choose the desired compartment; they waited for some moment, observed closely and selected the small box having greater number of shrimps. This experiment proved that cuttlefish babies can count up to 5.

 **11. They can see behind them**

Their impressive vision enables them to camouflage and interpret visual stimuli excellently. Their W-shaped pupil allows them to have full-fledge range to horizontal vision due to which they can completely see what is behind them. Similar to the rear and front camera of the smart phone, cuttlefishes are unique for switching their front and backward visual field instantly when required (Lydia et. al., 2013).

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