

The case for octopus sentience: a follow-up to Simone’s “Are octopuses sentient beings?”

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Abstract: Recently, a paper published in a Brazilian malacology online journal argued against the existence of sentience in octopuses based on disputable arguments – the presence of cannibalistic behavior, absence of sociality and parental care, short lives, size and complexity of the nervous system and intelligence. This response discusses a different perspective on the issue of octopus sentience, rebutting each of the arguments above.

Key-words: Cephalopoda, evolution, intelligence, subjective experience, valence.

1. Introduction

Today, non-human animal sentience is hardly an issue. There are fewer doubts about the consciousness of animals and more questions about what forms of consciousness exist in animals and if they are comparable on some biological level (Birch et al., 2020).

In a recent publication, Simone (2024) challenged the idea that octopuses are sentience based on the following key points: (1) their display of cannibalistic behavior; (2) their solitary nature; (3) the lack of parental care and their brief lifespan; (4) the dimensions and intricate structure of their nervous system; and (5) their perceived limitations in intelligence and predictive abilities compared to humans. Simone regarded these traits as crucial indicators of the absence of sentience in octopuses.

Here, based on Birch et al. (2021, p. 12)'s definition of sentience as "the capacity to have feelings. Feelings may include, for example, feelings of pain, distress, anxiety, boredom, hunger, thirst, pleasure, warmth, joy, comfort, and excitement", and to prevent the spread of unsupported claims regarding octopus sentience, we offer a brief commentary on each of the features highlighted by Simone (2024) as indicative, in his perspective, of the lack of sentience in octopuses.

2. Debating Simone's arguments

For Vallortigara (2021), definitions of consciousness are like toothbrushes since nobody wants to use someone else's. The same seems valid for definitions of sentience. Nevertheless, one common characteristic of sentient beings is noteworthy: the possibility of having subjective experiences and sensing both the external and internal world (Rowan et al., 2021; Browning & Birch, 2022; Mather, 2022a).

Initially, Simone (2024) separates what he thought were the truly sentient animals, i.e., humans, from the putative sentient animals. To do so, the author bases himself on different phenomena such as self-consciousness, abstract language, and memory – and octopuses, according to Simone (2024), don't have these phenomena. First of all, what defines self-consciousness, abstract language, and memory?

Self-consciousness second Birch et al. (2021), "is the conscious awareness of oneself as distinct from the world outside." In a way, a multitude of animals have this capacity, that is, to capture experiences (internal bodily events that are different from events that occur in the external world). Based on the definition of sentience by Birch et al. (2021), it is acceptable to consider any sentient species as having some level of self-consciousness; the same is not true if we consider the definition of self-consciousness that covers the ability to read the mental states of other individuals, a mechanism that is related to the theory of mind (Krupenye & Call, 2019).

Abstract language refers to language that conveys ideas that are not tangible or concrete (Zdravilova et al., 2018). Although abstract language plays an important role in the expression and understanding of communication, emotions, and thought in human beings, it is not a prerequisite for sentience (subjective experience) that exists independently of human language.

Memory is defined as the ability to remember past events relating to perception and experience of time. The case for memory as a crucial aspect of sentience stems from the idea that

sentience is related to "monitoring," which refers to the capability of self-monitoring and observing the external world (Mather, 2022b). Birch et al. (2021) also believe that different types of memory are one of the phenomena linked to sentience (one part of the temporality dimension). In this case, the argument that memory does not exist in octopuses is not real (e.g., Mather & Dickel, 2017; Hanlon, 2018; Schnell et al., 2021; Mather et al., 2022ab; Ponte et al., 2022).

Below we comment on the presumed sentience markers raised by Simone (2024) to deny the possibility of octopus sentience.

2.1 Octopuses are not sentient because they can exhibit cannibalistic behavior

Simone (2024) postulates that cannibalism is evidence that octopuses are not sentient, associating sentience with self-consciousness and the capacity for empathy.

Cannibalism is the term given to the behavior of consuming a member of the same species. This behavior occurs in numerous species and can provide a competitive advantage between different stages of life and be beneficial for survival in periods of food scarcity (Ibáñez & Keyl, 2010). In cephalopods, cannibalism is frequently reported (Hanlon & Forsythe, 2008; Hernández-Urcera et al., 2014; Ibáñez & Keyl, 2010). Nevertheless, if we use this argument to rule out sentience in animals, we would have to rule out sentience in fishes, amphibians, reptiles, birds, insects, and mammals because there is evidence of cannibalism for all these groups (Bose, 2022).

Empathy is a phenomenon that allows a living being to experientially share the feelings and emotional states of others, with a high impact on prosocial behavior (Adriaense et al., 2020). An organism's ability to feel positive or negative emotions has nothing to do with its ability to read these subjective states in other organisms. Hence, the absence of empathy as evidence for non-sentience does not hold up.

Whether an organism is sentient is a complex question beyond a single behavior, such as cannibalism.

2.2 Octopuses are not sentient because they are not social animals

Numerous animal species are not inherently social. Although sentient, some species may exhibit solitary behaviors or have limited social interactions. For example, solitary felines, e.g., *Felis*

silvestris (Bradshaw, 2017), and some species of sharks (Findlay et al., 2016) have essentially solitary lives.

Although social interaction can be significant for many sentient animals, the degree to which they need socialization varies depending on their evolutionary history, ecological niche, and individual needs. Nevertheless, animals do not need to be social to be able to feel and interpret the world through positive or negative emotions.

2.3 Octopuses are not sentient because they have no parental care and are short-lived

The argument reveals a 'vertebratocentric bias' (Andrade & Santos, 2021). Maximizing the number of offspring and not having parental care covers most animals – invertebrates, fish, amphibians, and reptiles. In other words, it is characteristic of most sentient animals (Cunha, 2022).

Yet, according to Simone (2024, p. 4), "Sentient beings are generally expected to have longer lifespans, allowing for the application of acquired knowledge and the investment of intellectual attributes gained by the individual and society." As already postulated by Mather (2006), there is a strong tendency to assume that only animals with long lives and parental care, i.e., social animals, have learning capacities and complex behaviors. There is none in octopuses, so their learning and aspects of sentience depend on the environment (Mather, 2022a). Figure 1 shows that the life stages of cephalopods and mammals are quite different. In octopuses, most of their life is in the pre-reproductive phase, and in mammals, it is in the reproductive phase.

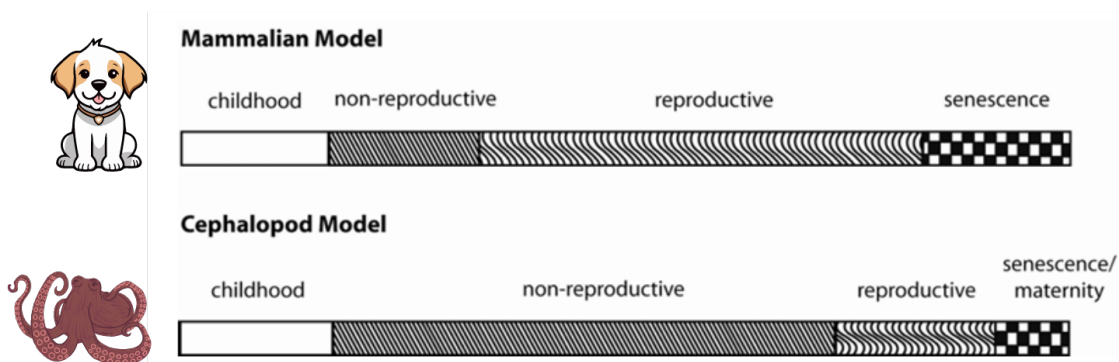


Figure 1. An illustration showing the division of life stages of a mammal and a coleoid cephalopod - octopus (Adapted from Mather, 2006).

Nevertheless, octopuses are still capable of perception, causal reasoning, short and long-term memory, future planning, and associative learning capabilities (Mather & Dickel, 2017; Hanlon, 2018; Schnell et al., 2021; Ponte et al., 2022). All these characteristics are also present in social and long-lived animals.

For Simone (2024, p. 3): “Octopuses, like all cephalopods, follow an r-strategy, characterized by high reproductive rates, where survival to reproductive age relies on sheer numbers rather than parental investment. Such behavior is not typically observed in sentient beings, as the inefficiency and loss of thousands of offspring do not align with sound reproductive strategies”. R-selected and K-selected strategies refer to reproductive strategy, not sentience since sentience is related to cognitive and emotional capacities. It is worth remembering that strategy K is present in a minority of animals. Still, the k and r strategist concepts are mostly outdated (Reznick et al., 2002).

2.4 Octopuses’ size and complexity of the nervous system

Octopuses have been considered candidate animals for sentience due to their neuroanatomical, neurochemical, neurophysiological, and behavioral characteristics (Low et al., 2012). Octopuses do not have a cortex or thalamus, although other nervous structures with similar functions exist (Ponte et al., 2022).

According to Carls-Diamante (2022), octopuses have 500 million neurons, 45-50 million of which are in their central nervous system, and the rest are distributed throughout the body; there is even a structure possibly analogous to the thalamus, which is the dorsal, basal and sub-vertical lobes. Previously, another proposal considered the inferior frontal lobe as another potential analog to the thalamus since it is a well-known chemotactic memory system and a motor sensory center that processes information coming from both the arms and the suckers (Shigeno et al., 2018).

According to Birch et al. (2021), there is evidence from the nervous system of octopuses that supports the idea that they are sentient beings. This evidence includes the presence of nociceptors and integrative brain regions that can process information from different senses. Octopuses also have neural pathways that connect the nociceptors to the integrative brain regions, and they exhibit a behavioral response to a noxious stimulus that is modulated by

chemical substances in their nervous system. Furthermore, octopuses are sensitive to anesthetics and analgesics and display self-protective behavior when injured.

Here, we argue about the significant attribution of sentience – the ability to feel discomfort and pain. In addition to self-protective behavior, negative emotional states such as physical or psychological pain have been discussed across a variety of taxa (Broom, 2001; Sneddon, 2019; Walters & Williams, 2019). Crook (2021) found evidence of tonic and emotional pain in pygmy octopuses of the species *Octopus bocki* Adam.

2.5 Octopuses' intelligence

Intelligence refers to the set of characteristics of an animal that enable it to acquire, process, and store information for decision-making (Mather & Dickel, 2017). Animal cognition studies have historically been criticized as biased towards mammals and birds (Kelly & Lea, 2023). Based on this bias, cognitive complexity, and intelligence were intrinsically related to social complexity in animals (Schnell et al., 2021). This social intelligence argument comes up against the possibility of intelligence among cephalopods. Actually, octopus' intelligence most likely obeys the "ecological intelligence hypothesis," which postulates that the environment acts as a selective funnel (Schnell et al., 2021).

According to Simone (2024, p. 4), "(...) Intelligence relies heavily on the definition used. Intelligence can be interpreted in multiple ways depending on the context, but generally, it pertains to the capacity to acquire and apply knowledge and skills effectively. This includes a diverse array of mental abilities such as reasoning, problem-solving, learning, understanding, perception, creativity, and adaptability to new situations". He then equates intelligence with the capacity of prediction, and continues "prediction (...) involves the capacity to foresee an event based on an individual's wisdom, accumulated knowledge, and ability to process the present context in order to anticipate future outcomes".

Mather & Andrade (2023) discuss evidence indicating that cephalopods can both remember the past and plan ahead. Thus, octopuses evaluate and act accordingly. An example is the Passing cloud, a dark band that travels across the animal's body. During octopuses' foraging, when encountering crabs, they often try to capture this prey with their web (webover). However, when the attack is unsuccessful, the octopuses usually display a passing cloud directed at their prey to scare the crab away.

Another example is that octopuses do not move from their dens to search for food in the same place they have been in the past. They go to a different location since they seem to remember where they have already hunted and caught prey. In addition, octopuses that forage in open areas with high risk use coconut shells, carrying them with their arms. These animals use coconut shells as shelter in potentially dangerous situations, suggesting risk assessment and decision-making based on past and future planning.

3. Conclusion

We conclude that Simone's (2024) arguments to rule out octopus sentience are not consistent with current scientific literature. In this sense, the community should continue researching octopuses' sentience better to understand the evolution of such a phenomenon across Metazoa.

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