

ANIMAL SENTIENCE

AN INTERDISCIPLINARY JOURNAL ON ANIMAL FEELING

Woodruff, Michael L (2022) [Sentience in decapods: Difficulties to surmount.](#)
Animal Sentience 32(11)

DOI: 10.51291/2377-7478.1725



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Sentience in decapods: Difficulties to surmount

Commentary on [Crump et al.](#) on *Decapod Sentience*

Michael L. Woodruff

Biomedical Sciences, East Tennessee State University

Abstract: In the target article Crump et al. present 8 criteria to assess whether decapods experience pain. Four of these -- sensory integration, motivational trade-offs, flexible self-protection, and associative learning -- could be used to assess sentience in general. In this commentary I discuss difficulties with using these criteria to provide evidence of sentience in decapods, particularly if this evidence is to change public opinion and policies. These difficulties are lack of evidence, the potential to eventually explain the neurobiological basis of the behaviors chosen as criteria, thereby eliminating any explanatory work for sentience, and the reluctance to bring animals that are not cuddly under our moral umbrella.

[Michael L. Woodruff](#) is Professor Emeritus of Biomedical Sciences in the Quillen College of Medicine at East Tennessee State University. His current research interests include cognitive neuroscience and the philosophy of mind. [Website](#)



1. Introduction. In the target article Crump et al. (2022) present criteria for sentience in decapod invertebrates revised from those proposed by Smith and Boyd (1991) for vertebrate animals used in biomedical research. This is an important addition to the work being done to provide policy-makers and the general public with scientific evidence that these animals warrant protections from suffering caused by commercial and sport activities. I applaud their efforts. In particular, in agreement with Tye's (2022) commentary on the target article, I applaud Crump et al.'s recognition that neuroanatomical homologies to structures in the human brain are not the gold standard for the presence of sentience. Behavioral markers should take precedence.

However, in this commentary I want to discuss difficulties with using these criteria, particularly if satisfying them is intended to change public opinion and policy. Some of these difficulties are recognized by Crump et al. and by other commentators on the target article (Brown, 2022; Gorman 2022; Souza Valente, 2022).

2. Lack of evidence. In his commentary on the target article, Brown (2022) notes that there is a lack of evidence for sentience in many decapod species. He rightly worries that there will be those who interpret this "as evidence of a lack of sentience, rather than just a current lack of evidence for sentience." I agree with Brown and suggest three correctable reasons for the lack of evidence.

First, unlike research on consciousness in humans and some monkeys (Dehaene, 2014; Koch, 2012), there have been no studies explicitly designed to assess sentience in decapods. Rather, the research Crump et al. cite was done to investigate various variables influencing behaviors which, depending on one's interpretation and acceptance of the proposed criteria, may, or

may not, be markers for sentience. Research designed to directly assess whether decapods are sentient is clearly needed, but this will require a stronger consensus than now exists as to what behaviors are markers of sentience. Lack of consensus concerning what behavioral and neurological phenomena are markers of consciousness has plagued neuroscientific studies in humans as well but through the Templeton Foundation's "Accelerating Research on Consciousness" project¹ consensus may be on its way. Ideally a similar project should be mounted to develop a consensus about markers of sentience in non-human animals.

Second, while I understand why Crump et al. chose to concentrate on the experience of pain, the title of their paper implies that their criteria can be applied as a test of sentience in general. As Souza Valente (2022) writes in her commentary: "The ability to feel is not limited to the ability to feel pain." I suggest that in future work their case would be strengthened by including a systematic review of the literature outside of avoidance studies. I think this is especially true for the evaluation of their Criterion 5.

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| <ol style="list-style-type: none">1. Nociception2. Sensory integration3. Integrated nociception4. Analgesia: (a) endogenous (b) exogenous5. Motivational trade-offs6. Flexible self-protection7. Associative Learning8. Analgesia preference: (a) self-administer (b) location (c) prioritised <p style="text-align: center;"><u>Crump et al.'s 8 criteria</u></p> |
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For example, Jens Herberholz and his colleagues have examined decision-making in crayfish (Herberholz & Marquart, 2012; Liden & Herberholz, 2008; Liden et al. 2010). They observed the response of foraging crayfish to the introduction of shadows that served as visual threats similar to those caused by a flying predator. Foraging crayfish, reacting to the approaching shadow, choose one of two anti-predator behaviors – freezing in position or tail-flipping. Freezing presumably reduces stimuli used by the predator to detect and identify the prey and may supplement crypsis (Caro 2014). By flipping their tails under their bodies crayfish rapidly propel themselves rear-first through the water. This is an effective way to escape the predator. By manipulating food odor concentration in an artificial stream and presenting shadows moving toward the animal, Liden et al. (2010) created the need for hungry crayfish to decide whether to stay near the food source or flee. They found that a 10-fold increase in food odor concentration changed the behavior of the crayfish to approaching shadows from tail-flips to freezing. In other words, when food value was high crayfish were less likely to move away from a food source in the presence of a prey signal. To me this is a compelling example of a decapod satisfying criterion 5.

Third, Crump et al. rely too heavily on associative learning in the form of shock avoidance to make their case. Sentience may not be needed to explain associative learning. Joseph LeDoux

¹ <https://www.templetonworldcharity.org/our-priorities/accelerating-research-consciousness>

has made this argument for years based on his extensive research on the neural basis of threat conditioning in rats (e.g. LeDoux 2014; LeDoux et al. 2017). The details of his arguments are beyond the scope of this commentary, but he concludes that: “From a neuroscientific perspective, behavioral learning can be accounted for in terms of cellular and molecular events occurring in functional circuits. These events strengthen connections between stimuli in Pavlovian conditioning, and between actions and outcomes in instrumental learning. *There is no need to introduce a fear construct.*” (Emphasis added, LeDoux et al. 2017.) That is, on this view, there is no need to invoke sentience to explain associative learning. I think LeDoux makes telling points which should be considered in further work by Crump et al.

3. If the neural circuits underlying behavioral markers of sentience become known, is sentience still needed as an explanans? In stating that “behavioral learning can be accounted for in terms of cellular and molecular events occurring in functional circuits” LeDoux is clearly leaning toward the eliminative position espoused by some philosophers (e.g. Churchland, P. M., 1981; Churchland, P. S., 1989; Dennett, 1991). On this metaphysical view, once all the entities and activities at multiple levels within the neural circuits controlling, for example, crayfish freezing and tail-flicking in response to threat become known, there will be no work left for sentience. It will, therefore, be eliminated from the explanation for the behavior. For example, because the entities governing behaviors such as nutrient seeking in bacteria have been elucidated, I have used this argument (Woodruff, 2016) to counter Reber’s (2016) claim that the behavior of bacteria indicates that they are sentient. Given that the crayfish nervous system is comparatively simple and much of the circuitry underlying the tail-flip has been worked out (e.g. Edwards et al., 1999; Paige et al. 2007) it is plausible that this knowledge is within reach. If this argument is valid, then the claim that sentience and consciousness exist only in the gaps in our understanding is plausible. This is a difficulty that Birch, Crump and their colleagues may need to confront.

4. The “cuddliness” criterion difficulty. Even if the difficulties presented above are overcome, there is one additional difficulty. Most of the contributors to *Animal Sentience* are educated as scientists or philosophers. As such, they develop and/or evaluate studies and experiments to assess empirical evidence for the presence or absence of sentience and may, at least implicitly, assume that rational, thoughtful evaluation of this evidence will compel public opinion to conclude that many non-human species are sentient. In his commentary Gorman (2022) articulates an important caveat about this assumption. He writes: “The reference to the public nature of this topic is a reminder that controversies over sentience do not take place only within a scientific context. They involve other stakeholders...” And these stakeholders are likely to use other than scientific evidence to decide which animals share our moral community and thus deserve protection.

I have argued (Woodruff, 2020) that whether we perceive an animal as having what some philosophers (Coeckelbergh & Gunkel, 2014) call “the face of the other” is an important determinant of whether we include that animal in our moral community. Assignment of the face of the other generates an empathic relationship. The neuropsychologist Karl Pribram noted an important subliminal factor in our assessment of this face. In an essay on consciousness Pribram (1976) wrote: “In short, I tend to view animals, especially furry animals, as conscious – not plants, not inanimate crystals, not computers. This might be termed the “cuddliness criterion for consciousness.” I think that Pribram speaks for many people. Lack of cuddliness is a barrier that must be overcome if sentient decapods are to

receive a moral status which leads to extending to them rights and protections approaching those accorded to mammals. To reduce this barrier a better understanding of how to counteract the cuddliness criterion is necessary and, as Gorman (2022) observes, “Social science can be helpful as a way to understand how and why decapod crustaceans are – as Crump et al. note – a controversial candidate.”

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