Crustacean & Cephalopod Sentience Briefing

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Summary

The common argument against the sentience of cephalopods (octopus, squid, cuttlefish etc.) and crustaceans (crabs, lobsters, crayfish, shrimps and prawns) is that they process information in ganglions rather than in the brain, as vertebrate animals do. However, different neurological architecture is not evidence of the absence of sentience: this takes too anthropocentric a view of the concept. What matters is whether these animals experience pain and pleasure in their own right, not the structures that give rise to such experiences.

Drawing on welfare biologist Donald Broom's well-known definition of the attributes of sentience, this report argues that there is sufficiently strong evidence to conclude that both cephalopods and crustaceans are sentient.

Sentience and why it matters

This report builds on the arguments made in Conservative Animal Welfare Foundation's fish sentience briefing. We define sentience as the capacity to be aware of feelings and sensations, as opposed to reacting to stimuli automatically.

Five attributes are widely acknowledged among the scientific community as indicating animal sentience[1].These are the capacity to:

- experience feelings (e.g. pain)
- evaluate the actions of others in relation to themself and third parties
- remember and learn from their actions
- assess risks and benefits
- have some degree of awareness

Our report highlights some of the most important scientific experiments and studies of cephalopods and crustaceans in demonstrating these five attributes. We show that there is sufficient evidence to suggest that cephalopods and crustaceans are sentient.

It is fair to say that we have less evidence that cephalopods and crustaceans are sentient than we do for fishes and other vertebrate species. However, it is important to remember that an absence of evidence is not equivalent to an absence of sentience – and moreover, that we simply do not yet have the same wealth of information about cephalopods and crustaceans as we do for vertebrate species, since these animals have been less studied by scientists.

[1] See Donald Broom, 2019. Sentience.

Despite growing consensus that these animals can suffer in a meaningful way[2], they are yet to be recognised as sentient under UK law. The stakes are high: the UK fishing fleet lands more than 420 million cephalopods and crustaceans each year[3]. This is a total of 73,600 tonnes of crustaceans (crabs, Nephrops, lobsters, shrimp and prawns) and 12,100 tonnes of cephalopods (squid and cuttlefish)[4].

With so many individuals at stake, even if we were not certain that these animals were sentient, it may be advisable to follow the precautionary principle[5] – but, as the evidence presented in this report shows, we must stop underestimating the capacities and sentience of these invertebrates purely because their neurological architecture differs from our own.

Experience feelings (e.g. pain)

Crustaceans

In Barr et al., (2008), after brushing an irritant substance onto one of the antennae of glass prawns, the animals not only displayed the reflex tail-flick response[6], but also showed prolonged grooming of the treated antenna and rubbing of that same antenna against the tank. Mechanical stimulation by pinching one of the antennae with forceps also caused prolonged rubbing of the area affected. This behavior was not seen if just seawater was applied to the animal's antennae. The authors of this study conclude that shrimps' reactions to the irritant substance and pinching are "prolonged complex responses" which indicate pain.

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[2] See for example the 55 leading experts and professional bodies plus 41 animal welfare organisations that have signed Crustacean Compassion's open letter supporting their position that decapod crustaceans should be protected in animal welfare law

[3] Dr. Maisie Tomlinson, Co-Director and Co-founder of Crustacean Compassion, writing for the British Veterinary Association's blog. Grasping the moment: recognising decapod crustacean sentience in 2021.

[4] Data taken from UK sea fisheries statistics 2019, pg. 57. "Landings into the UK and abroad by UK vessels"

[5] A principle which states that we should "err on the side of caution" when formulating animal welfare practices and legislation.

[6] Also known as the Caridoid escape reaction, this is an innate escape mechanism that allows crustaceans to escape noxious stimuli through rapid abdominal flexions that produce powerful swimming strokes—thrusting the crustacean backwards through the water and away from danger.

Cephalopods

Protective behavior[7] has been observed in Alupay et al., (2014). When a section of their arm was crushed with forceps, octopuses contracted the injured arm and held it close to their body. Some animals also used adjacent arms to curl around the injured site. This guarding behavior was provoked further by stimulation of the wounded arm. This behaviour is suggestive of pain, though more research is needed into nociception and pain as the number of studies found on this indicator was small.

Evaluate the actions of others in relation to themself and third parties

Crustaceans

The strongest example of this can be seen in the predator avoidance behaviour of hermit crabs. To understand this we must compare two sets of experiments.

First, Elwood and Appel (2009) wanted to know whether electric shocks would induce crabs to move out of their shells. In the experiment hermit crabs were induced into shells, some of which had wires attached to deliver small shocks to the crab's abdomen, and then offered new shells. The study found that the shocked crabs were more likely to move out of the 'shock' shell and into a new one. They also did this more quickly than the non-shocked crabs.

[7] Protective behavior is a type of non-reflexive reaction to injury in which an injured animal attempts to guard, groom, or otherwise tend to the injured body part.

In itself, this experiment does not prove that something more than a reflexive reaction to the shock motivates hermit crabs to leave their shells. However, a second series of experiments from Magee and Elwood (2016) suggests that something more complex is occurring. This second set of experiments examined hermit crabs' responses to electric shocks within their shells when they were exposed to predator odours. It found that crabs remain in their shells when the odor of a predator is present, suggesting that the behavior is not reflexive. Instead it seems that the crabs weigh the pain of the shock against the fear of a predator.

Source: Crustacean Compassion, 2021. DO CRABS AND LOBSTERS FEEL PAIN?

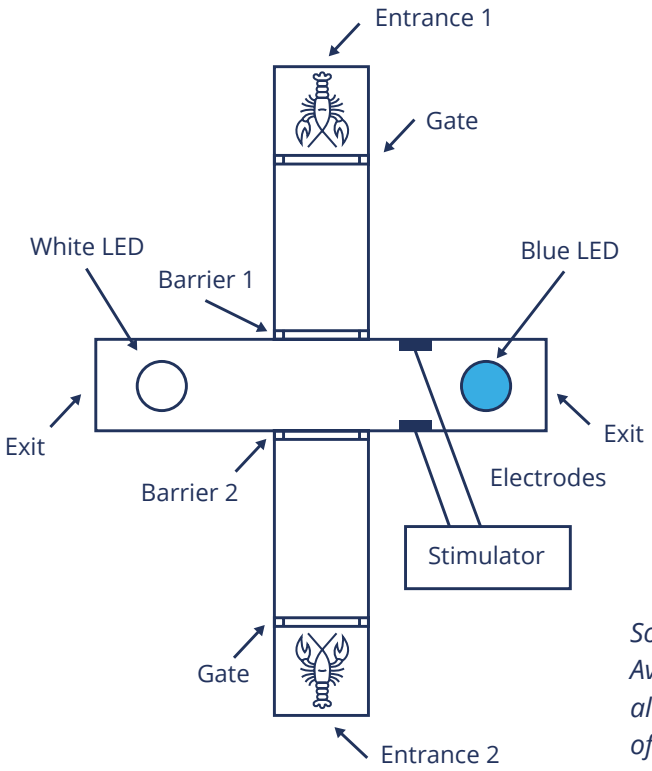
Cephalopods

Predator avoidance tradeoffs can also be found in cephalopods. Mather and O'Dor (1991) found that juvenile octopus minimise foraging time due to pressure from predators: "If predation risk is high, the octopus may maximize efficiency not by optimizing energy gain but by avoiding the risk of injury or death to ensure survival to reproduction."

Remember and learn from their actions

Crustaceans

Crayfish alter their behaviour over the long-term to avoid noxious stimuli. Okada et al,. (2021) placed crayfish in a plus maze that had a blue-lit and white-lit exit. Animals initially moved away from the white light and towards the blue light. In the next stage of the experiment, electric shocks were applied to the animals when they oriented to the blue-lit exit. In general, animals avoided the blue-lit exit in the memory tests. When training [applying electric shocks when they oriented to the blue-lit exit] was carried out three times, the long-term memory was retained for at least 48 hours, although a single bout of training was also enough to form a long-term memory.



Source: Okada et al,. (2021). Aversive operant conditioning alters the phototactic orientation of the marbled crayfish.

Cephalopods

We see a similar ability in cephalopods to alter their behaviour over the long term. For example, Ross, 1971 found that octopuses avoid attacking prey (hermit crabs) after being stung by sea anemones attached to the crabs' shells. The octopuses continued to avoid the hermit crabs 24 hours after being stung.

Assess risks and benefits

Crustaceans

Many animals, including crustaceans, are willing to pay a cost to avoid a noxious stimulus. For example, Elwood and Magee (2013) placed a group of shore crabs in a brightly lit tank with two shelters in which to hide. Shore crabs generally avoid well-lit areas, preferring to hide in dark environments such as those found under rocks. Given the choice between two chambers in this experiment, one brightly lit and the other dark, the crabs will universally choose the dark chamber.

However, if the dark chamber is rigged to deliver a mild shock, the crabs will begin to opt for the well-lit chamber that they normally avoid. The crabs do so in increasing numbers (and increasingly quickly) as the number of trials increases. A compelling explanation of this behavior is that the crabs feel pain, then learn to avoid the pain by choosing the opposite, otherwise undesirable chamber.

Source: Crustacean Compassion, 2021. DO CRABS AND LOBSTERS FEEL PAIN?

https://www.crustaceancompassion.org.uk/do-crustaceans-feel-pain

Cephalopods

In Ross 1971, as previously mentioned, octopuses avoid attacking prey (hermit crabs) if they have stinging sea anemones attached to their shells. In this example we see that the octopus weighs the risk of noxious stimuli against the potential benefit of feeding.

Have some degree of awareness

Many of the case studies already discussed take conscious awareness as a prerequisite.

For example, being able to make trade-offs between pain and predator avoidance, between pain and undesirable [bright] environments, and between pain and feeding, requires that the animals making those decisions are aware of the choices they have and can weigh costs and benefits.

Conclusion

Common arguments against crustacean and cephalopod sentience focus on distinctions between these animals' anatomy and human anatomy (such as that they process information outside of the brain, e.g. in ganglions). However, this anthropocentric view fails to capture what it means for an animal to be sentient. Crustaceans and cephalopods undoubtably experience the world in extremely different ways to ourselves. What matters, though, is whether that experience entails conscious experience of pleasure and pain. **We believe that the evidence is sufficient to show that these animals do experience pleasure and pain.**

Given the strength of the evidence and the vast numbers of animals involved, it is important that we move past the question of whether these animals can suffer and towards exploring how we can alleviate their suffering. Legal industry practices currently inflict unnecessary pain and suffering upon these animals (such as the live boiling of large crustaceans). Enshrining crustacean and cephalopod sentience into UK law would be an important first step towards improving the welfare of the more than 420 million crustaceans and cephalopods landed by the UK fishing fleet each year.

With this philosophy in mind, and the evidence outlined in this report (as well as similar reports from Crustacean Compassion and Sneddon et al,. 2014), we hope to see the UK solidify its position as a leader in animal welfare by recognising crustaceans and cephalopods as sentient. Such recognition is consistent with the protections afforded invertebrates in existing UK legislation[8], and with the protections already extended to them as individuals capable of suffering in many other countries[9].

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[8] E.g. The common octopus is included in the Animals (Scientific Procedures) Act 1986.

[9] For example, New Zealand recognises octopus, squid, crab, lobster, and crayfish as "capable of feeling pain" and the European Food Safety Authority has classified decapods and cephalopods as Category One animals "where the scientific evidence clearly indicates that…animals in those groups are able to experience pain and distress". For a full list of countries where crustaceans and cephalopods already receive protections please see OneKind Scotland's article "Are lobsters, crabs and octopuses sentient?".

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