WHY FISH WELFARE MATTERS:

THE EVIDENCE FOR FISH SENTIENCE

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WHAT IS SENTIENCE?

Sentience refers to having the awareness and cognitive (mental) ability necessary to have emotions[1]. This means sentient beings don't just detect, observe or react to the things around them, but they can also feel something in response. Emotional states make evolutionary sense: some (e.g. pleasure) incentivise and reward you for behaviours that benefit your survival and chances of reproduction, and others (e.g. fear) reinforce the negative experience of doing something harmful and make you more likely to remember and avoid that in the future[2]. It is therefore unsurprising that the capacity for 'feelings' has evolved in different animal groups.

WHY DOES SENTIENCE MATTER?

As sentient beings can feel positive and negative emotions, happiness and fear, and can experience pain, we have a duty of care for the welfare of those that we farm and keep in captive environments. One animal group that has historically been forgotten in discussions of animal sentience and suffering, is fish. But fish are used in enormous numbers by humans for food, experimentation and as pets. Globally, up to 3 trillion fish are caught from the wild and up to 160 billion are farmed for human consumption each year[3]. This is around 40 times more animals than all the farmed land animals combined (which is approximately 74 billion[4]). This is having a devastating impact on wild fish populations, the aquatic environment, and crucially – fish welfare.

HOW DO WE KNOW THAT FISH ARE SENTIENT ANIMALS?

There is a growing body of scientific evidence to show that fish are sentient[5-11]. However, the sentience of any other animal – whether that's a fish, a dog or even another human – is not something we can directly measure. Instead, we can observe how animals behave in the wild, and use research studies to test different aspects of behaviour, cognitive abilities and physiological responses[12]. This allows us to make robust conclusions about the inner thoughts and feelings of other animals, including fish. Understanding a fish's capacity for feeling pain and suffering is particularly important in relation to the way they are treated in fish farms and wild capture fisheries around the world.

EVIDENCE THAT FISH HAVE INNER THOUGHTS AND FEELINGS

Scientific studies have found evidence that fish have 'access consciousness'. This is **the ability to introspectively think** about a mental state, either current or associated with a past memory, and have thoughts about information[13]. Essentially, it means you can create a mental representation of something.

Frillfin gobies live in intertidal rock pools. When the tide goes out they become trapped in a pool which leaves them vulnerable to predators. But if needed they can escape danger by jumping from pool to pool, even though they are unable to see where they are jumping. They do this by memorising the layout of the pool – **creating a mental map** of the area – when the tide is high, so that if a predator comes, they know which direction, and how far to jump, in order to escape[14].

Siamese fighting fish are able to predict the winners and losers of fights based on prior information, such as dominance and fighting ability, and use this information to **make logical deductions** about others in the group[15], which is an impressive ability.

Fish also show examples of 'phenomenal consciousness', which refers to the experience of sensing what is around you, and the **emotions and feelings** generated by what you detect – this gives rise to a feeling that you know you exist[13]. In humans there are structures (the limbic system) in the brain that affect our emotional behaviour, and they work closely with the dopamine system. **Fish also have a dopamine system**, and researchers have identified a specialised area in the fish forebrain that seems to work much like our limbic system[13].

Fish also change the way they react to an aversive situation based on the context, which shows that **they are flexible and not just acting based on reflex.**

In one study, trout were exposed to mild electric shocks in a part of their tank, and soon learnt to avoid the area. But when researchers added more fish to the adjacent tank, they began to tolerate the mild shocks in order to socialise with the others, something which was clearly important to them[16].

Scientists have also found that fish may become pessimistic or optimistic, and the mood of some fish is affected by the presence or absence of their mate.

The mood of convict cichlids – monogamous fish which form strong pair bonds in the wild – is affected by the presence of their partner. Researchers found that females who could see their preferred male were optimistic when performing a task, and those who could only see a non-preferred male were pessimistic[17].

Other fish have passed behavioural tests designed to assess 'self-consciousness', which is an awareness of yourself as a separate entity from others and the world around you. This test involves animals first being presented with a mirror and allowed to see themselves. They are then marked (e.g. a red dot of paint to the head) and their behaviour is again observed. Animals that are deemed to pass the test usually change their behaviour – moving around the mirror to better see the mark, and trying to rub it away. Human babies fail this test until they reach around 18 months old. The cleaner wrasse[18] and the giant manta ray[19] have joined chimps, elephants, dolphins and others on the list of animals able to pass the test, which suggests they may be self-aware.

THE COMPLEX BEHAVIOURS AND COGNITION OF FISH

There are over 32,000 (and counting) known species of fish around the world[20]. The behaviours and abilities that allow fish to flourish in the many different aquatic habitats they live in are diverse and very impressive. In fact, fish are much more intelligent than most people give them credit for.

Fish behaviour is fascinating in itself but, more importantly, it gives us insights into the internal world of fish. Some examples are given here but these are just a drop in the ocean of studies documenting these abilities – many serve as further evidence that fish are indeed sentient animals.

LEARNING AND PROBLEM SOLVING

Fish can learn a wide variety of things; they can learn how to perform certain tasks, memorise journeys and where to locate food. They can remember information about other fish in the group, such as which fish perform better in fights, which fish are trustworthy, and which are poor co-operators[21]. They can also remember negative experiences and learn to avoid harmful objects that caused them pain and fear in the past[16, 22, 23]. The truth is very far from the 3-second memory that fish are often accused of having; many fish have impressive long-term memories lasting several years[11, 21].

In one learning test, cleaner wrasse were shown to outperform chimpanzees, orangutans and capuchin monkeys in a complex learning task[24]. This is not the outcome that many people expect, but it demonstrates that fish can excel when given suitable tests that work to their natural abilities. Some fish even have numerical skills[6] and some solve problems with innovative solutions. The tuskfish uses a rock as an anvil to open a cockle shell; this conforms to the definition of tool use[25].

SOCIAL LIVING

Shoals of fish may look like random collections to the human eye, but fish usually form relatively stable groups and become familiar with the individuals within that group[21]. Fish can learn from others in the group and social traditions can form this way, especially in long-lived species. Traditions are believed to be responsible for the migration routes of several species of fish, including cod[26].

COMMUNICATION AND COOPERATION

Fish communicate with each other using body language, releasing chemicals in the water, and some use sounds, electrical pulses or bioluminescence[11]. This allows for many social complexities such as courtship, social bonds, fighting, reconciliation, and cooperation[21]. Some fish cooperate when gathering information about predators, when foraging, digging pits, or when defending a territory or their young[27].

One well known example of cooperation between different fish species is of cleaner wrasse and their 'client' fish, to whom they offer a parasite and dead skin removal service. They can recognise each of their regular clients who present themselves to a cleaner's station on coral outcrops[28]. The client will swim away if the cleaner should accidentally bite them[28]. However the cleaner will entice the client back by quickly following them and giving them a back rub[28]. Cleaner fish have been found to prioritise waiting clients based on their residential status (local or transient) and their foraging tendencies (predator or non-predator)[29]. Some cleaners pair up to provide a better service[30].

Not only do fish communicate and cooperate with shoal mates and other species of fish but some even engage with non-fish species. For example, groupers have been seen hunting cooperatively with octopus[31]. Cooperation between different species is very rare in the animal kingdom.

FISH FEEL PAIN

Pain is an important survival mechanism. When animals experience pain – not just act on reflex – but detect, feel and remember pain, it helps them to learn about harmful things to avoid in their environment[32]. Fish are no exception.

FISH HAVE THE PHYSIOLOGY NEEDED FOR DETECTING PAIN

- Fish have the necessary receptors and nerve fibres to detect painful events; both A-delta fibres which transmit the first sharp pain and C fibres which transmit the slower, duller type of ache[33].
- Electrical signals are passed on to the brain for processing after painful stimuli triggers activity in the nervous system[13].
- Teleost fish have elaborate forebrains. The brains of fish are arranged in a similar structure to mammal brains, with the exception of the neocortex which developed in mammals[20]. Some people argue that the lack of a neocortex in fish means that they cannot be sentient. However, that is like arguing that fish cannot breathe because they don't have lungs. Brains of different animals have evolved to do similar things in slightly different ways, or using different structures[32, 13]. Another example of this is that vision is processed in the cortex in mammals, but in fish and reptiles vision is processed in the optic lobe, and yet all of these animals can achieve the same end goal – they can see[34].
- Typical physiological changes happen in response to pain, e.g. breathing rate increases, heart rate increases, stress hormones are released[13].
- Fish respond to pain relief, e.g. morphine. In fact, they have an opioid system that works in a similar way to the one found in mammals, and fish produce the same opioids (the body's innate painkillers) that mammals do[35].

FISH HAVE AN EMOTIONAL RESPONSE TO PAIN – THEY FEEL IT

Fish, and other animals, can respond to pain by unconscious recognition of the nervous system[13]. For example, if you put your hand on a hot pan you recoil away before you've even realised what has happened, and only a second or two later do you feel the painful sensation from the burn. However, there is also evidence that fish can experience pain – becoming aware of it mentally and emotionally, and responding to it in a similar manner to other vertebrates[5]. For example:

- Not only do fish try to escape from objects or environments that are causing pain, but they remember and try to avoid the same objects or environments in the future[16].
- Fish are distracted when in pain. Fish injected with bee venom or vinegar gave less attention to novel objects which they would otherwise be wary of and avoid[36]. But when also given morphine, they showed their normal avoidance behaviour towards the novel objects[36]. Interestingly, morphine only affects the experience of pain, but doesn't remove the source of pain itself, suggesting that the fish's behaviour reflects that their mental suffering from pain was eased by the pain killers[13].
- Pain affects the behaviours and decisions made by fish[37].
- Like us, fish often pay attention to the area of their body that's been injured. For example, trout and goldfish injected with venom in their lips were seen rubbing their mouths against the side of their tank and the gravel. Trout and carp injected with venom were also observed rocking back and forth near the bottom of the tank[36, 38]. Vigorous tail fin wafting was observed in zebrafish that were injected with acid near the tail fin, even though they were not swimming and activity was reduced[39].
- Some fish reduce or lose their appetite when in pain[40].
- Higher order mental processes are altered significantly by painful stimuli, e.g. their spatial awareness[13].
- When in pain, fish are willing to pay a cost to gain access to painkillers[41].
- Fish trade-off pain for other needs showing that their reactions to pain are not merely reflexes[42].

CONCLUSIONS

Fish are sentient. They feel pain subjectively and can suffer.

Victoria Braithwaite – one of the prominent academics studying fish pain concluded in her book on the subject: "there is as much evidence that fish feel pain and suffer as there is for birds and mammals – and more than there is for human neonates and preterm babies" (p.153)[13]. There is also strong evidence that fish feel emotions and have inner thoughts.

As fish are sentient animals, we must meet their welfare needs in captivity. This means ensuring that their physical and mental wellbeing is good and providing them with opportunities to perform their natural behaviours. Acceptance of fish sentience and better understanding of their welfare needs is long overdue. It's time to rethink fish.

Read more at: RETHINK.FISH

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Enquiries: Tel +44 (0)1483 521 953 (lines are open Monday to Friday, 9am to 5pm) • Email supporters@ciwf.org

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