

Becoming Conscious About Fish Conscience

In this age of aquaculture the question of fish welfare finds increasing limelight in both the public and political domains. New research attempts to determine what fish desire, whilst identifying expressions of fear and stress, but can we ever really experience the world from such an alien perspective? Asks Adam Anson, reporting for TheFishSite.



Fish welfare in human hands
Photo: Stockxchng

As wild fish stocks decline, the economic lure of farming new species has become increasingly attractive. But, as with all farmed animals, when new environments are imposed upon an individual, a question of welfare needs to be asked.

During the race of global aquaculture industries, fish welfare needs have been left behind. However, in the last decade the welfare of fish has become a high-priority issue on political grounds. In 1997, the Treaty of Amsterdam agreed that throughout the EU the concept of welfare is the same in fish as it is in mammals and birds and necessary protection should be applied. More recently, the OIE (World Organisation for Animal Health) announced its plan to harmonise standards throughout its 172 member countries.

Following a request from the European Commission the Animal Health and Welfare (AHAW) panel was asked to deliver a *Scientific Opinion* on welfare aspects of husbandry systems for farmed fish. The opinion tried to identify their capacity to experience pain, fear and distress, whilst taking into account expressions of sentience.

While for a long time it was believed that fish did not possess complex emotions, new research has highlighted dynamic social functions and environmental responses, whilst issues of fish stress and disease has been forced into the limelight due to the damaging repercussions they can have on the industry.

However, scientists are deeply divided on what level of emotional response and sentience fish are capable. Whilst similar measures of welfare developed for other animal are often relevant to fish, clearly defined protocols of fish welfare

evaluation are lacking. Similarly, the body of research into fish welfare also falls far short of that in livestock.

Research into this area has not just been hampered by a lack of investment, but also by the complexity of the issue and the difficulty in achieving scientific, relevant measurements. It has proven difficult to perceive how a fish might interpret the world around it due to the different biological functions and senses that they possess, while simply identifying individual changes and needs underwater poses practical difficulties.

A further complexity to the issue is added by the numerous different species of fish that are now used in farming - a figure that is continually growing. Research must identify all the varying degrees of behavioural patterns and social activities. Welfare standards must, in turn, take these natural drives into account, applying unique welfare standards for each different species. Some of these natural conditions will be impossible to recreate in a fish pen. For instance, the Atlantic salmon will never be able to make the monumental migrations, risking life in its desire to reproduce, whilst trapped inside the confines of a net.

It is easy to see how fish welfare is a complex and potentially very expensive issue for the industry, but the more that is understood, the more necessary the research seems.

Measuring Emotions

Welfare concepts

Terrestrial farm animal welfare concepts that would ensure positive physical, physiological and mental states are encompassed in what is known as the Five Freedoms, as proposed in 1979 by the Farm Animal Welfare Council (FAWC) in the UK:

- i) Freedom from Hunger and Thirst** - by ready access to fresh water and a diet to maintain full health and vigour;
- ii) Freedom from Discomfort** - by providing an appropriate environment including shelter and a comfortable resting area;
- iii) Freedom from Pain, Injury or Disease** - by prevention or rapid diagnosis and treatment;
- iv) Freedom to Express Normal Behaviour** - by providing sufficient space, proper facilities and company of the animal's own kind;
- v) Freedom from Fear and Distress** - by ensuring conditions and treatment which avoid mental suffering.

"As for all animals it is impossible to find one single measurement or welfare indicator that will cover all possible husbandry systems, farmed species and situations," says the AHAW Scientific Opinion. "A range of welfare indicators should be considered when welfare is being evaluated."

The report recommends that new research and developments in the area of

cognition and brain imaging techniques should be carried out in fish to further knowledge and understanding of pain perception, but many reactions that seem natural to us under stressful and dangerous situations can be clearly observed with the human eye. Some fish show fight or flight reactions when encountering threatening situations, whilst others freeze and sink to the bottom of ponds, or hide behind rocks to avoid danger.

Researchers can also analyse and compare the biochemical, physiological and behavioural response of fish from one environment to another - and in doing so can calculate how natural stress levels are. Fish in a natural habitat display complex swimming, feeding, anti-predator and reproductive behaviours that are often lacking in fish farms. Fish farmers themselves have witnessed how prolonged exposure to stressors can lead to maladaptive effects or chronic stress. Chronic stress responses that can indicate poor welfare conditions include reduction in immune function, disease resistance, growth and reproduction and even result in death. Fin condition and parasite load are clear and comparable indications that are often associated with poor welfare.

However, indicators of condition do not necessarily show whether a fish is undergoing real feelings of pain, but while some scientists say that fish lack a biological capacity to experience the world in the same way that we do, there is a growing body of evidence to suggest that biological responses are much more similar than previously believed. According to the AHAW Scientific Opinion, there is scientific evidence to support the assumption that some fish species have brain structures potentially capable of experiencing pain and fear.

Fear and Loathing in Fish Farms

According to the AHAW Scientific Opinion, the concept of pain in vertebrates revolves around the perceived noxiousness of certain stimuli, whilst nociception is the ability to detect these stimulus and generally respond to it by a reflex withdrawal away it. Tests have revealed that the reaction of lamprey (*Petromyzon marinus*) to heavy pressure, puncture, pinching or burning, was like that which would be recorded in a mammalian nociceptor when responding to a painful stimuli.

Some scientists argue that fish lack the neocortex, which plays a key role in the subjective experience of pain in humans, whereas others have suggested that it is possible that parts of the brain other than the neocortex have evolved the capacity of generating emotional states, including pain.

Another test involved giving goldfish an electric shock to show how agitated its swimming became. The threshold for this response was then shown to increase if morphine was injected into the fish.

A simple reflex response to a noxious stimulus can indicate nociceptive function,

however, adverse effects on an animal's normal behaviour beyond a simple reflex may indicate a psychological component that is indicative of suffering, and suggests that the animal may be perceiving pain. Reflex responses occur instantaneously, but some of the responses of fish may be prolonged to three to six hours, which may indicate a psychological component that is indicative of suffering. Another study on rainbow trout showed an enhanced respiration rate for approximately three hours after they were injected with acetic acid and bee venom. The research also noted that they did not feed within this period, and showed anomalous behaviours such as rubbing of the affected area on the aquarium substratum and glass and rocking from side to side on either pectoral fin.

Learned avoidance of a stimulus associated with a noxious experience has also been observed in fish species. Rainbow Trout learned to avoid electric shocks, while common carp, and pike learnt to avoid hooks in angling trials. Learned avoidance studies not only show that a consistent range of behaviours are produced in response to fearful stimuli in fish but they also provide evidence that the displayed behaviour is not merely a reflex response. According to the AHAW Scientific Opinion, many fish species also release chemical alarm substances when injured. "These are thought to act as warning signals, as conspecifics show a behavioural fright response to these chemicals."

In the context of welfare of farmed fish the physiological, biochemical and behavioural reactions of fish are considered to be part of the experience of pain, fear and distress - and whilst the extent to which feelings of pleasure exist in fish is unknown - the hormone oxytocin, associated with pleasure in humans and other mammals - occurs in fish. It could be argued that a level of awareness is a requisite to these emotions, but which emotional states they may experience is a mystery.

It seems that we may never truly know how complex the emotional life of a fish may be - but the same may be said of terrestrial animals and even the people whom we feel the closest to. Further research and consequent aquaculture practise may bring no benefit to consumer or even to the fish, yet there are areas where fish farmers could benefit from knowing how to keep their products healthy and free of disease and there are ethical obligations that should be fulfilled.

March 2009