Why worry about fish welfare?
There are indications that the public, particularly in the industrialised world, consider that fish are entitled to good welfare (12). As consumers begin to enquire about welfare in industrial fish farming, the production sector cannot ignore fish welfare; bad publicity may affect the sales of farmed fish (4).

Public concern may relate to the fact that many people believe we have a moral obligation to the animals we keep and control. Furthermore, science has brought insight into the complex lives of fish, their capacities for learning and social interactions. However, the most important factor is the growing evidence that fish are sentient and can feel pain.

Sentience and pain in fish
For several years, discussions have been taking place regarding fish consciousness and the possibility of fish feeling pain. Rose (14) argued that fish cannot feel pain since they lack a neocortex and when they display responses to noxious stimuli it is merely an unconscious reflex.

However, other scientists have shown significant evidence of nociception in fish and demonstrated discomfort when noxious substances have been administered (16, 18) and have formed the opinion that fish are sentient and are able to feel pain (6, 7).

Sentience is usually seen as a prerequisite when considering welfare. It refers to the ability of an animal to experience comfort and discomfort. It is thus a key issue when considering animal welfare (4).

Pain is defined as an aversive sensation and feelings associated with actual or potential tissue damage (3, 4). Pain is normally associated with poor welfare.

According to Broom (4), there is evidence that some species of fish, as well as cephalopods and decapods, have perceptual ability, pain and adrenal systems, emotional responses, long- and short-term memory, complex memory and the capacity for social learning.

Fish have the necessary areas within the brain (e.g. pons, medulla, thalamus) for nociceptive processing to occur (17). It has been argued that fish possess the same type of specialised receptors to detect noxious stimuli as do birds and mammals (1). Neuroanatomical and neurophysiological studies have shown that nociceptors able to detect noxious stimuli exist in fish (i.e. nociceptive neurons in the skin) (15, 16).

It has been shown that some fish species have two types of nociceptors, A-delta and C fibres present in peripheral nerves, indicating that pain may be modulated in fish (2, 4, 15, 16). It has also been shown that the transmitters substance P and enkephalin (opioid, \( \beta \)-endorphin), which act as endogenous analgesics in mammals, are also present in fish (4, 13). Ehrensing et al. (8) showed that the response to analgesics is the same in goldfish as in rats.

Welfare indicators
Welfare indicators in fish may be abiotic or biotic. Abiotic factors include a range of water quality parameters, such as oxygen content, pH, salinity, temperature, management procedures, the design of tanks and net cages, as well as handling and sorting practices. Biotic factors include fish density, feeding, genetics and health issues (diseases).
How to achieve good welfare conditions

In order to achieve good welfare conditions in fish farming, fish should be offered feed that is optimal in nutrient content, quantity and physical appearance for the species in question. The environmental conditions regarding farm design (tanks, cages), water quality (oxygen content, temperature, etc.) and stocking density should be appropriate to the species and life stage in question. It is also important to implement good management procedures in order to prevent injuries, prevent diseases (vaccination) and detect and report disease outbreaks quickly.

Legislation and guidelines

While animal welfare legislation was introduced in England as early as in 1822, it was not until the end of the 20th Century that the protection of fish was included (12).

In the ‘Holmenkollen guidelines’, it was suggested that principles ensuring health and welfare should govern the aquaculture industry (19). An important step forward was the OIE Strategic Plan 2001-2005 (21), that had as a key objective the development of international animal welfare standards including for aquatic animals (10, 11).

Fish welfare is increasingly being considered in national animal welfare legislation globally, as reported by Mejdell et. al. (12). The European Council has also called for welfare provisions in regard to fish farming.

OIE work in aquatic animal welfare

In aquaculture, human intervention may significantly affect farmed fish welfare and it is thus important for the OIE, as the leading international standard-setting organisation in the field of animal welfare, to develop guidelines for aquatic animals, as has already been done for terrestrial animals (10).

Welfare issues for aquatic animals have been discussed in the OIE Working Group on Animal Welfare (WGAW) since 2003. During this period, texts have been prepared, based upon the scientific work of ad hoc Groups convened for the purpose.

At the most recent meeting of the WGAW, in 2007, members were briefed on new versions of the documents ‘Introduction to OIE guidelines for the welfare of aquatic animals,’ ‘Guidelines for the transport of fish by boat’, ‘Guidelines for the land transport of fish’, ‘Guidelines on slaughter of farmed fish for human consumption’ and ‘Guidelines for the humane killing of fish for disease control purposes’, that had been updated to take into account the comments of OIE Members on previous draft texts. It was agreed that, for the moment, the guidelines should relate to farmed fish and not to invertebrates as there is well established scientific evidence that finfish can feel pain. The WGAW recommended some modifications to the draft texts and these were sent to the Aquatic Animal Health Standards Commission for further consideration.

Conclusion

Despite the considerable progress made to date, there is still relatively limited knowledge and research regarding sentience and pain in aquatic animals and the welfare needs of aquatic animals (20, 12). It is thus important for the OIE to continue its work in the field of aquatic animal welfare in order to establish an appropriate framework for protection of these animals, as has already been done for terrestrial animals.

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