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Fish Welfare Initiative



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Defining 'Welfare' for Fish

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Introduction

Fish Welfare Initiative works to positively influence the welfare of farmed fish. This is not only for the resulting social and environmental benefits,¹ but also because we believe that fish deserve better treatment than they are currently given. Specifically, we believe that fish welfare is currently unsatisfactory in many aquaculture facilities. To properly understand what it means to bring positive welfare to fish, we must first understand what we refer to when we say “welfare.”

This report considers the working definition of welfare that Fish Welfare Initiative uses in its operations. Our definition rests on numerous insights throughout the history of defining welfare in animals. Therefore, we will also review relevant theories given by others, noting the aspects we considered for our definition.

Types of Definitions

The definition of animal welfare is complex and often disputed. There is no single framework that is commonly agreed-upon. Instead, most definitions fall into one of three broad categories:²

- (1) **Feeling-based definitions**, in which welfare links to the emotional (or emotion-like) states of the animal under review. Good welfare under these definitions typically requires a reduction in negative experiences (such as stress or fear) and an assurance of positive experiences (such as the presence of counterparts for members of social species)
- (2) **Function-based definitions** focus on an animal's ability to adapt to its current environment, in which good welfare requires the animal to be in good health.³

¹ For more information on the social and environmental benefits of fish welfare, see our [Why Fish Welfare? webpage](#)

² FSBI (2002). [Fish Welfare. Briefing Paper 2, Fisheries Society of the British Isles.](#)

³ Here 'good health' refer to the animal's biological and physiological systems functioning appropriately and not being forced to respond beyond their capacity

- (3) **Nature-based definitions**, in which each animal is seen as having an inherent biological nature that it must express. Good welfare requires that the animal can lead a natural life and express its natural behavior.

Although each approach takes a different viewpoint, they often overlap. For example, overcrowding can induce stress, create health problems, and restrict natural behavior.⁴ Some argue that all of these definitions should be taken as an important aspect of welfare.

These definitions, however, are broad, making them difficult to translate into farm management practice. Fish farming is a difficult and complicated process, where:

- The absence of negative factors, such as diseases or injuries, cannot be guaranteed.
- It often isn't possible to provide fish with entirely natural environments or the freedom to express all their normal behaviors (for example, fish species cannot migrate in captivity, which could stifle "an intrinsic drive to move to new areas").⁵
- It isn't possible to track fish emotive states and target welfare issues as accurately on farms as in laboratory conditions.⁶

Although these issues do not mean that the definitions of welfare above are technically incorrect, they do make them impractical, highlighting the need for actionable guidelines that can be legislated.

The "Five Freedoms" Approach

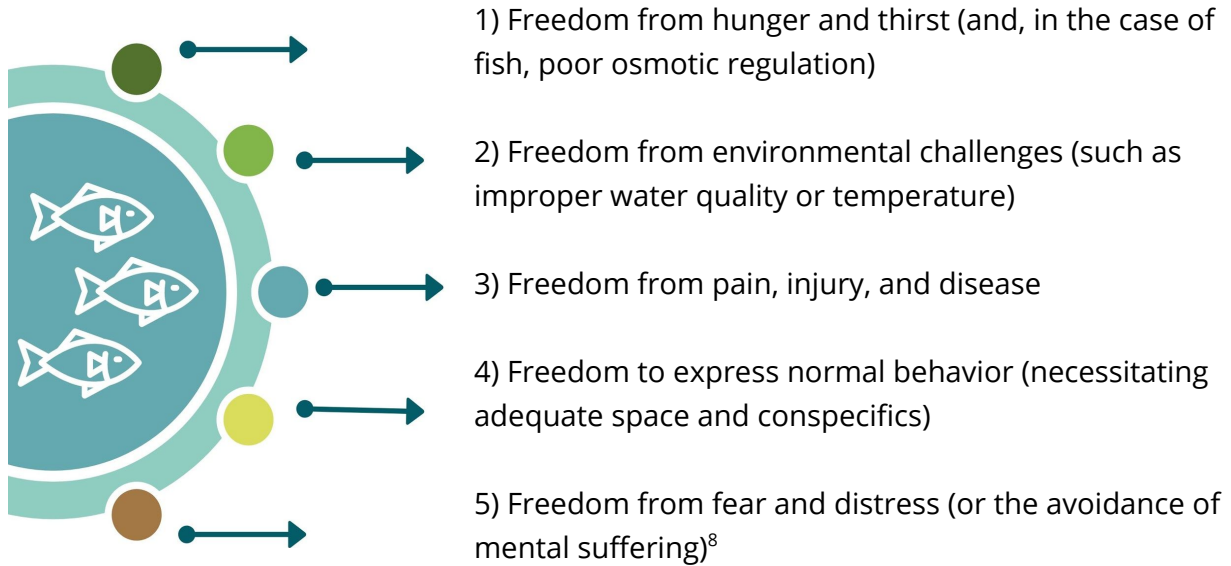
To forward a practical definition of welfare, the Farm Animal Welfare Council, UK outlined five "freedoms" that producers should give animals under their care.⁷ These are:

⁴ FAWC (1996). [Report on the Welfare of Farmed Fish](#).

⁵ Ashley, P. J. (2007). [Fish welfare: Current issues in aquaculture](#).

⁶ Often the welfare indicators most useful in laboratory conditions are too technically complex for practical use on farms. See: FSBI (2002). [Fish Welfare. Briefing Paper 2, Fisheries Society of the British Isles](#).

⁷ FAWC (2009). [Farm Animal Welfare in Great Britain: Past, Present and Future](#).



The Five Freedoms model states that animals are experiencing good welfare when all of these criteria are met. David Mellor later updated the five freedoms model into what is now referred to as “the five domains.”⁹

The Five Freedoms model has many practical advantages over previous definitions of welfare, outlining clear goals which can gradually be achieved through guidelines and legislation.

Allostasis

However, the five freedoms have been criticized for being grounded in “strict homeostatic principles in which control of stress predicts a linear relation between stress-related welfare and stress load”.¹⁰ In other words, it is often assumed that reducing stress is always beneficial for the fish and that a lack of stressful encounters is the optimum for fish welfare. However, this is not the case, and such treatment goes against an animal’s freedom to express natural behavior.

⁸ Rey, S., Little, D., and Ellis, M. (2019). Farmed fish welfare practices: salmon farming as a case study.

⁹ Mellor, D.J., and Reid, C.S.W. (1994). Concepts of animal well-being and predicting the impact of procedures on experimental animals.

¹⁰ Raposo de Magalhães, C.S.F., Cerqueira, M., et al. A Proteomics and other Omics approach in the context of farmed fish welfare and biomarker discovery.

A large body of research shows that fish have a qualitative experience of the world,¹¹ can learn and remember,¹² anticipate future events,¹³ and are less negatively affected by stressors that they can anticipate.¹⁴ These findings show that fish can adapt to environmental challenges.

Not only can fish adapt to their environment, but they also require biologically relevant challenges in order to experience optimal welfare. The effect of low stimulation (hypostimulation) creates boredom, which can be detrimental to animal wellbeing.¹⁵ Extreme cases can manifest as repetitive stereotypic behavior such as incessant pacing of barren enclosures.¹⁶ Rather than striving towards a static state, organisms should have “the ability to achieve stability through change.”¹⁷

The opportunity to adapt to biologically relevant challenges is part of an animal’s freedom to express normal behavior, and so concepts of welfare that neglect this need cannot be said to properly fulfill the five freedoms model. Consequently, our concept of welfare focuses not on homeostasis but allostasis.

Allostasis is the process of achieving stability through an adaptive and dynamic nature. In a naturally dynamic environment, fish must cope with stressors by adapting to different requirements. To be given stimulation in this way is crucial for good health and welfare.¹⁸

Allostasis-based welfare theories predict that the welfare of the fish relates to stress load in a hyperbolic manner:¹⁹

¹¹ Brown, C. (2014). Fish intelligence, sentience and ethics.

¹² Millot, S. et al. (2014). Use of conditioned place preference/avoidance tests to assess affective states in fish.

¹³ Cerqueira, M. et al. (2017). Cognitive appraisal of environmental stimuli induces emotion-like states in fish.

¹⁴ Madaro, A. et al. (2016). Effect of predictability on the stress response to chasing in Atlantic salmon (*Salmo salar* L.) parr.

¹⁵ Martins, C.I.M. et al. Behavioural indicators of welfare in farmed fish.

¹⁶ Korte, S.M., Olivier, B. & Koolhaas, J.M. (2007). A new animal welfare concept based on allostasis.

¹⁷ McEwen, B.S. and Wingfield, J.C. (2003). The concept of allostasis in biology and biomedicine. *Hormones and Behavior*.

¹⁸ Korte, S.M., Olivier, B., and Koolhaas, J.M. (2007). A new animal welfare concept based on allostasis.

¹⁹ Raposo de Magalhães, C.S.F., Cerqueira, M., et al. A Proteomics and other Omics approach in the context of farmed fish welfare and biomarker discovery.

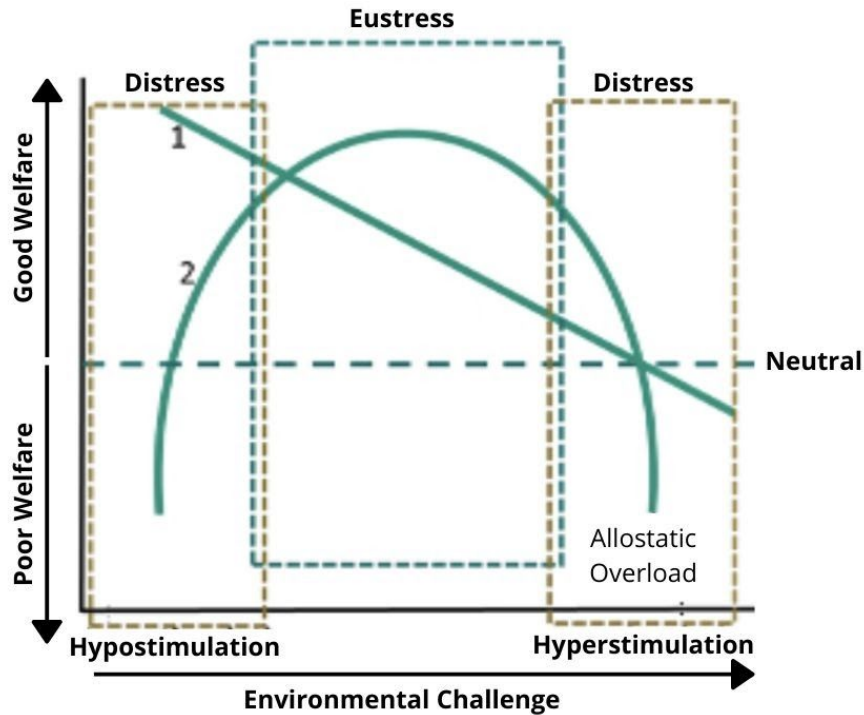


Figure 1: Allostatic theories' relationship between stress load and welfare. As animals are challenged, their welfare forms a bell curve, as shown in line 2. Line 1 shows this relationship as understood by "linear" definitions of welfare.²⁰

- Stress loads that are either too low or too high negatively impact welfare. The former affects welfare by failing to adequately activate reward systems, which can lead to boredom and languishing.²¹ The over-activation of stress responses leads to "allostatic-overload," where an animal is stressed beyond its ability to cope. Allostatic overload decreases growth rates and natural reproductive ability, as well as other harmful "tertiary stress responses."²²
- The intermediate range of stress load, or "eustress," improves future welfare. Successfully coping with a stressor stimulates neurogenesis (learning), which enhances future ability to cope with that stressor. Coping with the stressor also activates the reward system, which is a positive experience for fish.²³

²⁰ This graph is produced by Fish Welfare Initiative, based on: Korte, S.M., Olivier, B. & Koolhaas, J.M. (2007). [A new animal welfare concept based on allostasis.](#)

²¹ Martins, C.I.M. et al. [Behavioural indicators of welfare in farmed fish.](#)

²² Wedemeyer, G., McLeay, D., and Goodyear, C. P. (1984). [Assessing The Tolerance Of Fish And Fish Populations To Environmental Stress: The Problems And Methods Of Monitoring.](#), and Raposo de Magalhães, C.S.F., Cerqueira, M., et al. [A Proteomics and other Omics approach in the context of farmed fish welfare and biomarker discovery.](#)

²³ Raposo de Magalhães, C.S.F., Cerqueira, M., et al. [A Proteomics and other Omics approach in the context of farmed fish welfare and biomarker discovery.](#)

Allostatic theories focus on how individual animals subjectively perceive their lives. These theories of positive welfare connect to the concept of **quality of life**,²⁴ which recognizes that it is important for an animal to achieve a balance between positive and negative experiences.

Fish Welfare Initiative's Definition of Welfare

The primary focus of work in farmed animal welfare, including our own, is improving the lives of farmed animals. However, the safeguarding of animal welfare is valuable to many more individuals than the animals alone. Improving fish welfare improves food safety, increases environmental sustainability, and creates a healthier society.²⁵ Fish Welfare Initiative works to unite stakeholders of all of these benefits to create a unified movement for better fish welfare. Given how diverse these stakeholders are, we need to ensure that **our definition of "welfare" can be applied across all these groups** to facilitate collaboration.

Another important consideration is that, from our observations, **fish are not passive observers within their environment**. Fish can learn, adapt, and interact with changing conditions, and we believe that these opportunities are necessary for a good quality of life for fish. Thus, definitions of welfare should not treat homeostasis as the ideal.

Therefore, our definition must adequately detail the complexities of fishes' inner experiences, as well as ensure practicality for those looking to change welfare standards on farms. We aim to do this through further building upon the highly-practical 'domains' of the five freedoms, directing their focus towards achieving an allostatic equilibrium:

An individual is in a **positive welfare state** when they have the **freedom to adequately (i.e., adaptively) react to:**

- Hunger and thirst
- Environmental challenges (such as water quality or temperature)
- Pain, injury, and disease
- Mental challenges such as fear and distress

This allows fish the freedom to engage in normal behavioral patterns that allow them to adapt to their changing environment and reach a state that they perceive as positive. By our definition, good welfare is guaranteed when the level of stimulation within the

²⁴ Kirkwood, J.K. (2007). [Introduction - Quality of life: The heart of the matter](#).

²⁵ For more information on the social and environmental benefits of fish welfare, see our [Why Fish Welfare? webpage](#)

environment falls within the allostatic range of the fish. This is based on the fish's perception, and so we can count this as a feelings-based definition.

Therefore, we are still utilizing the five freedoms model but underscoring allostatic principles. This allows for greater emphasis on the fish's subjective experience, the removal of homeostasis as an ideal, and more opportunity to include positive welfare improvements. Our definition also promotes farmers using predictive behavior that allows fish the freedom to anticipate and thus cope better with stressors they encounter.

Ultimately, we believe:

“Animal welfare is the quality of life as perceived by the animal itself”

Bracke et al. (1999)²⁶

To that end, rather than claiming that negative emotions should be avoided and positive emotions should be promoted, we will instead direct our attention to determining whether conditions allow for fish to be stimulated whilst avoiding overload. From this, we hope to give fish a life worth living, as they perceive it.

²⁶ Bracke, M.B.M., Spruijt, B.M., and Metz, J.H.M. (1999). Overall welfare reviewed. Part 3: Welfare assessment based on needs and supported by expert opinion.