

On-farm Welfare Standards in Aquaculture

Annex to White Paper - No
Animal Left Behind: The need for
a new Kept Animals Regulation
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On-farm Welfare Standards in Aquaculture

Introduction

A life worth living for fish and other animals in aquaculture systems can be achieved by ensuring the right inputs and monitoring outcomes across the 5 domains. We welcome the option in the Commission's 2021 [Inception Impact Assessment](#) to introduce species-specific requirements for farmed fish.

Here we set out recommendations based on science and existing guidelines that should be implemented as legal standards. Many of these recommendations are applicable across species and are based on current best practices.

Although less detail is known about the needs of crustaceans compared to the needs of fish, the same principles and environmental factors are applicable to both groups^{1,2} and we make these recommendations for finfish and decapod crustaceans in aquaculture.

We recommend certain parameters for which species-specific thresholds should be established, and welcome that the [roadmap for European Food Safety Authority](#) work in the context of the review of animal welfare legislation foresees mandates on 7 finfish species and another on invertebrates. Additionally, we recommend that an EU Animal Welfare Reference Centre is established to consolidate knowledge and support Member States and producers in the practical implementation of these standards.


Most of the numbered recommendations in this document are amalgamations and adaptations of provisions from these four standards:

- Council of Europe. (2005) [Recommendation concerning farmed fish](#). *Standing Committee of the European Convention for the Protection of Animals Kept for Farming Purposes*.
- Government of Norway. (2008) [Regulations on the operation of aquaculture facilities](#). *Ministry of Trade and Industry*.
- EU Platform on Animal Welfare. (2020) [Guidelines on Water Quality and Handling for the Welfare of Farmed Vertebrate Fish](#). *EU Platform on Animal Welfare Voluntary Initiative on Fish Welfare*.
- World Organisation for Animal Health. (2021) [Aquatic Animal Health Code](#).

Where a specific recommendation is based on a different source, the source is referenced.

¹ Albalat, A., Zacarias, S., Coates, C. J., Neil, D. M., & Planellas, S. R. (2022). Welfare in Farmed Decapod Crustaceans, With Particular Reference to *Penaeus vannamei*. *Frontiers in Marine Science* Vol. 9. [Link](#)

² Freire, C. A., Cuenca, A. L. R., Leite, R. D., Prado, A. C., Rios, L. P., Stakowian, N., & Sampaio, F. D.F. (2020). Biomarkers of homeostasis, allostasis, and allostatic overload in decapod crustaceans of distinct habitats and osmoregulatory strategies: an empirical approach. *Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology* Vol. 248. [Link](#)



Domain 1: Nutrition

Carp feed on fish food pellets at an Indonesian fish farm. Source: We Animals Media

Introduction

The amount, composition, and distribution of feed should promote good welfare, including maintaining physiological condition and health, having energy for necessary and normal behaviours, feeling satisfied, maintaining homeostasis, and maintaining growth.

Underfed fish are stressed and less resilient to infectious diseases, and might have compromised swimming performance, abnormal behaviours, emaciation or an increased rate of deformities.³

General Requirements

1. All fish shall have access to an adequate and not excessive amount of nutritious, balanced and hygienic feed according to their physiological needs.
2. Feeding regimes and pellet size and formulation must be adapted to the species, age, developmental stage, weight, physiological and behavioural needs of the fish.
3. Fish should normally be fed daily unless this is not appropriate for the species or stage of development in question. They must be fed in such a way that all the fish have easy access to feed, and without fish being damaged during feeding.

Feeding Equipment

4. Feeding equipment shall be designed, constructed, placed, and maintained in such a way that contamination of the water is minimised, it operates in all weather conditions, it cannot harm the fish, and the amount of feed provided can be monitored.

³ Lall, S. P. & Lewis-McCrea L. M. (2007). Role of nutrients in skeletal metabolism and pathology in fish – an overview. *Aquaculture* 267(1-4). [Link](#)

Feed Source

5. The number of animals used in feed shall be minimised.⁴ Animals used for the production of feed shall be raised or captured according to the same welfare standards as when produced for human consumption.⁵

Feed Withdrawal

6. Prior to some handling and management procedures feed shall be withdrawn for as short a period as necessary to clear the gut so as to maintain water quality.
7. The Commission proposal shall include species specific maximum feed withdrawal periods, taking fish size and water temperature into account.

It shall be for a maximum of 50 degree days and 48 hours, whichever is shorter. In case of temperatures below 10 degrees C it shall be for a maximum of 72 hours.⁶

⁴ EU. (2018). Regulation 2018/848 on Organic Production and Labelling

⁵ Eurogroup for Animals. (2018) *Looking Beneath the Surface: Fish Welfare in European Aquaculture*.

⁶ Eurogroup for Animals recommendation



Domain 2: Physical Environment

Introduction

The fishes' environment in a fish farm is the quantity and quality of space surrounding and available to the fish and is especially related to water quality, stocking density, and the enclosures and buildings in aquaculture facilities. These are fundamental to providing conditions for the physiological functions and behaviours of fish.

Water Quality

During all life and production stages, sufficient water supply and good water quality is essential for the welfare of fish. Water quality refers to the physical and chemical environment that the fish are exposed to and comprises a complex set of interacting factors.

All aquatic organisms have certain tolerance limits with regard to water quality, where they are able to maintain homeostasis. Poor water quality elicits a stress response in fish. Fish are able to tolerate poor conditions for a short period only. When the conditions become too challenging or prolonged, fish experience chronic stress which can impair immune function, growth and reproductive function. Furthermore, chemical substances may have toxic effects at the level of cell and tissue but, in addition, elicit an integrated stress response.⁷

The threats to fish welfare from water quality relate not only to its parameters' absolute levels but also to their rate of change. They also relate to the species, the size of the fish, their developmental stage, previous experience, health status, and different coping strategies and capacities.⁸

Recirculating aquaculture systems rely on multiple systems to maintain water quality, have a higher risk of poor welfare, and require more intensive monitoring of a wider range of parameters than other systems.⁹

⁷ EUPAW, Guidelines on Water Quality and Handling for the Welfare of Farmed Vertebrate Fish, EU Platform on Animal Welfare Voluntary Initiative on Fish Welfare, 2020. [Link](#)

⁸ Ibid.

⁹ Ibid.

Stocking Density

Stocking density has complex interactions with a range of input factors and welfare outcomes.¹⁰ An unsuitably high stocking density can impose significant welfare risks, including water quality deterioration¹¹ and higher rates of physical injuries¹¹, and changes in behavioural patterns such as reducing feed intake¹² and increased aggression¹³.

Enclosures and Buildings

Enclosures and buildings must create the necessary opportunity for movement and other natural behaviours. They must provide access for monitoring and inspecting fish, equipment, and environmental parameters and for all rearing activities. They must also take preventive measures against interactions with predators¹⁴, parasites¹⁵ and other local wildlife causing fear, stress, trauma and death.

General Requirements

1. Fish must be kept in an environment that provides good welfare based on species-specific and life-stage needs, and protects them against damage and unnecessary stress.
2. Some species may need to be physiologically prepared prior to entering a new environment, such as using temperature acclimatisation. This should be done in a way which minimises negative welfare consequences and should be carried out for a period appropriate for the fish species and size in question.

Water Quality

3. Water quality parameters shall be maintained within the adequate range that sustains normal activity and physiology. When parameters exceed the adequate range corrective actions shall be implemented to return to the adequate range as soon as possible. Water quality parameters shall at all times be within extreme tolerance limits.

¹⁰ Ashley, P. J. (2007). Fish welfare: Current issues in aquaculture. *Applied Animal Behaviour Science*. 104(3-4). [Link](#)

¹¹ Person-Le Ruyet, J., Labbé, L., Le Bayon, N., Sévère, A., Le Roux, A., Le Delliou, H., & Quémener, L. (2008). Combined effects of water quality and stocking density on welfare and growth of rainbow trout (*Oncorhynchus mykiss*). *Aquatic Living Resources*, 21(2), 185-195. [Link](#)

¹² G.A. Santos, J.W. Schrama, R.E.P. Marnauag, J.H.W.M. Rombout, J.A.J. Verreth. (2010) Chronic stress impairs performance, energy metabolism and welfare indicators in European seabass (*Dicentrarchus labrax*): The combined effects of fish crowding and water quality deterioration. *Aquaculture*, 299(1-4). [Link](#)

¹³ C E Adams, J F Turnbull, A Bell, J E Bron, and F A Huntingford. (2007) Multiple determinants of welfare in farmed fish: stocking density, disturbance, and aggression in Atlantic salmon (*Salmo salar*). *Canadian Journal of Fisheries and Aquatic Sciences*. 64(2) [Link](#)

¹⁴ F.A. Huntingford, C. Adams, V. A. Braithwaite, S. Kadri, T. G. Pottinger, P. Sandøe, J. F. Turnbull. (2006) Current issues in fish welfare. *Journal of Fish Biology*. 68(2). [Link](#)

¹⁵ L. T. Barrett, F. Oppedal, N. Robinson, T. Dempster. (2020) Prevention not cure: a review of methods to avoid sea lice infestations in salmon aquaculture. *Reviews in Aquaculture*. 12(4). [Link](#)

4. The facility shall be able to reliably provide an adequate water flow of appropriate quality.
5. All parties carrying out, supervising, and being responsible for the keeping of fish should ensure that consideration is given to the potential impact of water quality on the welfare of the fish.
6. The water quality shall be monitored based on the risk of poor fish welfare, including at intervals and locations determined on a risk-based approach. They shall be monitored systematically and where possible in an automated manner with integrated sensors and automated monitoring and alarm systems, and shall be recorded. Competent personnel shall be available to respond at all times.
7. Key parameters that shall be monitored systematically:
 - a. Oxygen should be measured at least daily.
 - b. Ammonium, nitrite and nitrate should be determined several times a week.
 - c. Carbon dioxide should be determined at least daily.
 - d. pH should be determined at least daily.
 - e. Temperature should be measured at least daily.
8. The Commission proposal shall include species-specific adequate ranges and extreme tolerance limits for the key parameters for, and based on the needs of, the EU's major aquaculture species.
9. Additional monitoring requirements on a risk-based approach are:
 - a. Total volume of suspended solids
 - b. Close monitoring in high density and warm water systems.
10. Additional requirements for recirculating aquaculture systems (RAS) are:
 - a. Ammonium, nitrite and nitrate shall be determined daily and additionally in the start-up phase and then when using medications, in the event of increased mortality, and when changing feeding regime.
 - b. Continuous monitoring of pH and temperature.
 - c. Integrated sensors and automated monitoring and alarm systems
 - d. Backup systems necessary to handle possible power, water supply or equipment failure including backup generators.
 - e. In marine water RAS systems sulphur shall be monitored continuously.
11. Additional requirements for net pen systems are:
 - a. During periods of high risk of plankton blooms, plankton levels should be monitored.¹⁶
 - b. Oxygen should be monitored continually during and after blooms of microalgae.¹⁷

¹⁶ RSPCA. (2021). *RSPCA welfare standards for Farmed Atlantic Salmon*

¹⁷ Anderson. D. M. (2009). Approaches to monitoring, control and management of harmful algal blooms (HABs). *Ocean & Coastal Management* 52.

Stocking Density

14. Appropriate measures shall be taken to avoid and minimise sudden changes in parameters affecting water quality. The Commission proposal shall include species-specific maximum rates of water temperature change including during acclimatisation procedures.
15. Dead and moribund fish shall be removed as soon as possible and at least daily.
16. The Commission proposal shall include species-specific maximum stocking densities (fish's weight per unit of water volume) that meet the needs of the fish¹⁸ including:
 - a. Allow for a range of species-specific behaviours
 - b. Control aggressive behaviours
 - c. Minimise stress and injuries
 - d. Meet the biological needs of the fish, including allowing fish to maintain homeostasis so as to avoid chronic stress and fully support their immune function and growth
 - e. Maintain environmental conditions
 - f. Accessing adequate environmental conditions
 - g. Ensure appropriate access to feed in the system
 - h. Ensure the stockman is able to properly look after and safeguard the welfare of the fish

Enclosures and Buildings


15. Enclosures and installations shall ensure that fish have sufficient space for movement, other natural behaviours, and accessing appropriate environmental conditions such as lower water temperatures at greater depth.
16. The design, construction and maintenance of enclosures and buildings for farmed fish shall be such that they allow for the fulfilment and inspection of all established requirements.
17. A risk assessment shall be carried out with a view to minimising the risk of escape. The risk assessment shall form the basis for systematic measures to prevent fish from escaping. Any escape must be detected as quickly as possible, it must be limited as much as possible, and escaped fish in the vicinity of the fish farm must be recaptured immediately.
18. Land-based aquaculture facilities must have a suitable facility to prevent fish from escaping through the drain or in some other way. The facility shall at least consist of a double fuse or other equivalent escape fuse. It must be possible to document that

¹⁸EU. (2018). Regulation 2018/848 on Organic Production and Labelling

other equivalent escape protection is at least as anti-escape as double protection. Mesh opening in the net bag must be adapted to the size of the fish, so that the fish cannot slip through the net bag.

19. Buildings, equipment and enclosures shall be designed and maintained as far as possible to provide protection to the fish from predators.
20. Buildings, equipment and enclosures, shall be designed and maintained as far as possible to prevent parasitic infestations.





Domain 3: Health

Introduction

The immune systems¹⁹ and appetites²⁰ of fish are especially vulnerable to stress. A short period of stress may bring long lasting effects including increased incidence of disease, increased mortality, reduced appetite, impaired development, and deformities.²¹ Common aquaculture practices that are inherently stressful should be carried out with the minimum suffering, stress, injury, and time to return to feeding.

The skin of the fish is the first line of defence against disease and provides protection from the environment.²² It contains sensory receptors for touch, water pressure and pain and also has respiratory, excretory and osmoregulatory functions. The skin also contains mucus glands, which secrete a protective layer over the skin.²³

Breeding programmes must ensure that individual fish are robust and have traits important for fish health and welfare.²⁴

Good health is essential for maintaining fishes' large array of coping mechanisms and responses to environmental challenges.²⁵

Mutilations are unnecessary and should not be carried out, while for other painful procedures pain management should be fully employed.²⁶

Emergency killing should also be provided for.²⁷

¹⁹ Gino Nardocci, Cristina Navarro, Paula P. Cortés, Mónica Imarai, Margarita Montoya, Beatriz Valenzuela, Pablo Jara, Claudio Acuña-Castillo, Ricardo Fernández. (2014) Neuroendocrine mechanisms for immune system regulation during stress in fish. *Fish & Shellfish Immunology*. 40(2). [Link](#)

²⁰ M. Conde-Sieira, M. Chivite, J. M. Miguez, J. L. Soengas. (2018) Stress Effects on the Mechanisms Regulating Appetite in Teleost Fish. *Frontiers in Endocrinology*. 9:631. [Link](#)

²¹ EUPAW, Guidelines on Water Quality and Handling for the Welfare of Farmed Vertebrate Fish, EU Platform on Animal Welfare Voluntary Initiative on Fish Welfare, 2020. [Link](#)

²² I. Sanahuja, L. Fernández-Alacid, S. Sánchez-Nuño. (2019) Chronic Cold Stress Alters the Skin Mucus Interactome in a Temperate Fish Model. *Frontiers in Physiology*. 9(1916). [Link](#)

²³ Council of Europe. (2005) *Recommendation concerning farmed fish*. Standing Committee of the European Convention for the Protection of Animals Kept for Farming Purposes.

²⁴ H. M. Nielsen, I. Olesen, S. Navrud, K. Kolstad, P. Amer. (2011) How to Consider the Value of Farm Animals in Breeding Goals. A Review of Current Status and Future Challenges. *J Agric Environ Ethics*. 24

²⁵ Madaro, A., Kristiansen, T. S., & Pavlidis, A. (2020). How Fish Cope with Stress?, in Kristiansen, T. S., Fernö, A., Pavlidis, M. A., & van de Vis, H. (Eds.), *The Welfare of Fish*. Springer

²⁶ Council of Europe. (2005) *Recommendation concerning farmed fish*. Standing Committee of the European Convention for the Protection of Animals Kept for Farming Purposes.

²⁷ Ibid.

General Requirements

1. The physiological condition of the fish shall be monitored routinely, preferably during a scheduled handling procedure so as to avoid additional instances of handling.

The following framework²⁸ shall be used for monitoring and recording morphological scoring. Records shall demonstrate that moderate, severe, and extensive lesions are exceptional occurrences and the necessary preventative changes to operations are made.

Aspect	Severity of the lesion	Extension of the lesion
Emaciation	Mild/Moderate/Severe	N/A
Skin haemorrhages	Mild/Moderate/Severe	Focal/Multifocal/Diffuse
Lesions/wounds	Mild/Moderate/Severe	Focal/Multifocal/Diffuse
Scale loss	Mild/Moderate/Severe	Focal/Multifocal/Diffuse
Eye haemorrhages	Mild/Moderate/Severe	Unilateral/Bilateral
Exophthalmia	Normal/Abnormal	Unilateral/Bilateral
Opercular damage	Mild/Moderate/Severe	Unilateral/Bilateral
Snout damage	Mild/Moderate/Severe	N/A
Vertebral deformities	Mild/Moderate/Severe	N/A
Upper jaw deformity	Mild/Moderate/Severe	N/A
Lower jaw deformity	Mild/Moderate/Severe	N/A
Sea lice infection (ectoparasite infestation)	Mild/Moderate/Severe	Focal/Multifocal/Diffuse
Active fin damage	Mild/Moderate/Severe	Focal/Multifocal
Healed fin damage	Mild/Moderate/Severe	Focal/Multifocal
Eye darkening	Mild/Moderate/Severe	Unilateral/Bilateral
Fungal/bacterial infections	Mild/Moderate/Severe	Focal/Multifocal/Diffuse

2. Fish must not be released into an aquaculture facility with an ongoing clinical disease outbreak if there is reason to believe that the released fish could become ill and/or be subjected to significant stress.
3. The prophylactic use of medicines as part of a management system to compensate for poor hygienic conditions, poor management practices, stressful conditions, or to mask signs of poor welfare such as pain and distress shall not be allowed.
4. Surgical interventions and removal of body parts on live fish are prohibited.

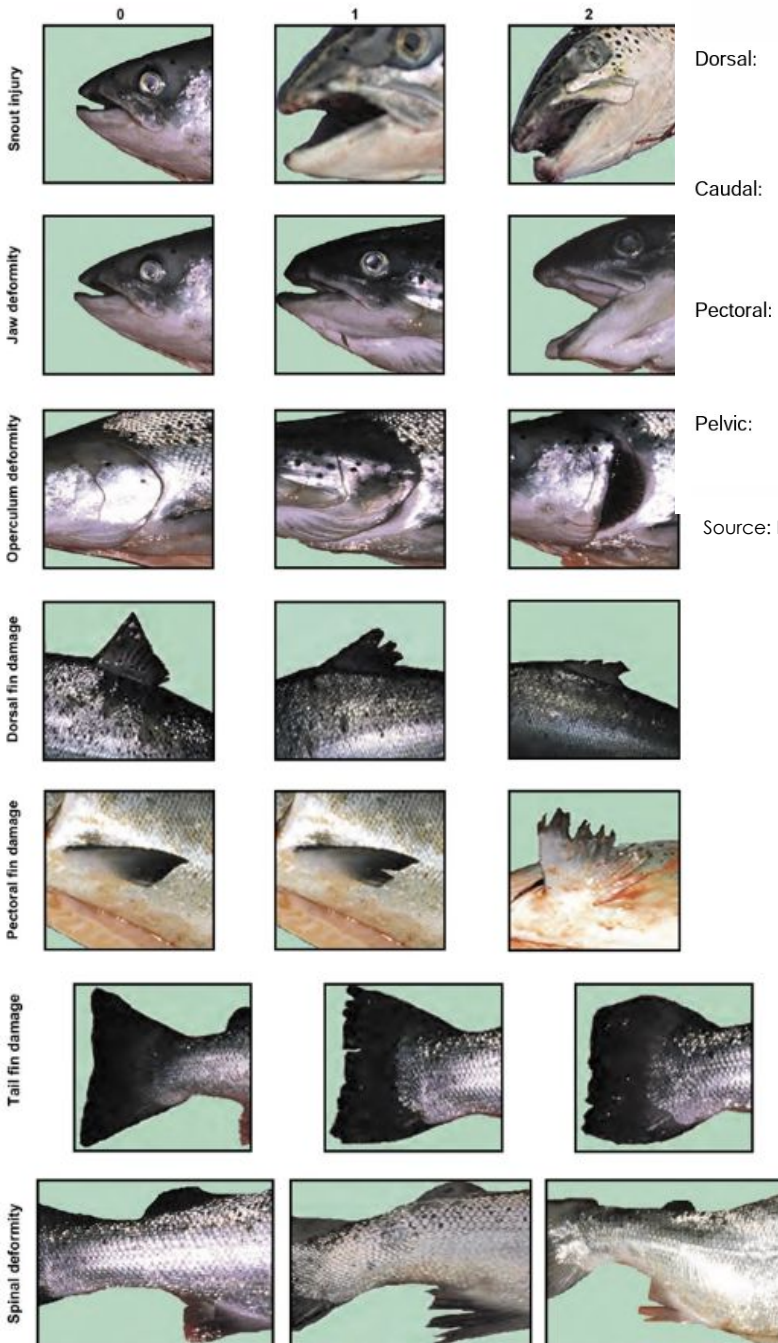
²⁸ Eurogroup for Animals recommendation

- Mutilation (a procedure carried out for other than therapeutic purposes and resulting in damage to or loss of a sensitive part of the body or the alteration of the bone structure) of fish shall be prohibited. Marking methods may be used only where they cause minimal damage and stress to the fish and do not impose behavioural restrictions, or when a veterinarian intervenes for fish health reasons.
- All physiological systems including the basic senses shall function properly.

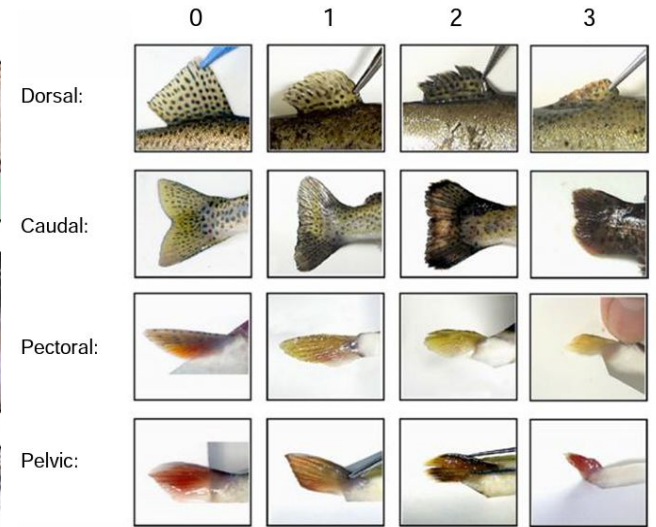
Examples of morphological scoring tools

Photographic examples for scoring

Suggested examples of normal, mild and severe for conditions classified in this way (note: eye loss/damage and scale loss have a different classification and no examples are given).



Fin damage assessment guide



Source: RSPCA Welfare Standards for Farmed Rainbow Trout (2020) [Link](#)

Source: RSPCA Welfare Standards for Farmed Atlantic Salmon (2020) [Link](#)

Breeding Programmes

7. No fish shall be farmed unless the fish's genotype or phenotype indicates that it is possible to maintain good welfare and health.
8. At least as much attention shall be paid to criteria conducive to the improvement of fishes' welfare and health as to production criteria. Breeding programmes select primarily for robustness of natural defence mechanisms.
9. Breeding programmes do not select for adaptation to poor farming practices.²⁹
10. Genetic manipulations including triploidy shall not be allowed except for species in which triploidy has been proven not to negatively impact welfare. Genetic manipulations including triploidy are strictly quality-controlled and shall not result in fish at higher risk of poor welfare than conventional fish.

The Commission shall establish a list of species approved for use of triploidy.

11. Natural or artificial breeding procedures that cause, or are likely to cause, harm or unnecessary stress shall not be used.

Pain Management

12. Painful procedures shall be avoided to the greatest extent possible.
13. Painful treatments shall be documented and require the use of anaesthetics. Appropriate numbers of competent staff shall be present during procedures. The welfare management plan and contingency plans shall detail procedures to ensure minimal stress and suffering.

Emergency Killing

14. If fish are ill or injured to such an extent that suffering is chronic and treatment is no longer feasible and transport would cause additional suffering, they must be killed on the spot and without delay by a person properly trained and experienced in the effective techniques of killing. The need for immediately rendering unconscious and rapid killing of large batches of fish for disease control purposes should also be considered.

²⁹ Eurogroup for Animals recommendation



Domain 4: Behavioural Interactions

Introduction

Fish interact with each other, they interact with their environment and objects in their environment, and they interact with people and equipment when they are handled.

Monitoring fish behaviours provides insights into the status of the nutritional, environmental, health, behavioural, and mental state of fish. The provision of environmental enrichment should facilitate positive mental experiences as well as good physical health. Handling practices and equipment should be minimised and carried out with a minimum of stress and harm.

Behaviours

Fish's natural and preferred behaviours are among fishes' basic needs underpinning their physical as well as mental state. These include species specific playing, exploring, resting, feed anticipatory, foraging, social interactions, and group and individual swimming behaviours, as well as individual fish's needs related to their position in the social hierarchy. Culture conditions can impede exploratory behaviour and motivate frustration, boredom, and discomfort, leading to abnormal or stereotypic behaviours. Confinement drives fish to adjust their swimming behaviour to the culture system's features, which can affect fishes' development, survival, and reproduction.³⁰

Many fish species are naturally territorial and function in social hierarchies, which may not mesh well with the confined environments of aquaculture. Less dominant fish are often unable to escape from more dominant fish, resulting in increased aggression, injury, and stress. Aggression can also lead to subordinate fish having limited access to feed and territories.³¹

Enrichment

Environmental enrichment is the increase in complexity of an animal's environment to prevent negative welfare (preventing stereotypical behaviours, preventing poor health, preventing chronic levels of stress) and promote positive welfare (promote the display of

³⁰ C. I. M. Martins, L Galhardo, C. Noble, B. Damsgård, M. T. Spedicato, W. Zupa, M. Beauchaud, E. Kulczykowska, J-C. Massabuau, T. Carter, S. R. Planellas, T. Kristiansen. (2012) Behavioural indicators of welfare in farmed fish. *Fish Physiology and Biochemistry*. 38. [Link](#)

³¹ Ashley, P. J. (2007). Fish welfare: Current issues in aquaculture. *Applied Animal Behaviour Science*. 104(3-4). [Link](#)

natural behaviours and enable animals to experience positive emotions).^{32,33} Environmental enrichment is commonly recognized as a fundamental need of fish and a tool for increasing fish welfare in any farming system, life stage, or species. Types of enrichment include social, occupational, structural, sensory, dietary and cognitive enrichment.³⁴ They can create positive experiences through controlled variability and predictability, choice, shelter and exploration. Structures mimicking fishes' natural habitats have been shown to contribute to lower stress and aggression, improve growth and health, and boost development and metabolic performance.

Handling

Handling causes stress, raising activity as well as oxygen demand. A brief period of stress may bring long lasting adverse effects. Various genetic, developmental and environmental factors can have a modifying effect on the magnitude and duration of the stress response.

Those procedures that are successful with one species may be ineffective or dangerous for another species. Inappropriate handling procedures can lead to injury, pain, distress, and suffering. As a result, increased disease incidence, increased mortality, reduced appetite, impaired development, and deformities in fish may ensue.



³² Näslund, J., & Johnsson, J. I. (2014). Environmental enrichment for fish in captive environments: effects of physical structures and substrates. *Fish and Fisheries*, 17(1)

³³ Boissy, A., Manteuffel, G., Jensen, M. B., Moe, R. O., Spruijt, B., Keeling, L. J., Winckler, C., Forkman, F., Dimitrov, I., Langbein, J., Bakken, M., Veissier, I., Aubert, A. (2007). Assessment of positive emotions in animals to improve their welfare. *Physiology & Behavior*, 92(3).

³⁴ Näslund, J., & Johnsson, J. I. (2014). Environmental enrichment for fish in captive environments: effects of physical structures and substrates. *Fish and Fisheries*, 17(1)

General Requirements

1. Aggressive behaviour shall be minimal and cannibalism shall not be present.

Behavioural Indicators

2. Behaviours will be observed and recorded on a routine basis and at least daily.

The following categories of behaviour³⁵ are to be recorded during normal farm conditions and around specific management procedures.

Indicators for regular monitoring and record keeping		
	Category	Indicator
Indicators of poor welfare	Foraging behaviour	Low feed intake
	Ventilatory activity	High ventilatory activity
	Aggression	Aggression
		Aggression and social hierarchy
		Aggression and territoriality
	Individual and group swimming behaviour	Random and disorganised swimming
		Disrupted natural swimming behaviour
		Increased swimming speeds
		Increased muscular activity
	Stereotypic and abnormal behaviour	Rocking from side to side on substrate
		Rubbing lips into objects, substrate or walls
Taking cover or freezing altogether		
Indicators of good welfare	Exploratory behaviour	Food searching
		Use of self-feeders
		Exploratory behaviour
	Feed anticipatory behaviour	
Reward-related operant behaviour		

³⁵ C. I. M. Martins, L Galhardo, C. Noble, B. Damsgård, M. T. Spedicato, W. Zupa, M. Beauchaud, E. Kulczykowska, J-C. Massabuau, T. Carter, S. R. Planellas, T. Kristiansen. (2012) Behavioural indicators of welfare in farmed fish. *Fish Physiology and Biochemistry*. 38. [Link](#)

3. In the case of deviations from normal or expected behaviour, monitoring shall be intensified and the necessary steps taken to maintain a good welfare status for the fish.

Enrichment

4. The Commission proposal shall include the commitment to develop and consolidate knowledge on the implementation of environmental enrichment in aquaculture for the future establishment of species and system specific requirements.³⁶

Handling

5. Handling shall be kept to an absolute minimum level. Practices are carried out for the shortest time possible and with the minimum disturbance, suffering, stress, injury, time to return to feeding, and instances of disease. Procedures, facilities and production cycles should be optimised to minimise handling.
6. The personnel involved in fish handling procedures, their roles, the approximate number of fish handled, health and welfare issues observed, as well as mortality rate and cause should be recorded and evaluated.
7. Where possible, fish shall be handled in water. If fish have to be taken out of the water for handling, this shall be done in the shortest time possible, all equipment in direct contact with fish should be moistened, and the fish should be kept moistened at all times.

The Commission proposal shall include maximum times out of water.

8. Fish shall not be allowed to asphyxiate.



Investigation into 7 Spanish fish farms, 2022 © Essere Animali / Aitor Garmendia

9. Handling shall not be carried out when water or air temperatures are outside of adequate ranges respectively.

The Commission proposal shall include adequate air temperatures

³⁶ Eurogroup for Animals recommendation

10. Painful procedures are prohibited without pain management.
11. When handled, the body of the fish shall be adequately supported and fish shall not be lifted by individual body parts only, such as the gill covers.
12. Fish shall not come into contact with ice.
13. If fish during handling show signs of oxygen deficiency or signs of avoidable stress, measures should be put in place such as increasing water turnover or adding extra oxygen so that fish can recover.
14. During treatments, movements and handling fish in an enclosure, water quality parameters shall be monitored and maintained at levels acceptable to the species concerned.
15. Fish should never be thrown onto solid objects or onto each other or hit solid objects including when exiting pipes and pumps. Fish should not be allowed to fall from a height that would compromise welfare.
16. Handling should not take place following any sudden decrease in dissolved oxygen.
17. Prior to any handling procedure, the health and welfare status of the fish should be assessed to ensure they are fit and able to withstand the rigours and stress of handling without risking adverse welfare and health implications.
18. Fish should not be handled if showing signs of disease, physical damage, lethargy, or unusual behaviour, except for the purposes of examination and treatment, or if they have recently been exposed to a significant stressor.
19. If fish show signs of behavioural changes beyond normal during handling, the necessary measures, such as increasing the volume available to fish or adding supplementary oxygen, must be implemented immediately to ensure the fish's welfare.
20. Fish should be inspected during and after handling for signs of external injury or excessive time to resume feeding that might be due to the procedures or equipment used. In case of injury or excessive mortality, the handling procedure should be evaluated to identify causes and alternative, preventive procedures to implement.
21. During crowding and removal of fish from water a maximal stress response shall not be invoked in the fish. Fish should be crowded at the lowest density possible and in several steps. The number of crowding events and the period in which fish are kept crowded should be minimised. The water quality and especially levels of oxygen should be monitored and kept within acceptable limits. If fish show signs of undue stress during crowding, immediate action must be taken as appropriate, such as increasing the volume available to fish or adding supplementary oxygen.

22. Size grading should be carried out when required for avoiding unnecessary suffering and should be carried out in-water, including prior to the use of equipment that is specific to the size of the fish such as vaccination equipment, and to protect cleaning fish before certain operations.
23. Fish should be killed before stripping or milking when this reduces unnecessary suffering, such as with atlantic salmon.³⁷
24. If live fish are to be stripped or milked, anaesthesia or sedation should be used as necessary for the species concerned. Where compressed air is used to assist stripping and milking in live fish they must be fully anaesthetised. Spontaneous spawning should be used where species-specific knowledge allows for it.
25. In the breeding of farmed fish, the stripping and milking process shall be carried out by trained and competent persons.
26. If gonads are removed from fish, the animal shall be killed prior to their removal.

Equipment

27. Procedures and equipment used in handling fish shall be planned and operated to minimise stress and injury.
28. Equipment including nets, pumping devices, pipes, brailing devices, vaccination equipment, grading devices, delousing equipment etc. should be appropriate to the species, size, weight and number of fish to be handled.
29. Equipment has no rough surfaces or protrusions liable to cause injury, and is properly maintained.
30. Equipment should be cleaned and disinfected between each use to reduce the risk of disease transmission.
31. Noise and vibrations from equipment shall be kept to a minimum.
32. Pumps or pipes have no sharp bends and piping size, height, pressure and speed, as well as the height from which fish fall when they emerge, are adjusted to minimise the risk of injury. The pump distance shall be as short as possible and a procedure is in place to ensure all fish have been removed from the system at the end of operation. A procedure and backup pump shall be in place to remove any fish trapped in the pipes in the event of a sudden pump failure.

The Commission proposal shall include a threshold volume of fish above which pumping rather than netting is the required method for moving fish.

³⁷ Eurogroup for Animals recommendation

33. Where nets are used to handle fish, they shall be designed to avoid physical injury, and they should not be overloaded so as not to crush or injure the fish. The mesh size shall be appropriate to the size of fish to avoid entanglement, and nets shall be of knotless construction.
34. Where the welfare, including health of the fish, depends on automatic or other mechanical systems, these shall be checked at least daily. Where defects are discovered these shall be rectified immediately, or, if this is impractical (e.g. in very rough seas) other appropriate steps taken to safeguard the welfare, including health of the fish until the fault can be rectified.
35. If an operation is dependent on equipment for the provision of essential resources (e.g. electricity, water supply, temperature control), there must be a reserve or emergency system that in the event of failure meets the fish's needs in a responsible manner. There must also be an alarm system that warns of a power failure or failure of the oxygen supply. Aquaculture facilities with closed production units must also have an alarm system that warns of system failures that are important for the fish's welfare or could increase the risk of escape. The alarm systems must be adapted to the risk in the individual aquaculture facility so that measures can be implemented as quickly as possible.



Carp farm in Poland. 2018 © Otwarte Klatki / Andrew Skowron



Domain 5: Mental Experiences

Introduction

The overall mental experience is the result of conditions under the 4 physical domains, comprising a range of positive and negative experiences including hunger, pleasure, comfort, pain, control, sickness, frustration, novelty, and affection. Positive mental experiences are fundamental for a good life for fish, and meeting standards across the 4 physical domains is the most comprehensive way to achieve a good life for farmed fish.³⁸

General Requirements

1. Training programmes and welfare management plans explicitly assess the Domain 5 impacts of common and expected circumstances during farming and demonstrate a good life for fish.³⁹

³⁸ Eurogroup for Animals. (2021). *No Animal Left Behind: The need for a new Kept Animals Regulation*

³⁹ Eurogroup for Animals recommendation



Horizontal Management Measures

Greece: workers fish sea Bass with a crane. Source: We Animals Media

Introduction

The implementation of specific measures under Domain 1 to 4 requires the integration of fish welfare into horizontal management practices including training, planning, record keeping, and inspections.

Training

Owners are responsible for ensuring all parties carrying out, supervising, and being responsible for (workers, owners and managers) the keeping of fish receive a substantial period of training appropriate to their responsibilities, including practical experience as well as continued training. Competent authority personnel shall also be trained appropriately. Personnel should be able to recognise whether or not the fish are in good health, understand the significance of behavioural changes, and appreciate the suitability of the environment for the fishes' welfare. Necessary competence shall be documented through practical and theoretical training.

The training shall:

- a. Be performed by a veterinarian, fish health biologist or other person with equivalent competence in fish welfare,
- b. Contain at least the following element:
 - i. The relevant legal provisions
 - ii. Natural needs, behaviour and physiology of the species, including how fish respond to pain, stress and disease
 - iii. Welfare indicators including normal behaviour, environmental factors, signs of disease and poor welfare,
 - iv. Methods for inspection of fish
 - v. Production conditions that are important for fish welfare
 - vi. Best handling practices
 - vii. Operation and maintenance of equipment
 - viii. Environmental enrichment
 - ix. Systems for management of water supply and quality control
 - x. Methods for the management of situations frequently encountered during the containment of fish,
 - xi. Methods for the management of unforeseen events including the design and implementation of contingency plans.
- c. Be repeated as needed and at least every five years

Planning

Every farm shall have a welfare management plan approved by a veterinarian. Among other things, it shall:

- a. identify critical control points
- b. provide an overview of animal welfare measures that are relevant to implement to prevent outbreaks of infectious disease
- c. specify the necessary competent personnel to be present for certain procedures

An updated contingency plan must be available at all times to contribute to safeguarding fish welfare in crisis situations. Among other things, it shall:

- d. Identify critical control points
- e. Propose corrective measures
- f. Indicate when to discontinue procedures in order to maintain adequate fish welfare, including a maximum residence time for fish in pipe systems in case of system failure, and the killing and destruction of sick and dead aquaculture animals
- g. Address the detection and recapture of escapes
- h. Address common handling practices
- i. Provide an overview of animal welfare measures that are relevant to implement, prevent and possibly deal with:
 - i. acute outbreaks of infectious disease
 - ii. acute pollution
 - iii. algae and jellyfish occurrences
- j. Plan for unforeseen events that may have an impact on procedures or fish welfare as appropriate to the system and site.

Record Keeping

The stockkeeper is responsible for keeping on-farm operating records which must be available to the competent authority for four years and operational facilities must have the records available for inspection. Records will allow traceability of batches of fish including back to the production of the eggs. Records shall at least contain updated information on:

- a. Aquaculture animals and animal products taken in and out of the aquaculture facility, including place of origin and place of receptions,
- b. Number of fish
- c. Weight of fish
- d. Stocking density
- e. Water quality measures
- f. Feeding times, methods and quantities
- g. Instances of use of medications
- h. Instances of use of mechanical treatments

- i. Instances of handling
- j. Mortality per unit of production relevant to the form of production, including the cause of mortality and any diseases diagnosed
- k. Results of completed health checks: number of completed health checks, sampling, examinations performed, diagnoses and completed treatments.

Inspections

The person responsible for day-to-day operations shall ensure that risk-based inspections are carried out with matters of importance to the welfare of aquaculture animals, including inspections of installations, technical facilities, equipment for production, containment units, water, and the animals. The inspection of aquaculture facilities shall be carried out at least once a day if the weather conditions allow it. The inspection shall be carried out in such a way that it minimises disturbance to the aquaculture animals. In the event of abnormal behaviour or the risk of significant stress, the person responsible for their care shall act promptly to establish the cause and take remedial action, if necessary, with the assistance of a veterinarian or other expert.

EUROGROUP FOR ANIMALS

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