Operational welfare indicators

A brief overview

A summary of fish welfare and operational welfare indicators – to complement Fish Health and Welfare Workshops as provided by Pharmaq Analytiq and BIM.

BIM Ireland's Seafood Development Agency

Ireland's EU Structural and Investment Funds Programmes 2014 - 2020
Co-funded by the Irish Government and the European Union

An Roinn Talmhaíochta, Bia agus Mara
Department of Agriculture, Food and the Marine

EUROPEAN UNION
This measure is part-financed by the European Maritime and Fisheries Fund

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Fish welfare – What is it and why is it important?

It is widely accepted that fish are sentient beings, capable of feeling pain and suffering, however fish welfare is not only an ethical consideration. Poor welfare leads to chronic stress, which can reduce growth and weaken the immune system leading to disease outbreaks. Poor fish welfare can also cause changes in behaviour, lower survival and reduce product quality. In other words – a high standard of fish welfare is necessary for ethical and successful fish farming!

But what is fish welfare exactly? There is no universally accepted definition but 3 general approaches exist: **biological functioning** (factors including good growth and absence of diseases are arguably a suitable proxy for good overall welfare), **nature based** (comparing the environment in captivity to the natural habitat and consdering the possibility of performing species-specific behaviours) and **feeling based** (arguing that the welfare of an animal is determined by its individual perception of its circumstances).

The **5 freedoms** (freedom from hunger and thirst, freedom from discomfort, freedom from pain, injury or disease, freedom to express normal behaviour, freedom from fear and distress) were long recognised as the gold standard in animal welfare and have been widely used in aquaculture. These reflect the biological definition of animal welfare and are comparatively easy to quantify, making them a practically useful model. A refined version of the 5 freedoms are the **5 domains**, which reflect the feeling based definition of animal welfare and aim to guarantee the animals a "life worth living". To do this, the first 4 domains (nutrition; physical environment; health and behavioural interactions) are used to judge the balance of positive and negative experiences resulting in domain 5, the overall mental state of the animal. The concept of the 5 domains is increasingly used internationally in a range of vertebrae species and animal use sectors.

A good starting point to ensure a high standard of fish welfare is to define the **basic welfare needs** of the fish in our care. Many authors have attempted to do this, and the results can broadly be summarized in **4 basic welfare needs**: 1) resources or adequate nutrition, 2) environment or appropriate water quality, 3) health and 4) behavioural freedom and safety.

A version of these basic welfare needs are the foundation of most animal welfare assessments, and it is our responsibility to ensure that these are met.

How can we assess the welfare of fish in our care?

Once we have established what fish need, how can we tell if what we are doing is working? There are many things we can look at that reflect welfare, known as **welfare indicators.** These can be as simple and obvious as mortality rate or as complicated as hormone analysis in a laboratory. All indicators that we can assess on site are called **operational welfare indicators (OWIs)**. The literature can be confusing as there are multiple terms for the same things, but key categories are as follows:

Environment based indicators (also called input or indirect indicators): These describe things that impact the welfare of fish, typically the resources or the environment. Key environmental indicators should always be monitored. Environment based indicators may help us react before the fish show signs of poor welfare!

Animal based indicators (also called outcome or direct indicators): These describe the animals themselves or their behaviour, examples include behaviour, external condition or signs of disease. Animal based indicators can be divided into **group based** (reflecting a group of fish), or **individual based** (measured on an individual fish).

Laboratory indicators: indicators that require specialised equipment and cannot be done on site. Some parameters that are now laboratory indicators may be possible to do on site in future as technology progresses.

Examples of key welfare indicators:

Environment based welfare indicators	Animal based welfare indicators	
	Group based	Individual
Temperature	Mortality	Opercular movement
Oxygen	Appetite	Gill condition
CO2	Growth rate	Skin, fin, eye condition
pH	Behaviour	Condition factor
Stocking density	Health status	Abnormal behaviour
Flow rate/current speed		Lice level
Harmful plankton species		Smoltification
Suspended solids		Deformities
Ammonia		Vaccine reaction
Nitrite		**Laboratory indicators**
Lighting		Plasma cortisol
Feed quality		Plasma lactate
		Microbiome

All indicators used should be clearly defined and as objective as possible. Some standardised scoring protocols are available, the RSPCA guidelines and the FISHWELL handbooks are examples worth looking up.

How can operational welfare indicators be implemented on the farm?

The indicators you choose to monitor on the farm depend on the circumstances. Guidelines for assessing welfare risks, are available in specialised literature or through the European Food Safety Authority (https://doi.org/10.2903/j.efsa.2008.736). But experience with the farm site is the most useful starting point in identifying the biggest risk for your particular case.

A good way to monitor fish welfare is to have a continuous OWI monitoring protocol in place that covers the biggest risks, and that reflects all **4 basic welfare needs** of fish. This protocol can be simple, consisting of key environment based parameters (like oxygen and temperature) and selected output, group based indicators like appetite, mortality and behaviour. For most sites, a suitable OWI monitoring protocol will also include regular examination of fish for individual animal based OWIs like skin and gill condition or sea lice counts. Make sure your sample size is large enough and reflects the population!

If the routine environment based parameters show a risk, or if output based indicators show welfare issues due to a known cause, this must be addressed. If routine monitoring indicates a welfare issue and the cause is not obvious, further investigation must be undertaken to identify the cause and resolve the issue. This can be in the form of more detailed sampling or external help.

Suitable OWIs are a valuable early warning system that helps us spot fish welfare issues early and lets us react in time!

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