

Do Fish Thrive or Simply Survive? Rethinking Well-Being in Aquaculture
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For decades, the success of animal agriculture has been measured by productivity. Animals that remained healthy, converted feed efficiently, reached market weight quickly, and generated an economic return were considered to have acceptable welfare. Those measures remain essential, but they no longer tell the whole story. Modern animal welfare science increasingly asks a broader question: What is life like from the animal's perspective? Productivity alone cannot answer that. An animal may be healthy and growing well while still being unable to express important natural behaviors or experiencing chronic stress.

This is where the concept of animal well-being becomes relevant. Well-being asks not only whether an animal survives and performs, but whether it can live in a way that reflects its biological and behavioral needs. It recognizes that the quality of an animal's life involves more than the absence of disease or suffering. The distinction may appear subtle, but it fundamentally changes how we evaluate animal production systems.

That distinction reminds me of a scene from the dark comedy *The War of the Roses*, starring Kathleen Turner and Michael Douglas. In one memorable sequence, Oliver (Michael Douglas) secretly urinates over an elaborate fish platter intended for his wife's dinner party. Unfortunately for him, both the caterer and one of the guests witnessed the entire episode. Moments later, as everyone waits for dinner to be served, the guest quietly leans toward the person beside him and whispers, "*I don't know if we should leave, but I definitely advise skipping the fish course.*"

That line stayed with me.

Years later, while serving on a volunteer assignment for the now-defunct United States Agency for International Development (USAID) in Central America, I visited a small tilapia farm where fish were being raised in old concrete troughs and fed fresh cattle manure. The water was dark, oxygen levels were obviously poor, and many fish crowded the surface gasping for air. Since those fish were destined for local restaurants, I quietly remembered the dinner guest's advice in that movie and ordered eggs instead.

We often see attractive infographics promoting integrated farming systems in which chickens are housed above fish ponds. Spilled feed and poultry manure become nutrients for the fish below, creating what is presented as an efficient and sustainable production system. It is. Integrated farming has undeniable advantages, particularly where resources are limited. Nevertheless, whenever I see those diagrams, I find myself asking a question that is rarely discussed: What is life like for the fish?

More recently, I had the opportunity to consult with a commercial aquaculture operation in Israel as part of a U.S. agricultural trade mission promoting high-protein distillers dried grains with solubles (DDGS) as an ingredient for aquaculture feeds. This was a modern, well-managed farm. Water quality was carefully controlled, feed conversion was excellent, and the fish reached market

weight efficiently. From a production perspective, the operation was impressive. Yet as I watched large schools of tilapia and carp surge to the surface during feeding, competing intensely for every pellet, I found myself wondering whether productivity alone should define success. The fish were surviving and growing, but were they truly thriving?



That question reflects an important shift taking place across animal agriculture. Increasingly, researchers recognize that welfare is not simply the absence of disease or the achievement of production goals. It also encompasses the opportunity to express species-specific behaviors, interact with an appropriate environment, experience positive states, and develop resilience to the challenges of daily life.

Aquaculture now finds itself at a crossroads like that faced by other livestock industries. As global demand for aquatic protein continues to grow, efficiency will remain essential, but it may no longer be sufficient to define responsible production. If fish can experience their environment in ways that extend beyond growth and survival, then the question is no longer simply how efficiently we can produce them, but whether we can create production systems that allow them to live in a manner consistent with their biology before they reach our dinner plate. After all, a tilapia, carp, or salmon, if given the choice, would not decide that its life should end the moment it reaches maximum economic value. That decision belongs to us. Our responsibility, therefore, extends beyond producing fish efficiently; it also includes ensuring that the lives they experience before harvest reflect more than biological survival. That is the conversation I would like to explore.

Why Are Fish Different?

Before discussing fish well-being, we must recognize a significant difference between aquaculture and most terrestrial livestock production. When we talk about dairy and beef cattle, broilers, or laying hens, we are referring to animals whose environmental requirements are broadly similar. A Holstein and a Jersey cow may differ in milk production, body size, or heat tolerance, but both require the same environment to remain healthy and express normal behavior. The same is true for commercial poultry strains or modern swine breeds.

Aquaculture encompasses hundreds of species that evolved under remarkably different environmental conditions. Salmon thrives in cold, highly oxygenated water that would severely stress tilapia. Conversely, tilapia tolerates warm water and oxygen concentrations that would be unacceptable for salmonids. Catfish can survive conditions that would be lethal to trout, while eels, carp, sea bass, shrimp, and marine fish each occupy ecological niches shaped by millions of years of evolution.

This diversity has an important implication. Discussing *fish welfare* as though all fish share identical biological needs oversimplifies one of the greatest challenges facing aquaculture. Unlike dairy or poultry production, there is no single environmental standard that defines good management for every species. A production system that promotes the well-being of one species may compromise that of another.

“For terrestrial animals, the environment surrounds them. For fish, the environment is where life occurs.”

A cow breathes air but walks, rests, seeks shade, and interacts with her surroundings. If one part of the barn becomes uncomfortable, she can often move elsewhere. Fish experience their environment differently. Every breath, every movement, every physiological process depends directly on the water that surrounds them. Temperature, dissolved oxygen, pH, salinity, water flow, turbidity, ammonia, and countless other factors are not simply features of the environment; they become part of the animal's immediate biological reality.

Consequently, water quality represents far more than a production parameter. It determines whether fish can breathe efficiently, regulate their metabolism, maintain osmotic balance, respond to stress, avoid disease, and express normal behavior. In terrestrial livestock production we often speak of providing a good environment for the animals. In aquaculture, the environment and the animal are inseparable.

This distinction also helps explain why productivity alone cannot define well-being. Growth rate tells us how efficiently a fish uses nutrients. It tells us far less about the quality of life experienced while achieving that growth. Fish maintained within acceptable limits for growth and feed conversion may still experience chronic stress, intense competition for feed, restricted behavioral opportunities, or environmental conditions that continually challenge their ability to cope. They may survive and even perform well while living under conditions that fall short of allowing them to thrive.



Recognizing these differences does not diminish the importance of productivity. On the contrary, efficient production remains essential if aquaculture is to meet the growing global demand for animal protein. Rather, it reminds us that biological performance and well-being are not always synonymous. Production measures how efficiently fish convert feed into growth. Well-being asks whether the conditions under which that growth occurs are consistent with the biological and behavioral adaptations of the species itself.

That distinction moves the conversation beyond welfare as the absence of disease and toward a broader understanding of what constitutes a good life for fish in commercial production systems.

Looking Beneath the Surface.

When I think back to that dinner scene in *The War of the Roses*, I realize that my reasons for skipping the fish course have changed over the years. At the time, my concern was food safety. Later, after visiting that small tilapia farm in Central America, it was the production system itself that made me hesitate. More recently, after visiting modern commercial aquaculture operations, I found myself asking a different question altogether. *What kind of life did that fish experience before it reached my plate?*

Perhaps that question reflects the evolution taking place across animal agriculture. For decades, our attention focused primarily on productivity, health, and efficiency. Those goals remain

essential, particularly as aquaculture assumes an increasingly key role in feeding a growing world population. But they are no longer sufficient to define responsible production.

Fish will never understand the economics that determine when they are harvested, but they do experience the conditions under which they live. Whether those conditions allow them merely to survive or genuinely to thrive deserves the same scientific attention we have devoted to nutrition, genetics, reproduction, and disease control in terrestrial livestock.

The future of aquaculture may not be judged solely by how many kilograms of fish we produce, but by how well we understand and meet the biological and behavioral needs of the animals beneath the surface. That shift, from measuring success by survival and productivity to evaluating the quality of life experienced before harvest, may represent one of the most important advances in how we define responsible food animal production.

Further reading

Maia, C. M., J. L. Saraiva, and E. Gonçalves-de-Freitas. 2024. "Fish Welfare in Farms: Potential, Knowledge Gaps and Other Insights from the Fair-Fish Database." *Frontiers in Veterinary Science* 11:1450087. <https://doi.org/10.3389/fvets.2024.1450087>

Maia, C. M., J. L. Saraiva, J. Volstorff, et al. 2024. "Surveying the Welfare of Farmed Fish Species on a Global Scale Through the Fair-Fish Database." *Journal of Fish Biology* 105(3):960-974. <https://doi.org/10.1111/jfb.15846>

Rey Planellas, S. 2026. "Fish Welfare in a Changing World: New Developments and Current Challenges." *Journal of Fish Biology*. <https://doi.org/10.1111/jfb.70423>