

BEYOND AESTHETICS: ADDRESSING ORNAMENTAL FISH WELFARE IN INDIA

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Abstract

The ornamental fish industry in India is experiencing rapid growth, driven by increasing consumer interest, government initiatives, and global trade opportunities. However, this expansion has raised significant concerns regarding fish welfare, environmental sustainability, and regulatory oversight. The purpose of this white paper is to examine the welfare conditions of ornamental fish in India, analyze gaps in existing regulations, and propose actionable solutions to ensure ethical and sustainable practices in the sector.

A qualitative research methodology was employed, incorporating a comprehensive literature review, analysis of legal frameworks, and industry insights. Primary data from trade reports, policy documents, and expert consultations were synthesized to assess current practices across the ornamental fish supply chain, from capture and handling to transportation and aquarium conditions.

The findings reveal widespread welfare issues, including high mortality rates due to poor handling, transportation stress, and inadequate habitat management. Additionally, destructive fishing practices and the introduction of invasive species pose severe threats to biodiversity and ecological balance. The study also identifies regulatory gaps, such as weak enforcement of existing laws and the absence of species-specific welfare guidelines.

The managerial implications emphasize the need for policy interventions, industry collaboration, and consumer awareness. Key recommendations include the implementation of standardized

welfare protocols, stricter regulations on harmful capture methods, improved trade monitoring, and incentives for sustainable aquaculture practices. Industry stakeholders, including government bodies, breeders, and retailers, must work collectively to enhance welfare standards and align with global best practices.

By addressing these challenges, India has the opportunity to become a global leader in responsible ornamental fish trade. This paper serves as a strategic resource for policymakers, industry leaders, and welfare advocates to drive ethical reforms and ensure a sustainable future for the sector.

Keywords: *Fisheries, ornamental, biodiversity, technology, ripple effect, aquarium.*

Introduction

Fish should not be called ornamental, as they are sentient beings with intrinsic value, not mere decorations

Ornamental fish include thousands of fish species with very unique and individualistic needs captured, cultured and traded across the world for their aesthetic appeal. Ornamental fishkeeping for aesthetic purposes dates back over 1,000 years, originating in China with the domestication of goldfish and koi, later expanding worldwide through advancements in aquarium technology and trade. Now ornamental fishkeeping has spread worldwide with advances in aquarium technology and transportation and this sector is experiencing rapid growth bolstered by an increase in disposable income for consumers and strong financial incentives for the industry.

Ornamental fishkeeping is a multi-billion-dollar industry and one of the most popular hobbies in the world. At present, India is not a leader in this global sector.

The Indian ornamental fish industry is poised for enormous growth, expected to nearly double in value by 2030, catalyzed by the sizable investments made by the Indian government and given the context of its standing in global aquaculture production.

The care and management of ornamental fish, like other animals, must consider species-specific needs throughout the production cycle. This includes stages such as capture or breeding, handling, transportation, and ultimately, the conditions in which they are housed in aquariums for most of their lives. However, due to limited public awareness, inadequate technical expertise among

handlers, and the lack of comprehensive regulations, millions of ornamental fish endure significant stress and welfare challenges at each stage of the trade cycle every year.

The absence of standardized guidelines for ornamental fish care, coupled with weak enforcement of existing laws, raises serious concerns not only for animal welfare but also for environmental sustainability and public health.

This paper seeks to analyze the scope and interconnected nature of these challenges, evaluate the current regulatory landscape in India, and propose practical solutions to mitigate the negative impacts of the ornamental fish trade. While species-specific considerations are undoubtedly important, addressing fundamental regulatory gaps and industry-wide shortcomings is essential before implementing targeted interventions for individual species. Therefore, this paper prioritizes broad, sector-wide reforms that can enhance fish welfare across multiple species rather than focusing solely on species-specific improvements.

Overview: Market Dynamics

India's ornamental fish trade, though not yet comparable to its global seafood trade, is steadily expanding, driven by nearly a million domestic hobbyists fueling domestic demand. However, accurately gauging the market size remains challenging due to limited data collection and reporting mechanisms. *Estimates suggest that in 2017-18, the domestic ornamental fish trade was valued at approximately INR 500 crores (USD 67 million) with a CAGR of 11-12%, while exports were valued at INR 8.4 crores (USD 1.1 million), accounting for less than 1% of the global market⁹. In 2019, India ranked as the 28th largest exporter, with total exports of USD 1.59 million. To bridge this gap and leverage growth opportunities, the Government of India, through the Department of Fisheries under the Ministry of Fisheries, Animal Husbandry and Dairying, launched the Pradhan Mantri Matsya Sampada Yojana (PMMSY) in September 2020, allocating INR 576 crores for the ornamental fish sector to support new production units, marketing, promotion, and skill development. While assessing the exact impact of PMMSY on the domestic market remains difficult due to data limitations, World Bank statistics indicate a notable improvement in India's export competitiveness in the ornamental fish sector.*

As previously stated, in 2019, India was the 28th largest exporter, with exports valued at USD 1.59 million, and by 2023, it had climbed up to become the 15th largest exporter, with exports worth

USD 4.97 million.¹¹ This significant growth reflects a 212% surge in exports between 2019 and 2023. Therefore, it can be inferred that India's ornamental fish market is well-positioned for further expansion, with international trade prospects looking increasingly promising.

This growth comes with challenges—limited data collection, inadequate reporting, and weak monitoring continue to hinder the sector. Outdated models make existing data unreliable for accurate market assessment, a concern also highlighted by the Ornamental Fisheries Training and Research Institute (OFTRI). As a Project Monitoring Unit under the NFDB, OFTRI oversees NFDB-funded ornamental fisheries projects across multiple states. Its acknowledgement of these issues is particularly concerning, given the substantial public investment under PMMSY.

The absence of robust data collection and monitoring points to weak regulatory oversight, casting doubt on the credibility of environmental sustainability and animal welfare claims. If left unaddressed, these gaps could undermine India's market growth and export potential, as sustainability and welfare concerns may hinder the sector's progress and expansion.

Market Analysis

This sector is driven by a diverse group of buyers, including hobbyists, pet owners, private and government aquarium owners, pet shop owners, retailers, exporters, Self Help Groups, fishermen and aquaculture farmers. There is also a growing trend of displaying ornamental fishes for entertainment, to generate revenue through entry fees at various exhibitions, like the ornamental fish exhibitions held in various cities across India.

Freshwater ornamental fish contribute to about 80%- 90% of the ornamental fish trade in India with the remaining 10%- 20% being from marine and brackish waters. The north-eastern states contribute around 85% of the total freshwater fish market, with the rest originating from southern states.

The domestic sector is growing at a projected rate of 20% and demand outweighs supply. Within the domestic market, 99% of the fish are exotic, consisting of approximately 288 varieties of ornamental fish that are not indigenous to India.

Trade Cycle

India's ornamental fish trade remains largely unorganized, sourcing fish from wild freshwater, brackish, and marine bodies or through aquaculture. Despite being the world's second-largest aquaculture producer, India cultivates only 2-5% of its marine ornamental fish, with 95-98% still wild-caught. While 98% of the domestic freshwater trade relies on cultured fish, 90% of freshwater ornamental exports come from wild indigenous species.

Rising demand has led to overharvesting, threatening sustainability, especially with high mortality rates exacerbating ecological strain. In response, aquaculture is being promoted, though it has its own sustainability concerns, India is also advancing hatchery technology to reduce dependence on wild stocks, with CMFRI developing breeding methods for species like seahorses and clownfish.

However, poor welfare and management lead to nearly 90% mortality in the trade, particularly during transport. Many surviving fish suffer injuries, illness, or are discarded. Those that make it to wholesalers and retailers receive minimal care, just enough to maintain profitability. These welfare failures not only impact sustainability but also impose significant economic costs, with the trade's market value representing only a fraction of the fish that suffer through its cycle.

Ripple Effects

1. Environmental Degradation

Ornamental fish farming, whether indoor or outdoor, optimizes resources like land, labor, and costs but often at an environmental cost, impacting soil, water, and air quality. *Excessive nutrients from feed, chemical contaminants, and organic waste degrade soil, reducing fertility and causing erosion.*

Water quality suffers from toxic chemicals like sodium cyanide used in fish capture, which harms aquatic life and poses severe health risks, including cyanide poisoning when it contaminates water sources. Additionally, improper disposal of fish waste and carcasses leads to ammonia spikes, further threatening aquatic ecosystems.

Biodiversity Loss

The ornamental fish sector poses significant biological and ecological threats to both aquatic and terrestrial ecosystems. These impacts can lead to localized species depletion and, in some cases, extinction. The aquarium fish trade can devastatingly affect coral reefs and their occupants, as well as inland fish biodiversity, threatening the existence of many endangered species of fish that are already subject to the effects of global warming and habitat destruction.

Biodiversity loss caused by the ornamental fish trade is primarily related to destructive capture practices, and the introduction of invasive species and exotic diseases.

1) Destructive Capture Practices

A major contributor to the loss of aquatic biodiversity occurs when ornamental fishes are captured using destructive fishing practices. Fish collectors practice cyanide fishing, which is done by crushing and dissolving sodium cyanide tablets in squirt bottles that are sprayed on the target fish for easy capture. Since corals play a pivotal role in aquatic ecosystems, this damage destroys their ability to support the numerous creatures that inhabit them, further compromising the ecological balance in these vital habitats.

Some corals are protected under the law and the use of destructive practices is prohibited around them. The Department of Fisheries, Government of India recommended banning the use of noxious and harmful chemicals and poisons for fishing.

2) Invasive species

Invasive fish are non-native species that disrupt ecosystems, outcompete native species, and cause biodiversity loss, economic damage, and habitat destruction. They often enter the wild through aquarium releases and fish farming, with the ornamental fish trade significantly contributing to their spread. Once established, invasive fish alter aquatic ecology by changing water chemistry, depleting resources, preying on native fish, and destroying eggs and larvae.

*India's documentation of invasive ornamental species remains limited, yet they pose a major ecological threat. Many, like guppies (*Poecilia reticulata*), giant gouramis (*Osphronemus goramy*), and swordtails (*Xiphophorus maculatus*), have been recorded in biodiversity hotspots like Kerala's Chalakudy River. The Alligator Gar (*Atractosteus spatula*) was found in Bhopal's Upper Lake (Bhoj Wetland) in 2023, a protected area. Species like *Pterygoplichthys* sp. disrupt*

food chains by overgrazing algae, uprooting plants, and causing bank erosion, while their sharp spines increase shorebird mortality.

Despite a third of the world's worst aquatic invasive species being ornamental, regulations remain inadequate, and India lacks comprehensive data on their impact. The Strategic Plan for Biodiversity 2011-2020 under the Convention on Biological Diversity (CBD) stressed the urgency of controlling invasive species, yet enforcement remains weak. India trades 300 ornamental fish species, many endangered, highlighting the need for stricter regulations. Without intervention, invasive species could severely threaten native freshwater biodiversity.

3) Exotic Diseases

Transportation of ornamental fish across different regions can lead to disease transmission which can significantly harm local fish populations. While transporting ornamental fishes in different batches, the same water is used, which increases the spread of diseases between fish. This water itself contains pathogens, which are subsequently disposed of into natural water bodies, leading to contamination.

Large-scale international transfers of aquatic animals have been implicated as vectors for the introduction of exotic pathogens, resulting in substantial ecological and economic repercussions in the recipient countries. There have been documented cases of introduced non-native fish diseases in the wild causing threats to coastal ecosystems in the US and Caribbean.

Carbon Emissions

Ornamental fish farming and aquarium keeping, much like other forms of aquaculture, require substantial energy for water pumping, heating, filtration, aeration, and lighting, all of which contribute to the industry's carbon footprint. Key factors influencing this footprint include energy-intensive fish feed production, transportation, and farm management practices. The production of fish feed for ornamental species is particularly energy-demanding and a major source of carbon emissions.

Capture practices that impact the coral reefs also increase the carbon footprint of this sector. Since the corals contribute to carbon and nitrogen cycling, their destruction can disrupt these essential aquatic ecological processes. Habitat destruction for the culture (breeding, storage) of ornamental fishes can contribute to biodiversity loss which leads to carbon sequestration loss.

The transportation of ornamental fish, often via airfreight, measurably increases the energy emissions of this industry due to the high energy input needed to maintain appropriate conditions during transit. This can be mitigated by decreasing the import of ornamental fish for trade.

Water Consumption

Water is an irreplaceable abiotic input for both the culture of ornamental fishes and in aquariums and tanks for housing and display of fish and effective water quality maintenance. Let us look at the yearly water consumption for weekly water changes of 6%–25% for aquariums and tanks, which varies by tank size. *On average, for a small tank with a capacity of 50 litres, the water consumption ranges from 156 to 650 litres per year. A medium tank, holding 200 litres, uses between 624 and 2600 litres annually. For a large tank with a capacity of 400 litres, the yearly water consumption ranges from 1248 to 5200 litres.* If the water used for aquariums and tanks is from Reverse Osmosis (RO), the consumption and wastage rise significantly. An approximate 5 litres of water is wasted for every litre of water produced using RO technology. This takes the annual rejected RO water produced weekly for water changes of 6%–25%, varying by tank size, to staggering levels. *Approximately, by taking the average reject water per litre of water produced using RO as 5 litres, for a small tank with a capacity of 50 litres, the reject water ranges from 780 to 3250 litres per year. A medium tank, holding 200 litres, generates between 3120 and 13,000 litres of rejected water annually. And a large tank with a capacity of 400 litres, the annual rejected water produced is between 6240 and 26,000 litres.* This projected use does not include aquaculture, which also places an additional strain on water resources.

This makes water consumption of the sector a particularly crucial factor for India to consider, where groundwater depletion is severe, and many regions are experiencing droughts and water shortages. *Major cities such as Delhi and Bangalore are grappling with this crisis already. Recently, the Jal Shakti Ministry confirmed in the Rajya Sabha that India will be in a water stress situation by 2030. A 2020 World Wide Fund report highlighted that 30 Indian cities are expected to face water scarcity by 2050.* This issue could become a key point of focus for ensuring the sustainability of the sector.

Public Health

Exposure to ornamental fish, whether as a hobby or profession, poses a risk of zoonotic infections, particularly for vulnerable populations. *Public health concerns in this sector include zoonotic pathogens and antimicrobial resistance (AMR)*, both exacerbated by increasing global trade, weak import regulations, and inadequate veterinary oversight. The ornamental fish industry facilitates the transboundary spread of diseases, bringing zoonotic risks into homes and workplaces.

Zoonotic transmission primarily occurs through direct skin contact with fish, contaminated water, or wounds. Industry professionals, including handlers, inspectors, and hobbyists, face the highest risk, while immunocompromised individuals, infants, and those with pre-existing conditions are especially vulnerable. *Mycobacterium marinum is the most commonly reported pathogen, showing antibiotic resistance and even causing fatalities in immunocompromised patients.*

India's warm climate further heightens these risks by fostering bacterial growth in aquaculture systems. Regulatory gaps, poor enforcement, and lack of training worsen the situation, emphasizing the urgent need for government action. Strengthening regulations, educating industry workers, and launching public awareness campaigns on zoonotic risks and AMR are critical. Expansion of this sector must adopt a precautionary approach to prevent potential outbreaks.

In India, zoonotic risks in ornamental fish trade are amplified by regulatory gaps, poor enforcement, and inadequate training. Warmwater conditions (above 25°C) further promote bacterial growth, heightening public health concerns. Urgent government action is needed to regulate zoonotic risks and AMR. Strengthening industry training, public awareness, and enforcement is crucial to prevent outbreaks while balancing sector expansion with a precautionary approach.

Current State of the Ornamental Fish Sector

Fish are fascinating animals that, despite ongoing debate, display clear signs of sentience. Recent research has shown that fish possess good memory capacities, live in intricate social communities where they recognize individuals, learn from one another and exhibit signs of reconciliation and cooperation. Fish construct complex structures, are capable of tool use and some species have also displayed the ability to recognise themselves. *Their primary senses are comparable to those of humans, and in some cases their sensory capacities supersede us. They employ similar methods as*

humans for keeping track of quantities. This information underscores the ethical obligation to address the impact of the ornamental fish sector on the welfare of these complex sentient beings.

Although there is no universally accepted definition of fish welfare, most definitions encompass the principles in this section. For this paper, fish welfare is described as *striving for a positive state of well-being that allows the fish to be able to exhibit natural behavioural, social and physiological characteristics*. This definition includes the principles of the “five freedoms” developed by the World Organisation for Animal Health (hereinafter “**WOAH**”) for terrestrial animals, which has been read into Section 3 and 11 of the Prevention of Cruelty to Animals Act, 1960 (applicable to all animals, including fishes), by the Hon’ble Supreme Court of India.

Ensuring fish welfare requires providing an appropriate environment that meets all relevant parameters. *These parameters include but are not limited to, maintaining optimal water quality, selecting suitable tank size and layout, fostering a compatible fish community, and providing proper nutrition.*

To evaluate fish welfare effectively, several key indicators can be measured. Stress, which can be measured through cortisol levels using both invasive and non-invasive methods (like testing the water in which the fish are held), serves as a primary indicator. Additionally, behavioural indicators like natural swimming patterns and functional indicators like fin damage and mortality help identify issues in fish welfare.

Understanding these welfare indicators is particularly important when considering the life cycle of ornamental fish, which encompasses multiple stages, each presenting its unique challenges and stressors. *Unfortunately, mortality rates for ornamental fish are exceedingly high, with most ornamental fishes succumbing to a range of welfare issues either before or after reaching the customer.* Fish display exacerbated responses to stress when forced to endure multiple or sequential stressors. Providing 24-hour recovery periods between stress can reduce the cumulative impact of stress on these animals.

Wild-caught ornamental fish endure multiple stressful stages, from capture to purchase, while aquaculture-bred fish face captivity-induced stress due to artificial environments. Sensitivity to temperature, salinity, and water chemistry makes suboptimal conditions a major cause of stress

and mortality. In many ways, aquaculture is more challenging and prone to higher issues than terrestrial animal culture.

Cultured fish are spawned, hatched, or born live, transported and raised in restricted and often stressful environments until they reach marketable size. After they reach this size, they undergo the same trade cycle as wild-caught fish, facing similar stress and welfare challenges.

The typical ornamental fish destined for an aquarium, irrespective of species, will be transported to a retailer, through middlemen and wholesalers, kept in a display tank and be dip-netted into a bag for transport to the customer's aquarium, usually in their home, where it is released. The final and typically longest phase is in the tank of the hobbyist or aquarium that purchases the fish. Aquarium fish often live in suboptimal conditions and unlike fish in their natural habitats, cannot escape a potentially harmful environment. Even the preeminent outfitted aquarium, combined with meticulous concern for water quality parameters, can never fully recreate the conditions available to these animals in the wild.

Challenges in Ornamental Fish Welfare

Capture

In India, most marine ornamental and exported freshwater fish are wild-caught, often using harmful methods like cyanide and blast fishing. These practices cause severe stress, injury, and high mortality rates, with cyanide exposure leading to irreversible damage and blast fishing destroying habitats. Many fish are discarded due to fin damage, wounds, or emaciation post-capture. A comprehensive ban on destructive fishing methods, including cyanide, blast fishing, and bottom trawling, is crucial for marine conservation, yet weak regulations allow these practices to persist.

Culture

The domestic freshwater ornamental fish trade is primarily reliant on aquaculture. In aquaculture, many stressors occur including poor water quality, handling, confinement, poor social and physical environment and disease.

Chronically or repeatedly stressed fish experience immunosuppression and as a consequence are more at risk of disease. Poor facilities and filtration of water can also lead to the concentration of pathogens in recirculating culture systems. Many diseases of ornamental fishes are caused by

pathogens that are extremely common and tend to manifest opportunistically in times of stress. Diseases can be either of parasitic, bacterial, viral or fungal origins and common symptoms include ulcers, fin and tail rot, dropsy, constipation, clamped fins, swim bladder inflammation, pop eyes and cloudy eyes, flip over disease, skin abnormalities and lesions.

Furthermore, intensive breeding and the abuse of genetic selection which tends to standardize size and colour variation has reduced disease resistance and health in ornamental fish. The resistance of some of the most popular ornamental fish species has decreased, with a subsequent increase in induced pathologies.

Handling

Handling fish, even briefly, can cause considerable stress, raising cortisol, in many species. The proficiency of the handlers plays a significant role in mitigating stress, which has a resultant impact on mortality rates.

Handling stressors are often repetitive, and reducing these stressors plays a tangible role in improving the welfare and survival of fish. Effective stress-mitigation techniques can include using wet, gloved hands, specially designed nets that safeguard the skin's mucous layer and scale, as well as the use of pain relievers such as clove oil to sedate fish before intense handling.

This highlights the necessity to improve and create new methods of handling as well as encourage comprehensive training for individuals handling fish.

Transportation

The transit routes of ornamental fishes are intricate and dynamic, spanning thousands of miles from their production origins and countries of source through various holding and transshipment facilities, from wholesale traders to retailers. The welfare of ornamental fish during transportation often raises significant animal welfare concerns.

During transit, fish may experience stress due to overcrowding, poor water quality, temperature fluctuations, and inadequate oxygen levels. These stressful conditions can lead to increased susceptibility to diseases, injuries, and mortality. Ensuring humane handling, proper packing

techniques, and maintaining optimal water conditions are crucial to minimizing mortality caused by welfare issues faced by ornamental fishes during transportation. During their transportation, fish may be placed in poorly packed containers like plastic bags, experience sudden changes in temperature, or experience events such as being dropped in their shipping boxes or loss of water through damaged and leaking bags. Rapid temperature changes, blunt force trauma and constriction are known causes of stress and often death.

Tank-based transportation is ideal for monitoring water quality and maintaining welfare but is an impractical solution due to the added costs associated with it. *Maintaining water quality is the primary way to minimize mortality during transportation, and techniques such as placing pure oxygen in the remaining space within the plastic bags can significantly help improve water quality during transportation which often lasts more than 12 hours or slow-release oxygen tablets, This is particularly important for warm-water ornamental fish species, which represent the majority of the ornamental fish trade in India, as there is less dissolved oxygen stored in higher-temperature water. Reducing waste buildup during transportation can also improve fish health and welfare but is slightly harder to ensure as different species' waste production systems and adaptability to water conditions can vary significantly. Implementing packaging and transport standards for ornamental fish can significantly improve fish welfare and reduce mortality rates. Unfortunately, in India, there is currently no regulation that prescribes even minimum standards for the transportation of these animals unlike most other commonly traded and transported terrestrial species that have species-specific standards under the Transport of Animals Rules, 1978. Although there is technically a Bureau of Indian Standards' Code, IS 10449:2024, on the Transportation of Ornamental fish, it is not mandatory and therefore limited in its application.*

Physical Environment

Ornamental fish come from diverse environments but share a common purpose—display. Their needs for space, water quality, and temperature vary widely, making welfare highly dependent on proper care. Most live in artificial environments, from culture tanks to home aquariums, where poor conditions, such as unsuitable water parameters, often lead to stress. Since critical values differ by species, general guidelines must be supplemented with species-specific standards.

When fish are dissatisfied with their current environment, they have three possible coping methods. *First*, they can adapt their physiology to suboptimal conditions through acclimation, gradually overcoming the mismatch between themselves and their environment. *Second*, they can migrate to a location with better conditions, a preferred tactic for many marine fish species. *Third*, they can resign themselves to poor welfare conditions and do their best to survive.

Water Quality

Water quality encompasses salinity, pH level, temperature, ammonia, nitrate, nitrite, dissolved oxygen, hardness, carbon dioxide, alkalinity, turbidity, chlorine and chloramines. The importance of water quality and composition in fish exhibits and habitats is essential to the health and well-being of all fish species. Stress responses to poor water quality in fishes cause changes in blood chemistry, haematology, cellular permeability and osmoregulatory needs in fishes. This triggers the fish's adaptive responses. When the fish fail to adapt effectively, noticeable behavioural changes and visible lesions or deformities occur. *The point at which the stress response becomes visibly noticeable is usually after the welfare of the fish has been significantly compromised.*

Optimal ranges for water quality parameters differ for each species. Besides the obvious differences in water quality parameters for fish such as salinity, some fish require different water quality parameters for various stages of their life cycle. In mixed tanks, ensuring optimal ranges for all species therefore becomes invariably complex. Even if members of one species can survive in a tank, they may still undergo chronic stress if the variables are unsuitable. Therefore, when choosing species for a mixed community tank, it is essential to consider species-specific ranges and compatibility to minimize stress, allowing for mere survival rather than thriving. Regular monitoring and keeping permanent records of water quality parameters help balance and enhance aquatic environments for fish.

Habitat Design

Though the long-term effects of captivity on fish are not well understood, designing species-specific habitats significantly improves welfare. Tanks should be non-toxic, free of sharp edge,

and appropriately sized, as wider, larger tanks reduce stress and maintain stable water conditions. Stocking densities must match tank size and species' social behavior.

Environmental enrichment, such as adding structures, plants, and hiding spots, reduces stress and supports natural behaviors. *While hobbyists often prioritize enrichment, aquaculture focuses more on convenience and cost, neglecting welfare. Social dynamics also impact well-being, as tankmates, hierarchy, and bullying can cause stress. Additionally, lighting conditions influence fish physiology, varying by species, life stage, and natural habitat.*

Nutrition

Food plays an important role not just in the health, well-being and immunology of the fish but also in their colour and, consequently, their value. In natural conditions, fish can regulate their diets more easily, reducing the likelihood of nutritional deficiencies, in comparison to confined tanks and spaces.

Fish can be classified as carnivores, herbivores and omnivores based on their species. Fish also exhibit diverse feeding patterns, including surface, column and bottom feeding. Additionally, different fish species range in frequency of consumption, from once-a-day feeders to continuous grazers, and factoring these diverse needs is essential to maintain welfare.

Providing appropriate diets for ornamental fish species can enhance nutrient digestibility, meet metabolic needs, reduce water pollution, increase fish immunology and improve survival rates. Nonetheless, most of the information on the nutritional requirements of fish comes from studies that anchor on the aquaculture of fish for food, which is insufficient to effectively understand the needs of ornamental fish. It is therefore important to conduct research to better ascertain the nutritional needs of ornamental fish.

Gaps in Regulatory Framework and Compliance

The regulatory framework in India, utilizing central, state and international laws, provides for animal and environmental protection through a multi-faceted approach. *In India, Fisheries, including ornamental fish, are governed by the State List Therefore, Inland fisheries are entirely managed by state/UT governments. States jurisdiction also extends to the development and*

regulation of marine fisheries within the 12 nautical mile territorial waters limit. Fishing and fisheries beyond territorial waters are governed by the Union Government, therefore the centre holds the responsibility for the management and regulation of marine fisheries in the Exclusive Economic Zone (EEZ), extending from 12 nautical miles up to 200 nautical miles.

Animal welfare; protection of wild animals and birds and forests (environment, biodiversity and wildlife); the prevention and control of the spread of infectious or contagious diseases affecting humans or animals (diseases affecting fish and zoonosis), fall under the Concurrent List, following both central and state authorities to regulate this area.

The Constitution of India outlines the duties of citizens and the State through various Fundamental Duties and Directive Principles of State Policy. Notably, it obliges the State to improve public health, nutrition, and the standard of living; Directs the State to organise animal husbandry along modern and scientific lines; tasks the State with the protection and betterment of the environment, forests and wildlife; and calls on citizens to have compassion for all living creatures. These articles in the constitution of India, while not being justiciable, are still valuable because they promote an ecocentric lens towards policy making.

India's ornamental fish trade is governed by various laws alongside policies and schemes by the Department of Fisheries. Key initiatives include the Pradhan Mantri Matsya Sampada Yojana (with the National Surveillance Programme on Aquatic Animal Diseases Phase-II), the Blue Revolution scheme, the Fisheries Infrastructure Development Fund (FIDF), and the Kisan Credit Cards scheme. Other notable efforts include the Sanitary Protocol for Import of Ornamental Fishes and action plans like *Development of Ornamental Fisheries: 2020-2025* and *AquaRainbow Vision 2030*.

A. Central Laws

LAWS RELATING TO ORNAMENTAL FISH WELFARE

The primary anti-cruelty legislation in India is the Prevention of Cruelty to Animals Act, 1960 (hereinafter “PCA”) which aims to ensure basic welfare and prevent unnecessary suffering of animals. The PCA is applicable to all animals, including fish. Although there are no specific Rules

for fish, certain provisions of Rules framed under the PCA like the Pet Shop Rules, the Regulation of Livestock Market Rules, 2017, Transport of Animals Rules, 1978 are also applicable.

The Act and the rules framed thereunder unfortunately do not prescribe any fish-specific minimum standards enabling ambiguity in implementation and leading to the suffering of millions of fish. *Furthermore, Indian criminal law such as the Bharatiya Nyaya Sanhita, 2023, read with the procedural law Bharatiya Nagarik Suraksha Sanhita, 2023, contains provisions that can be applied for mischievous killing and maiming or wanton cruelty to ornamental fishes, depending on the facts of a case.*

Laws Relating to Protecting Wildlife and Biodiversity

The ornamental fish trade has grave sustainability concerns as discussed in the previous section of this paper. As a result, some of the laws relating to the conservation of wildlife, natural ecosystems and biodiversity also apply to the ornamental fish sector. The government has made some attempts to address sector-specific environmental concerns like the ban on cyanide fishing.

Although there are some laws applicable, they are not comprehensive enough to adequately target the issue. The primary central legislations applicable are the Biological Diversity Act, of 2002 and the Wildlife Protection Act, of 1972 as amended in 2022.

The Biological Diversity Act, 2002 along with its amendments and the Biological Diversity Rules, 2004, is aimed at preserving biological diversity, ensuring sustainable use of its components, and fair sharing of consequent benefits. The Act establishes the National Biodiversity Authority (NBA), State Biodiversity Boards (SBB) and Biodiversity Management Committees (BMC) at the local level to implement its provisions. The Act also addresses access to biological resources and associated traditional knowledge, requiring prior approval for commercial use and research.

The *Centre for Biodiversity Policy and Law (CEBPOL)*, established within the NBA in 2013 through an India-Norway collaboration, strengthens biodiversity policies and stakeholder capacity. It focuses on mainstreaming biodiversity, Access and Benefit Sharing, invasive species, and global agreements.

As a statutory body, the NBA can advise the government on notifying threatened species and regulating invasive alien species (IAS). Lessons from the African catfish case highlight the need

to prioritize and control other invasive fish to prevent ecological damage. Collaborating with NBA and CEBPOL can support India's commitments under the *UN Convention on Biological Diversity (CBD)*.

The Wild Life (Protection) Act, of 1972, along with its amendments also play an important role in addressing some of the negative externalities of the ornamental fish trade. *Some ornamental fish are protected species listed¹²¹ under the act which prohibits their hunting and trade. It also addresses the management of invasive species by including specific provisions to regulate and control the introduction and spread of alien species in India through the National Board for Wildlife.* The Act aims to conserve fish species by regulating and monitoring their exploitation, ensuring sustainable use, and preventing overfishing, invasive species and habitat destruction.

The Coastal Regulation Zone notification was first issued under the EPA in 1991, followed by various amendments. Superseding previous versions, the 2019 notification declares specified stretches of coastal land as Coastal Regulation Zones (CRZs) across 4 categories. The setting up of new industrial activities and expansion of existing operations is prohibited across all CRZs. This includes fish processing units and the disposal of plastic waste into the ocean to further safeguard aquatic life. *Exceptions to prohibited activities and regulation of permissible processes such as fishing are given under specific CRZ categories.* The notification also provides for the regulation of marine and brackish water fish-rearing units, in addition to the policies of the Coastal Aquaculture Authority.

Mangroves and coral reefs are important habitats for wild fish and invertebrates, providing ecosystems for feeding, spawning, shelter etc. *The notification declares them to be Ecologically Sensitive Areas (ESAs) under CRZ-I. It states the need to conserve mangroves in the management of Critically Vulnerable Coastal Areas. Declared mangroves are further protected under the Forest (Conservation) Act, 1980 and undeclared ones by the concerned State Government/Union Territory. The destruction of corals and coral reefs is prohibited and other activities are regulated as given in the notification.* This is crucial for the prevention of destructive practices such as the use of explosives or cyanide and other poisonous compounds which harm mangroves, corals and others within the coastal aquatic ecosystem. Aquaculture as discussed earlier falls under the subject

matter of - the state -. This has led to vast discrepancies in the efficacy of regulation frameworks with some states having no regulation at all.

In 2011, *The Marine Products Export Development Authority (MPEDA)* constituted a "Task Force" to develop the *Guidelines for Green Certification of Freshwater Ornamental Fish* the only certification of its kind in India. The initiative aims for the conservation and sustainable development of the freshwater ornamental fish sector, covering collection, farming, and marketing through a certified value chain system. The Certification was proposed to be introduced voluntarily in phases, with mandatory certification for wild-caught native ornamental fish after a three-year transition period. It includes missions such as raising societal awareness, promoting ecosystem management, reducing wild stock dependency through captive breeding, establishing protected areas, adopting eco-friendly practices, preventing the release of farmed species into natural water bodies, and maintaining proper documentation at all stages. *However, through an RTI it was gathered that these guidelines have not been implemented since 2011 and not a single Green Certificate for freshwater ornamental fishes has been issued by MPEDA to date.*

Laws Relating to Disease Transmission in The Ornamental Fish Sector.

Zoonotic outbreaks pose a risk to the ornamental fish trade, making disease prevention laws crucial. The *Prevention and Control of Infectious and Contagious Diseases in Animals Act, 2009* (PCICDA) mandates disease identification, reporting, quarantine, and vaccination for aquatic animals. It empowers authorities to enforce biosecurity measures and establish disease-free zones, listing specific fish diseases under its control.

The *Livestock Importation Act, 1898* regulates livestock imports, including live fish, crustaceans, and mollusks, to prevent infectious diseases. The central government enforces this through Sanitary Import Permits and quarantine protocols for ornamental fish imports.

B. State Laws

Fisheries is a State subject under the 7th Schedule of the Constitution of Indiaⁱ. Inland fisheries are entirely managed by state/UT governments that also develop and regulate marine fisheries within the 12 nautical mile territorial limit.

Inconsistent policies across states pose major challenges to fisheries and aquaculture management. Varying regulations and enforcement lead to disparities in sustainability, overfishing, and environmental impact. This lack of uniformity also hinders efforts to combat illegal fishing, habitat destruction, and invasive species introduction. A fragmented regulatory framework hampers disease control, food safety, and antibiotic management in aquaculture. A unified, centralized approach is needed to align policies with national goals on sustainability, public health, and animal welfare. Standardization will mitigate risks and ensure the industry's long-term viability. An example of this discrepancy is best highlighted by comparing the state regulatory frameworks of Andhra Pradesh and Madhya Pradesh, two states currently growing their aquaculture production. *Andhra Pradesh*, the top aquaculture producer, has a robust and detailed regulatory regime that governs aquaculture and fisheries The Andhra Pradesh State Aquaculture Development

Authority Act, 2020 (APSADA Act) and Rules; Andhra Pradesh Fish Seed (Quality Control) Act, 2006 and Rules; and Andhra Pradesh Fish Feed (Quality Control) Act, 2020 and Rules play a crucial role in regulating the aquaculture sector in Andhra Pradesh. Additionally, the State Fisheries Department has issued several Government Orders (G.Os that govern the aquaculture and fisheries supply chain. The legal framework regulates aquaculture through licensing, environmental protection, disease management, financial aid, infrastructure, monitoring, market access, and penalties for non-compliance. However, poor enforcement, water pollution, over-extraction, low farmer awareness, and weak quality control remain key challenges.

Madhya Pradesh, in contrast, is an emerging player in the sector and lacks comprehensive policies for aquaculture. The state does not have any legislation focused on aquaculture and only regulates fishing through licensing. There is a need for states like Madhya Pradesh to develop comprehensive policies and enact future-proof laws to ensure the growth of fisheries and especially aquaculture is balanced with environmental sustainability, public health and animal welfare.

Future Proofing Ornamental Fish Welfare in India

Enhancing Research and Data Collection

The ornamental fish sector lacks comprehensive, up-to-date data, hindering effective policymaking. Current research primarily focuses on the Northeast region, missing a broader industry perspective. To bridge this gap, we propose

- Assessing fish welfare and industry impact across all trade stages.
- Researching sustainability to minimize environmental footprint.
- Developing a national database cataloguing species, trade patterns, and conservation status.

Strengthening Regulatory Frameworks

A comprehensive legal framework is essential for fish welfare, sustainability, and public health.

Key interventions include:

- Defining minimum welfare standards for breeding, transport, and trade.
- Establishing species-specific SOPs in collaboration with industry experts.
- Strengthening monitoring systems to track illegal trade and overfishing.
- Prioritizing invasive species control under the Biological Diversity Act, 2002.

Ensuring Effective Law Enforcement

Regulations must be strictly enforced through:

- Training workshops for law enforcement to identify cruelty in breeding farms, pet shops, and aquariums.
- Strengthening the Prevention of Cruelty to Animals Act, 1960, by increasing penalties.

Regulation by the Central Pollution Control Board (CPCB)

The CPCB should include ornamental fish breeding under its regulatory framework, enforcing:

- Effluent and waste management standards.
- Water and air quality regulations.
- Environmental compensation for violations.

Implementing Monitoring and Tracking Systems

Without proper tracking, assessing investment impacts and sustainability claims is impossible.

We recommend:

- Allocating a fixed percentage of government funds to monitor industry impact.
- Implementing state-level licensing and inspections to ensure compliance.

Encouraging Voluntary Certifications

In the absence of mandatory welfare laws, industry-led self-regulation should be promoted through:

- Green Certification (MPEDA) for domestic stakeholders.
- International standards like Green Aquaria Certification and Friend of the Sea.ⁱⁱ

Building Capacity and Training

Unskilled handling leads to severe welfare concerns. To mitigate this:

- Educate breeders, traders, and pet owners on proper fish care.
- Train veterinary and public health professionals on zoonotic disease management.
- Increase awareness about fish sentience and responsible aquarium keeping.

Preventing Zoonotic Disease Spread

To minimize public health risks, we propose:

- A centralized database for tracking disease outbreaks.
- Mandatory health certifications for domestic and international trade.
- Biosecurity protocols for handling, transport, and quarantine.
- Routine inspections of breeding farms, pet shops, and aquariums.
- Collaboration with WHO and OIE for global disease prevention strategies.

Conclusion

The ornamental fish sector in India presents economic opportunities but also poses challenges to sustainability, fish welfare, and public health. Growth in this industry must be balanced with regulatory reforms and capacity building, ensuring compliance with constitutional mandates, national laws, and international obligations.

A comprehensive scoping study is essential to assess the sector's impact, regulatory gaps, and priority areas for intervention. This should include surveys, field research, and documentation to

provide data-driven insights for informed policymaking. *A structured policy framework will help improve fish welfare, protect the environment, and ensure sustainable industry growth while mitigating negative socio-economic impacts.*

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