



Enhancing Hong Kong's Aquaculture Competitiveness: The New Trend of Aquatic Animal Welfare —The First Hong Kong Aquatic Animal Welfare Guide—

1. Introduction

1.1 Animal Welfare and Sustainable Development

Hong Kong is a globally significant hub for seafood consumption, with an annual per capita fish and seafood consumption of approximately 66 kg, ranking fifth worldwide.¹ This positions Hong Kong as a key player in advancing aquatic animal welfare. With the Agriculture, Fisheries and Conservation Department (AFCD) actively promoting aquaculture development and adopting new technologies, now is an opportune time to explore ways to enhance aquatic product quantity, quality, and value.²

The global aquaculture industry is undergoing a transformation. In 2022, aquaculture production (51%) surpassed capture fisheries for the first time. Global trade in aquatic products reached a historic high of USD 195 billion, a 19% increase from 2019. By 2032, aquaculture production is projected to rise to 111 million tonnes, accounting for 54% of total aquatic animal production and 60% of aquatic food for human consumption.³ Amid this trend, robust animal welfare measures not only improve the quality of life for aquatic animals but also deliver the following benefits:

Economic Benefits

- **Higher Profits:** Improving animal welfare reduces losses from disease and mortality, allowing producers to gain greater profits.
- **Enhanced Competitiveness:** As global consumers and investors increasingly prioritise animal welfare and product traceability, welfare-oriented production can unlock premium markets and improve yield and quality.⁴
- **Increased Survival Rates:** Optimal environmental conditions reduce morbidity and mortality.^{3, 5} (e.g., fish farms in Scotland and shrimp farms in Bangladesh have improved yields and management efficiency through welfare enhancements.)^{6, 7}
- **Improved Product Quality:** Minimizing stress during rearing and slaughter preserves tender meat quality. Stressed fish struggle excessively, producing higher lactic acid levels and lowering pH, which compromises preservation and meat texture.⁸
- **Increased Feed Efficiency:** Minimising stress sources accelerates fish growth and improves feed conversion efficiency.^{9, 10}

- **Employee Satisfaction:** Most employees acknowledge that fish are sentient and welcome environmental improvements. Clear welfare guidelines enhance employees' sense of achievement. ⁴

Environmental Benefits

- **Reduced Environmental Pollution:** Improved water quality management minimises waste discharge, lowering impacts on surrounding ecosystems. ^{11, 12}
- **Reduced Ecological Disruption:** Good welfare supports fish feeding, reduces feed waste, and minimises attraction of wild fish, lowering disease and parasite transmission risks. Escapes of farmed fish are also reduced, decreasing risks to wild populations. ⁴
- **Enhanced Resource Efficiency:** Well-designed aquaculture systems improve energy and water efficiency. ¹³

Social Benefits

- **Enhanced Food Safety:** Good welfare improves fish meat quality, extends shelf life, and ensures safer food products. ¹⁴
- **Reduced Antibiotic Use:** Improved welfare strengthens fish immunity, reducing the need for antibiotics and the risk of antimicrobial resistance. ⁴
- **Alignment with International Standards:** Countries increasingly demand higher welfare and quality standards for seafood, meeting such standards can lead to international certification. ^{4, 15, 16}
- **Addressing Public Concerns:** An EU survey indicates that 91% of respondents believe fish should receive welfare protections equal to or greater than other farmed animals. ¹⁷

1.2 Background and Purpose

Purpose of the guide:

Planet For All is launching Hong Kong's first "Aquatic Animal Welfare Guide" (first version) to spark discussion and raise awareness of aquatic animal welfare among stakeholders. We invite all stakeholders—including the aquaculture industry, consumers, and policymakers—to actively participate and provide valuable feedback, with the aim of collaboratively developing an improved version tailored to Hong Kong's context.

We aim to achieve the following objectives:

- **Establish a benchmark for quality and welfare in Hong Kong's aquaculture industry to promote sustainable development;**
- **Provide practical operational guidance to the industry to enhance efficiency and seafood quality;**
- **Increase public awareness and concern for aquatic animal welfare, thereby advancing food safety and environmental improvements.**

This guide is developed based on the following context:

Local Context

- The Hong Kong government's "Blueprint for the Sustainable Development of Agriculture and Fisheries" proposes upgrading and transforming local aquaculture to enhance competitiveness. ²

- Hong Kong consumers show growing concern for food safety and sustainable production,¹⁸ with approximately 64% of young respondents indicating a willingness to pay more for sustainable and environmentally friendly products.¹⁹

Asian Development

- China has organised the “International Symposium on Stress and Welfare of Aquatic Animals” since 2009.²⁰ In 2021, it also hosted the first “Global Aquaculture Conference”²¹ to promote scientific research and application of aquatic animal welfare domestically and internationally.
- Multiple organisations have issued fish welfare guidelines in China, e.g., those for grass carp and yellow croaker farming, alongside the Chinese edition of “Fish Welfare” guidebook.^{21, 22}
- In 2024, Singapore released its “Aquaculture Plan” to promote sustainable industry development. Its “Food Story R&D Programme” focuses on fish health, nutrition, genetics, aquaculture systems, and environmental management, successfully improving the growth rate and bacterial/viral survival rates of Asian sea bass, demonstrating the effectiveness of enhanced aquaculture management and welfare.²³
- In 2020, Taiwan issued the “Aquatic Animal Welfare Guidelines” to educate the aquaculture industry and consumers on daily welfare applications.^{24, 25}
- Since 2018, the World Organisation for Animal Health has implemented the “Regional Collaboration Framework on Aquatic Animal Health in Asia and the Pacific” to strengthen regional laboratory capabilities, disease response, and information sharing.²⁶

International Trends

- Several countries (including Switzerland, New Zealand, and Norway) have legislated that aquatic animals must be slaughtered humanely with minimal suffering;²⁷ the UK has included fish, lobsters, crabs, and octopuses in the “Animal Welfare (Sentience) Act 2022”.²⁸
- Numerous international organisations have incorporated fish welfare into policies, such as the “EU Animal Welfare Strategy 2012-2015”²⁹ and the World Organisation for Animal Health’s “Aquatic Animal Health Code”.³⁰
- International aquaculture certification schemes, such as the Aquaculture Stewardship Council and the RSPCA, have introduced welfare standards, with the market share of welfare-certified seafood continuing to grow.³¹
- Increasing numbers of global supermarket chains, such as Tesco, M&S, Lidl, and Waitrose, have committed to higher welfare standards for farmed seafood, implementing humane farming and slaughter practices.^{32, 33, 34, 35}
- The United Nations One Health initiative highlights the close interconnection between human, animal, and environmental health. Enhancing animal welfare helps reduce the risk of disease transmission, ensures food safety, and promotes sustainable development for both society and the environment.³⁶ To achieve the UN Sustainable Development Goals (SDGs) 2030,³⁷ animal welfare should be integrated into relevant policies, such as:
 - SDG 2 – Zero Hunger: Healthy aquaculture reduces mortality and disease, improving the stability of food supply.
 - SDG 3 – Good Health and Well-being: Minimises zoonotic and antimicrobial resistance risks, safeguarding public health.
 - SDG 12 – Responsible Consumption and Production: Promotes higher standards in farming and supply chain management.
 - SDG 14 – Life Below Water: Improves aquaculture practices to reduce pressure on marine ecosystems and wild fish populations.

2. Fundamental Principles of Animal Welfare

2.1 The Five Domains of Animals

Aquatic animal welfare standards are based on the internationally recognised “Five Domains” model, which is widely applied across species and adapted to meet the specific needs of aquatic animals: ³⁸

1. **Nutrition:** Provide adequate and balanced feed and water to prevent malnutrition or hunger, supporting normal growth and development.
2. **Physical Environment:** Maintain good water quality and suitable habitat conditions to ensure comfort and safety.
3. **Health:** Reduce disease, injury, and pain through preventive measures and timely treatment to maintain good physical condition.
4. **Behavioural Interactions:** Provide sufficient space and environmental features that allow animals to express natural behaviours and choose whether to interact with or avoid others.
5. **Mental State:** By ensuring proper nutrition, environment, health, and behavioural opportunities, minimise fear and stress to promote a positive mental state.

2.2 Sentience of Aquatic Animals

Recent research increasingly confirms that aquatic animals possess sentience, and their suffering during aquaculture should not be overlooked:

- Fish have pain receptors similar to those of mammals, enabling them to perceive and remember painful stimuli; ³⁹ under stress, they produce stress hormones like cortisol, similar to mammalian stress responses. ⁴⁰
- Fish may seek analgesia to reduce its pain, indicating their ability to perceive pain and seek relief, ⁴¹ and when stimulated, they exhibit abnormal behaviours to mitigate discomfort, such as rapid breathing, mouth rubbing against tank walls, or pectoral fin flapping. ⁴²
- Crustaceans (e.g., crabs) show clear avoidance responses to painful stimuli and can learn to avoid pain-inducing situations. ⁴³
- Cephalopods (e.g., octopuses and squids) possess complex nervous systems and cognitive abilities. ⁴⁴

3. Aquatic Animal Welfare Practices in Aquaculture

Upgrading aquaculture management systems is fundamental to achieving industry benefits and animal welfare. Food and Agriculture Organization of the United Nations and the AFCD of Hong Kong both emphasise that maintaining a good aquaculture environment is critical for sustainable development and raising healthy, high-quality fish. ^{2, 3}

3.1 Aquaculture Facilities and Environmental Management

“Environmental enrichment” enhances farm efficiency and effectively reduces stress across multiple species.⁴⁵ Fish raised in enriched environments exhibit lower heart rates and amplitudes and recover to normal levels more quickly, indicating better physiological conditions.⁴⁶

Environmental Design

- Designing environments that mimic the ideal habitats for different species and life stages helps animals express natural behaviours.^{45, 47}
- Provide spaces for resting, burrowing, or hiding, and design tank colours, patterns, surface shelters, and bottom fixtures.^{45, 47}
- Structures should be evenly distributed and continuously monitored to avoid competition or territorial disputes.⁴⁵

Noise Management

- Fish exhibit escape responses to noise, with stress increasing cortisol secretion and affecting health.^{47, 48}
- Reducing noise enables fish to communicate naturally, such as during mating, spawning, or alerting, which often involve vocalisations.⁴⁷
- Prolonged exposure to repetitive noise may lead fish to habituate, but chronic brain stress persists, suppressing growth and reproduction.⁴⁸
- Farms should avoid establishing sites in areas with frequent vessel traffic, use shock-absorbing equipment, and limit or transition to low-noise electric vessels.⁴⁸
- Soundproof materials and spatial planning can reduce background noise.⁴⁷
- Depending on the species, introducing natural habitat sounds or low-frequency rhythmic sounds (e.g., classical music) can promote fish growth, feeding efficiency, and stress reduction.⁴⁷

Light Management

- Light cycles and intensity affect fish growth, behaviour, physiological cycles, and reproduction, often in conjunction with temperature regulation to induce or delay spawning.^{47, 49}
- Artificial lighting can guide behaviour; e.g., salmon follow vertical light sources, enabling farms to guide fish away from lice-infested water layers, improving health and space utilisation.⁴⁷
- Appropriate lighting enhances growth and feed conversion efficiency, reducing costs and improving overall farming returns (e.g., LED lighting offers better cost-effectiveness and spectral stability).^{47, 49}
- Prolonged or unnatural lighting causes stress; continuous bright light (e.g., 24-hour illumination) or exposure of deep-water fish to intense light may increase stress, reduce immunity, and elevate mortality.^{47, 49}
- Conversely, insufficient light impairs fish foraging ability, affecting growth and survival.⁴⁹
- Water lighting is influenced by water quality, depth, tank colour, light source orientation, and diurnal cycles.^{47, 49}
- Tank colours and patterns can enrich visual environments, influencing activity levels, aggression, and stress responses.⁴⁷
- Lighting should be adjusted based on species, growth stage, and habitat depth.^{47, 49}

Social Design

- Provide appropriate social interaction spaces based on species characteristics and behaviours. ⁴⁹
- Fish should have options to interact, avoid, or hide from companions to prevent stress or aggression. ⁴⁹

3.2 Water Quality Management

Water quality directly impacts the growth and yield of aquaculture products, which requires close monitoring, parameters should be established according to the specific species and life-stage needs.

Key Water Quality Parameters

- Include dissolved oxygen, carbon dioxide concentration, pH, water temperature, turbidity, salinity, ammonia, and nitrate. ⁴⁵
- Monitor at least once daily, ideally with continuous 24-hour monitoring. ⁴⁵
- Implement contingency plans if water quality anomalies are detected. ⁴⁵

Mariculture Water Quality Management (Referencing AFCD Guidelines)

Water Quality Control Standards

- Dissolved Oxygen: Most fish require levels above 5 mg/L. ⁵⁰
- Nitrogen: Excess nitrogen promotes excessive algae growth, reducing dissolved oxygen, producing harmful algal toxins, and blocking sunlight penetration. Nitrogen levels should be controlled to maintain water quality. ⁵¹
- Water Temperature: Excessively high or low temperatures affect fish growth; abrupt changes should be avoided, and temperatures adjusted based on species' natural habitats. ⁵²

Tidal and Water Flow Management

- Monitor the impact of tidal fluctuations on water quality, particularly during neap tides when water exchange rates are lower. ⁵²
- Take appropriate measures for low dissolved oxygen, such as using aeration equipment. ⁵²

Seabed Management

- Seabed is a critical buffer for maintaining good water quality. ⁵²
- Excessive feeding and organic matter accumulation degrade water quality. ⁵²

Pond Fish Aquaculture Water Quality Management (Referencing AFCD Guidelines)

Water Quality Control Standards

- Water Colour: Should normally be pale green (bean colour); overly dark or abnormal colours indicate water quality issues. ⁵³
- Transparency: Approximately 30 cm is ideal; excessively high or low transparency is detrimental to fish health. ⁵³
- Suspended Solids: Should be controlled below 50 mg/L. ⁵³
- Dissolved Oxygen: Maintain above 4 mg/L to prevent oxygen deficiency. ⁵³
- pH: Maintain between 6–8.5, depending on species requirements. ⁵³
- Water Temperature: For local aquaculture species, 16–32°C is optimal. ⁵³

Water Source Management

- Rainwater: Slightly acidic, typically around pH 5.6, requiring pH adjustment. ⁵³
- River Water: Avoid sources with excessive algae or pollution. ⁵³
- Well Water: Typically has lower temperature and dissolved oxygen; use aerators as needed and maintain temperature. ⁵³
- Seawater: Extract high-quality seawater during high tides and avoid sudden salinity changes. ⁵³

3.3 Feeding Management

Provide appropriate quantities and nutritionally sufficient feed formulations based on species and life stages. ⁴⁵

Feed Management (Referencing AFCD Guidelines)

- Switch to Dry Pellets: Facilitates tailored nutritional formulations, easy storage, and prevents bacterial growth and water pollution. ⁵⁴
- Segmented and Measured Feeding: Avoid overfeeding to reduce organic load in the water and prevent toxic chemical buildup. ⁵⁴
- Observe Feeding Behaviour: Adjust feed quantity and frequency based on fish responses. ⁵⁴
- Keep Feeding Records: Track feed costs and conversion rates for timely strategy adjustments. ⁵⁴

3.4 Space and Density Management

- In high-density aquaculture environments, excess feed, fish waste, and algae can degrade water quality. ⁴⁵
- Maintain appropriate densities based on species and life stages to avoid negative physical, psychological, and behavioural impacts. ⁴⁵
- Increase water volume per fish for free movement to meet species-specific needs. ⁴⁵

Mariculture Density (Referencing AFCD Guidelines)

- Maintain Appropriate Water Depth and Seabed Distance: Marine aquaculture water depth typically ranges from 10 to 50 feet, with fish cages generally 8 to 15 feet deep; avoid overly deep cages to prevent seabed contact and low-oxygen zones. ⁵²
- Cage Separation: Regularly sort fish by size and growth rate to prevent larger fish from bullying smaller ones. ⁵²
- Clean Cage Fouling: Ensure good water flow and maintain dissolved oxygen levels. ⁵²
- Reference AFCD's Density Charts: Set appropriate density standards to maintain a healthy environment and optimal growth performance. ⁵²

3.5 Health Monitoring and Disease Prevention

Robust health management reduces losses from fish diseases while upholding aquatic animal welfare. ⁵⁵
Aquatic animals are often affected by diseases and parasites, making prevention the primary strategy. ⁴⁵

Health Monitoring System (Referencing AFCD Guidelines)

- Regular Pond/Cage Inspections: Observe fish conditions at least once daily. ⁵⁵
- Behavioural Observations: Monitor feeding levels and activity, such as checking for abnormalities in gill, fin and swimming behaviour. ⁵⁵
- Physical Inspections: Check body shape, colour, surface conditions, e.g., skin and fin integrity. ⁵⁵

- **Mortality Records:** Record and analyse daily mortality, promptly remove dead individuals, and investigate causes. ⁵⁵

Biosecurity Measures (Referencing AFCD Guidelines)

- **Quarantine for New Fish or Fry:** Isolate and observe for several days to prevent disease introduction. ⁵³
- **Regular Equipment Disinfection:** Use appropriate disinfectants to avoid cross-contamination. ⁵³

Health Management Strategies

- **Prohibit Practices Harmful to Welfare:** e.g., eyestalk ablation in shrimp for reproduction or improper handling causing chronic fin damage. ⁴⁵
- **Vaccination:** When necessary, administer by qualified veterinarians or professionals under anaesthesia to minimise pain. Avoid routine or preventive antibiotic use, but it is acceptable for reducing suffering in necessary treatments. ⁴⁵
- **Staff training:** Ensure all relevant staff receive ongoing training on welfare indicators and assessments.
- **CityU's ambulatory veterinary team** provides fish health and production support, contact (852) 5596 0777 for assistance.

Emergency Response Measures

- **Water Quality Changes:** Increase aeration, replace water, or adjust stocking density. ⁵³
- **Disease Outbreaks:** Isolate infected individuals and treat per professional guidance. ⁵⁵
- **Extreme Weather Response:** Implement preventive measures for events like cold snaps, typhoons or fires. ⁴⁵

3.6 Managing Impacts on Wild Ecosystems

- **Minimise Impacts on Wild Ecosystems:** Ensure site biosecurity to prevent disease spread and genetic pollution of wild populations. ⁴⁵
- **Monitor Native Species:** Track wild species populations around farms; if significant impacts occur, reduce aquaculture scale. ⁴⁵
- **Manage Wild Predators:** Avoid lethal methods for controlling predator populations; prioritise non-lethal preventive measures. ⁴⁵

4. Harvesting and Transport of Aquatic Animals

4.1 Harvesting Standards

Applying scientific harvesting processes is critical for ensuring seafood quality. According to the Humane Slaughter Association, proper harvest management significantly reduces stress and improves product quality. ⁵⁶

Pre-Harvest Preparation

- **Cease Feeding:** For most species, avoid fasting beyond 72 hours. ^{45, 56}
- **Water Quality Adjustment:** Ensure good water quality before harvesting to minimise additional stress. ⁵⁶

- Avoid Disturbance: Reduce noise and vibrations that may cause fish distress. ⁵⁶
- Fish inspection: Check the condition of fish before transport; do not load or transport any showing signs of disease, injury, or abnormal behaviour.

Harvest Operational Standards

- Equipment Checks: Ensure all equipment functions correctly to avoid delays; e.g., prepare sufficient oxygen supply for emergencies. ²⁴
- Use Appropriate Nets: Select nets of suitable size and type to minimise fish injury. ⁵⁶
- Control Harvest Speed: Slow and steady operations reduce stress. ⁵⁶
- Avoid Air Exposure: Aquatic animals should not be exposed to air for more than 15 seconds. Fish should be removed from water or drained only near stunning sites; if exceeding 15 seconds, anaesthetics should be used. ^{45, 56}

4.2 Live Transport Standards

When transporting aquatic animals, minimise stress and disturbance, and reduce handling time. Slaughter should occur on-site whenever possible to reduce transport-related stress; if not feasible, transport duration should be minimised. ⁴⁵

Set transportation standards according to the species and life-stage requirements, including parameters of carbon dioxide, dissolved oxygen, ammonia, cooling rate, water temperature range, pH, and transport density for live fish and crustaceans. ⁵⁶

In addition, provide sufficient water volume or a humid environment, prevent stacking to avoid injury, and consider species-specific traits (e.g., territoriality and aggression) when grouping or transporting animals.

Transport Equipment Requirements

- Basic Biological Needs: Water quality, lighting, and other needs vary by species to avoid pain and inhumane treatment. ²⁴
- Oxygen Supply System: Provide necessary oxygen during transport; moderate use aids cooling. ²⁴
- Temperature Control System: Ensure stable transport environment temperatures, cooling or heating as needed. ²⁴
- Holding Tanks: Temporary storage before and after transport, providing adequate oxygen and stable water quality. ²⁴
- Transfer Slides: Wet or water-flow slides reduce stress during capture and transport. ²⁴
- Protective Equipment: Use physical or chemical protections to safeguard workers and animals, preventing injury, contamination, or infection. ²⁴
- Backup Systems: Emergency measures for equipment failures. ²⁴

5. Display and Sale of Aquatic Animals (Applicable to Markets, Supermarkets, and F&B Industries)

5.1 Principles for Handling Live Fish Display and Sale

Traditionally, live fish are considered fresher, but scientific research shows that **humanely processed chilled fish have superior quality. Less suffering leads to better flavour and quality.** ⁸ Therefore:

- **If displaying and selling live fish, provide good welfare conditions during the process, or**
- **If good welfare conditions are challenging, fish should be humanely slaughtered at harvest to avoid suffering from prolonged transport and display.**

This balances traditional demands with seafood quality and aligns with animal welfare principles.

5.2 Display Equipment and Daily Management

- **Holding Tanks:** Avoid overcrowding during short-term live fish storage, maintain appropriate water quality and temperature, and include escape-proof designs and easy fish retrieval. ²⁴
- **Water Circulation System:** Maintain stable water quality, regularly clean and replace filters. ²⁴
- **Oxygen Supply System:** Provide sufficient oxygen, adjusted based on species and quantity, with increased supply for high-density conditions. ²⁴
- **Temperature Control System:** Adjust water temperature to suitable ranges; lower temperatures help maintain fish vitality and freshness. ²⁴
- **Water Inlet/Outlet Pipes:** Include water level indicators for easy water changes and safe daily operations. ²⁴
- **Lighting System:** Used for observation or display, avoiding overly strong or prolonged lighting to prevent stress or disturbance to fish. ²⁴
- **Isolation Devices:** Use flexible designs for easy adjustment to separate different species or diseased fish, reducing conflict or injury risks. ²⁴
- **Escape-Proof Devices:** Properly cover tank tops and sides to prevent fish from jumping or falling, especially for species with strong jumping abilities. ²⁴

5.3 Sales Equipment and Daily Management

- **Capture Tools:** Select appropriate net sizes and mesh based on species for quick, accurate capture to avoid injury. ²⁴
- **Temporary Holding Cages or Trays:** Minimise time out of water for live fish. ²⁴
- **Packaging Bags/Boxes:** Use appropriately sized, double-layered designs for short-distance transport to prevent punctures by aquatic animals or other objects. ²⁴

5.4 How Consumers Can Practise Animal Welfare

- **Clear Handling Instructions:** Specify humane handling methods for different species, such as immediate slaughter, chilling, or avoiding live boiling. ²⁴
- **Accurate Information Communication:** Live fish do not always equate to optimal flavour; consider cooking methods. ²⁴

6. Slaughter and Humane Handling of Aquatic Animals

6.1 Basic Principles and Standards for Humane Slaughter

Humane slaughter is the final step in ensuring seafood quality and animal welfare, with the following principles and standards: ⁴⁵

- **Minimise Suffering:** Avoid unnecessary pain and stress.
- **Stun Before Slaughter:** All aquatic animals must be effectively stunned before slaughter to ensure they are unconscious.
- **Rapid Stunning Methods:**
 - Stunning methods should be selected according to species and size (e.g., electrical stunning, percussive/hand-stunning) to ensure effectiveness.
 - Minimise the interval between stunning and slaughter to reduce the risk of the animal regaining consciousness.
 - Ensure animals are rendered fully unconscious (not merely immobilised) and are killed before any possibility of consciousness recovery.
 - Simultaneous stunning and slaughter (e.g., electrocution) is preferred; if stunning precedes decapitation, it must be immediate.
 - All stunning and slaughter equipment must be precisely calibrated for species and size to achieve immediate, irreversible unconsciousness.
- **Avoid methods like ice suffocation, salt baths, carbon dioxide, or ammonia.**

6.2 Other Slaughter Techniques and Operational Recommendations

Slaughter methods vary by fish size and species. ²⁴

- Common practices:
 - Small fish: Neck breaking
 - Medium fish: Rapid piercing
 - Large or specific species: Electrocution
- Other methods include live spiking (also known as ikejime), neural spiking (also known as Shinkei-jime), or bleeding

All operations should prioritise minimising suffering and avoid: ²⁴

- Prolonged distress or disturbance to aquatic animals.
- Using public slaughter as a marketing gimmick.
- Delaying processing, causing prolonged suffering.

Staff training

- Farm staff should receive proper training to perform rapid and accurate slaughter techniques.
- Ensure safety, reduce risks, and uphold basic aquatic animal welfare.

7. Methods for Continuous Welfare Improvement and Adding Value to Aquaculture

7.1 Welfare Monitoring Indicators

Welfare Indicators and Staff Training

An effective welfare monitoring system is key to enhancing industry benefits and ensuring welfare standards. Welfare indicators should be tailored to species, life stages, and farming environments, adopting best practices with scientifically validated behavioural and physiological indicators. Standards for assessing psychological well-being, particularly validated parameters, should also be considered. ⁴⁵

All staff must receive adequate training to implement and monitor these standards.

Data-Driven Approach and Transparency

All standards should be based on the latest scientific evidence, encouraging the industry to promote and share best practices. Public disclosure of health data (including private sites) serves the public interest. Farms should record animal diseases, treatments, transport, mortality rates, and causes of death to continuously improve conditions. ⁴⁵

Core Indicators

Production Indicators

- Growth Rate: Poor welfare impacts growth performance
- Mortality Rate: Directly reflects health and welfare issues ^{3, 5}
- Feed Conversion Rate: Strong indicators reflect overall health ^{9, 10}

Physiological Indicators

- Cortisol Levels: Stress hormones are key indicators of fish stress ⁵⁷
- Blood Glucose Levels: Elevate under stress ⁵⁷
- Lactic Acid Content: Reflects muscle activity and oxygen supply ⁵⁷

Behavioural Indicators

- Feeding Behaviour: Reduced appetite is often an early stress signal ⁵⁸
- Swimming Patterns: Abnormal postures may indicate disease or discomfort ⁵⁸
- Social Behaviour: Increased aggression or abnormal behaviour may signal welfare issues ⁵⁸

Monitoring Tools and Methods

Technical Devices

- Water Quality Monitoring Equipment: Automated monitoring of dissolved oxygen, pH, etc.
- Imaging Systems: Observe behavioural changes
- Biosensors: Record physiological parameter changes ⁵⁷

Assessment Methods

- Regular Sampling: Randomly select individuals for health assessments
- Systematic Records: Establish standardised welfare assessment forms
- Professional Veterinary Evaluations: Conduct regular professional inspections

7.2 Mechanisms and Recommendations for Continuous Improvement

Continuous evaluation and improvement of aquaculture operations and management systems can achieve higher aquatic health and industry benefits. The AFCD of Hong Kong encourages farmers to adopt good practices and continuously improve aquaculture management.

Industry Systems and Certification

Standard Update Mechanisms

- Regularly evaluate the effectiveness of existing standards (e.g., AFCD Accredited Fish Farm Scheme ⁵⁹)
- Reference international research and standard developments
- Conduct research and adjustments based on local practices

Industry Certification

- Develop local welfare certification: Establish a local premium eco-friendly seafood certification system and enhance brand marketing to boost market recognition. ⁴
- Align with international certification systems: Reference top global aquatic animal welfare standards, ³¹ such as the Aquaculture Stewardship Council (ASC) standards, ¹⁶ to align with international best practices.

Technological Innovation and Training

Training and Knowledge Sharing

- Provide regular training for practitioners to raise awareness of animal welfare importance and share best practices.
- Develop young talent through free training, internships, advanced courses, and industry development projects.
- Establish industry knowledge exchange platforms to foster collaboration between local and mainland industries, integrating research and practice.

Technological Research

- Encourage development of improved welfare monitoring technologies.
- Enhance existing farming and processing equipment.
- Establish fisheries research centres to study modern aquaculture directions, conduct experiments, and promote processing technologies, such as remote real-time monitoring platforms.

7.3 Successful Case Studies of Welfare Implementation in Aquaculture

Aquaculture enterprises worldwide have improved efficiency and enhanced product image and market competitiveness through fish welfare measures, providing valuable references for Hong Kong's industry.

Norwegian Salmon Industry ⁶⁰

- Established fish welfare standards, including stocking density, water quality, and transport management.
- Reduced antibiotic use by 99% over a decade, with sustained industry growth.

Scottish Salmon Industry

- Implemented a “Salmon Scotland Sustainability Charter” to enhance fish welfare, improve farming environments, and reduce fish stress. ⁶¹
- Established a premium product image, with exports reaching £614 million in 2021, a 36% increase from the previous year. ⁶²

8. Conclusion

8.1 Long-Term Benefits of Animal Welfare for Hong Kong’s Aquaculture Industry

Implementing aquatic animal welfare is not only a moral choice but also a strategic investment to enhance the competitiveness of Hong Kong’s aquaculture industry. In the long term, it will deliver the following key benefits:

- **Industry Upgrading:** Transition traditional aquaculture to modern, high-efficiency, and high-quality practices.
- **Market Expansion:** High welfare standards facilitate entry into premium markets.
- **Enhanced Risk Management:** Reduce disease, environmental, and market risks, improving resilience.
- **Brand Building:** Use welfare to ensure quality, creating a high-value brand image.
- **Sustainable Development:** Balance environmental and resource efficiency for long-term growth.

8.2 Advocacy for Government and Industry Involvement

Achieving an aquatic animal welfare system requires collaboration among government, industry organisations, and businesses:

Government Level

- **Policy Guidance:** Incorporate animal welfare into aquaculture development plans.
- **Funding Support:** Establish dedicated grants to support facility and technology upgrades.
- **Standard Setting:** Develop localised welfare standards based on international experience.
- **Regulatory Enforcement:** Establish effective oversight to ensure implementation.

Industry Collaboration

- **Professional Support:** Provide training and technical assistance to strengthen industry capabilities.
- **Knowledge Exchange:** Create platforms to share local and international experiences.
- **Brand Promotion:** Organise campaigns to enhance market recognition.

Business Management

- **Strategic Development:** Integrate welfare measures into long-term plans.
- **Team Capability Building:** Enhance technical and management skills.
- **Innovative Transformation:** Adopt new technologies and equipment to improve efficiency.
- **Corporate Social Responsibility:** Fulfil responsibilities to build a positive image.

8.3 A Call to Hong Kong Society

Aquatic animal welfare is a societal responsibility and a global trend. In the context of sustainable development, improving welfare standards has become a critical direction for aquaculture transformation.

Beyond industry efforts, consumer choices can shape market trends. Emphasis on animal welfare, food safety, and environmental responsibility is a driving force for industry innovation. Societal consensus on respecting life will provide stronger support for policy-making and industry development.

Through collaboration among government, industry, and the public, Hong Kong has the potential to become a regional leader in aquatic animal welfare, collectively shaping a more sustainable and competitive aquaculture future.

Acknowledgement

- Agriculture, Fisheries and Conservation Department of Hong Kong
- Animal Kingdom Foundation
- Aquatic Life Institute
- Environment & Animal Society of Taiwan
- FAI Farms
- The Fisher
- Fish Etho Group
- Fish Welfare Initiative
- Future Green Global
- GREEN Hospitality
- Hong Kong Aquaculture
- Huazhong Agricultural University
- International Cooperation Committee of Animal Welfare (ICCAW)
- Ocean University of China
- WWF