NEW ZEALAND
Sustainable
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# New Zealand Farmed Salmon Welfare Standards

2021

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# INTRODUCTION

The New Zealand Salmon Farming Industry, which farms King (Chinook) salmon (Oncorhynchus tshawytscha), recognises the importance of managing animal welfare to the greatest extent practicable in its operations. The A+ New Zealand Farmed Salmon Welfare Standards have been developed by members of the New Zealand Salmon Farmers Association (NZSFA) Fish Welfare Working Group, and are based upon current New Zealand legislation, international animal welfare policy, codes of practice, scientific research, veterinary advice, and practical farming experience.

**Signed this 30th day of August 2021 by:**

Duncan Bates for Akaroa Salmon

Karl French for High Country Salmon

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# OBJECTIVES

**Through the implementation of national welfare standards, the New Zealand salmon industry seeks to:**

- Manage salmon welfare standards transparently and consistently, so that all parties can be assured that appropriate measures are being carried out by the industry.
- Provide assurance to regulators that agreed national standards are in place and maintained to safeguard the welfare of our salmon; and
- Through salmon welfare leadership, improve the overall finfish welfare status throughout New Zealand.

**By achieving these objectives, direct and indirect outcomes will include:**

**Direct outcomes:**

- Integrated/holistic fish welfare indicators across the industry.
- Consistent awareness of fish welfare initiatives among key stakeholders.

**Indirect outcomes:**

- Improved fish health; increasing production efficiency.
- Consistently high quality of product.
- Improved public perception towards New Zealand farmed salmon.

# PROCESS AND DOCUMENT LIFE

High level animal welfare objectives were agreed by a working group of the NZSFA. These objectives were then translated into the specific New Zealand Farmed Salmon Animal Welfare Standards and approved by the Salmon Welfare Working Group of the NZSFA.

The agreed A+ New Zealand Farmed Salmon Welfare Standards will be embedded into the Sustainable Management Framework of the A+ Sustainable Aquaculture Programme for salmon farmers.

Salmon farmers will be required to develop Fish Welfare Management Plans to address these standards. Farmers will also be required to self-report their compliance with these New Zealand Farmed Salmon welfare standards as part of their annual membership to the A+ Sustainable Aquaculture Programme and may be assessed against the standards by a third-party assessor appointed by Aquaculture New Zealand (AQNZ).

These A+ New Zealand Farmed Salmon Welfare Standards will be reviewed every two years by the Salmon Welfare Working Group and updated as required, however it may be necessary to make an amendment at any time with the agreement of the NZSFA and AQNZ.

AQNZ acts as secretariat for the Salmon Welfare Working Group and maintains the standards as they exist within the A+ Programme.

# SCOPE

The farming of any species can expose animals to a range of stressors, which may lead to a variety of welfare issues. These can include physical injuries, an increased susceptibility to disease and developmental abnormalities as well as fear, distress, and pain, which can manifest in reduced production efficiency (low growth rate, high feed conversion ratio (FCR)), and lower flesh quality. The A+ New Zealand Farmed Salmon Welfare Standards are designed to ensure farming and harvesting processes are carried out according to global best practices and in a humane way.

**The scope of these New Zealand Farmed Salmon Welfare Standards includes:**

1. Operational Welfare Indicators (OWI)
2. Husbandry
3. Environment
4. Nutrition
5. Handling and Corralling
6. Transport and Towing
7. Training

# DEFINITION OF WELFARE

The World Organisation for Animal Health - OIE has developed international standards for the welfare of farmed fish (except ornamental species) in the Aquatic Code (2012) and advocates the use of 'handling methods appropriate to the biological characteristics of the fish and a suitable environment to fulfil their needs' [1].

Collective evidence suggests that fish do have the capacity for pain [2] and international legislation currently reflects this view. From the point of view of fish as sentient animals, and assuming they can feel and suffer pain, we should minimise any procedure that can potentially cause distress in fish and seek to implement integrated welfare assessments using Operational Welfare Indicators [3,4].

## FIVE FREEDOMS

Internationally, many animal welfare guidelines refer to the '**five freedoms**' which are:

1. Freedom from **Hunger and Thirst** - by ready access to suitable water and a diet to maintain full health and vigour
2. Freedom from **Discomfort** - by providing an appropriate environment including shelter and a comfortable resting area
3. Freedom from **Pain, Injury or Disease** - by prevention, rapid diagnosis, and treatment
4. Freedom to **Express Natural Behaviou**r - by providing sufficient space, proper facilities, and the company of the animal's own kind
5. Freedom from **Fear and Distress** - by ensuring conditions and treatment that avoid mental suffering.

Although the five freedoms have been widely adopted, there is some concern that they focus on the negative aspects of welfare e.g., "free from", rather than improving the animal's quality of life[5]. Additionally, some argue that the focus on creating stable conditions to maintain an animal's internal stability (homeostasis) may not be ideal for good long-term welfare and as such we should be incorporating the concept of allostasis (stability through change). Increasingly, rather than trying to minimise any changes, the capacity of fish to respond to changes and biologically relevant challenges that promote good health and welfare should be a key indicator [6]. Ultimately, animal welfare rests with those who are responsible for their care.

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1 OIE, 2012: Section 7.1. Introduction to Recommendations for the Welfare of Farmed Fish. Aquatic Animal Health Code, 12 edn. World Animal Health Organisation, Paris. (https://www.oie.int/index.php?id=171&L=0&htmfile=chapitre_welfare_introduction.htm)

2 Brown, C., Dorey, C 2019. Pain and Emotion in Fishes – Fish Welfare Implications for Fisheries and Aquaculture, Animal Studies Journal, 8(2), 175-201. Available at: https://ro.uow.edu.au/asj/vol8/iss2/12

3 Huntingford, F.A., Adams, C., Braithwaite, V.A., Kadri, S., Pottinger, T.G., Sandøe, P., Turnbull, J.F., 2006. Current issues in fish welfare. J. Fish Biol. 68, 332–372. https://doi.org/10.1111/j.0022-1112.2006.001046.x

4 Turnbull, J., Bell, A., Adams, C., Bron, J., Huntingford, F., 2005. Stocking density and welfare of cage farmed Atlantic salmon: application of a multivariate analysis. Aquaculture 243, 121–132. https://doi.org/10.1016/j.aquaculture.2004.09.022

5 Rey S, Little D.C, Ellis, M.A. 2019. Farmed fish welfare practices: salmon farming as a case study. GAA publications.

6 Korte, S.M., Olivier, B., Koolhaas, J.M., 2007. A new animal welfare concept based on allostasis. Physiology & Behavior. 92(3):422-428

**These standards require the use of Operational Welfare Indicators (OWI)[7] as part of best management practices (BMP) to improve the quality of life of our fish by providing:**

- Caring and responsible planning and management (including training and record keeping)
- Skilled, knowledgeable, and conscientious husbandry
- Access to adequate nutrition
- Appropriate environmental and farm design that enables practical mitigation measures to be applied (e.g., predators on farms and in hatcheries; $O_2$, temperature and $CO_2$ levels in Recirculating Aquaculture Systems (RAS))
- Considerate handling (includes stripping, grading, culling, and harvesting)
- Responsible stock transport (includes tankers, towing, well boats)

# NEW ZEALAND LEGISLATION

**All salmon farming operations must comply with the requirements of the Animal Welfare Act 1999.**
http://www.legislation.govt.nz/act/public/1999/0142/latest/DLM49664.html

7 Noble, C., Gismervik, K., Iversen, M.H., Kolarevic, J., Nilsson, J., Stien, L.H. & Turnbull, J.F. (eds.) (2018) Welfare Indicators for farmed Atlantic salmon: tools for assessing fish welfare.

# VOLUNTARY DISCLOSURE OF MALPRACTICE (WHISTLEBLOWING)

The NZSFA members support all good faith communication based on reasonable grounds that discloses or demonstrates an individual or group of individuals who are breaching the standards of the Animal Welfare Act 1999.

If an individual wishes to report alleged serious wrongdoing occurring within another company, which is a member of the NZSFA, then that person should report the alleged breach of serious wrongdoing to an officer within the company which they work for, such as a person of appropriate seniority for example a General Manger or the Chief Executive Officer, in the first instance.

If the alleged wrongdoing is in relation to wrongdoing in the company in which they work, then any disclosure must be made in accordance with the individual's company's protected disclosures policy and be made to an officer of the company who is not involved in the alleged wrongdoing, as set out in the company's protected disclosures policy, which must be followed.

Under the Protected Disclosures Act 2000 there are circumstances where disclosure about alleged wrongdoing within the individual's own place of work may be made to an appropriate authority in circumstances where the employee believes on reasonable grounds that:

- The head of the organisation may be involved in the serious wrongdoing alleged in the disclosure; or
- That immediate reference to the appropriate authority is justified by reason or urgency of the matter to which the disclosure relates, or some other exceptional circumstance; or
- There has been no action or recommended action on the matter to which the disclosure relates within 20 working days after the disclosure is made.

Under the Act, an appropriate authority includes a private sector body which is made up of members of a particular profession and which has powers to discipline its members. Therefore, disclosure can only be made to a body which has disciplinary oversight of a company/organisation.

# STANDARDS

# OPERATIONAL WELFARE INDICATORS (OWI)

The development and standardisation of best management practices and routine health checks are considered essential to minimise disease and maintain a good welfare status in salmon aquaculture. Welfare indicators have been developed to monitor health and welfare across all lifecycle stages, in hatcheries, freshwater grow-out, and at sea.

Operational Welfare Indicators (OWI) are quantifiable on-farm measurements carried out by farm staff who have been properly trained to recognise and consistently evaluate them (Table 1). Most OWI are based on routine husbandry procedures and production measurements to assess the effects of stressors through the salmon life cycle and are based on optimal environmental conditions, physical and physiological status, and behaviour (Table 2).

**Consistency and correctness of data recording is key for the efficient use of OWI.**

NZSFA are committed to using OWI when assessing overall fish welfare. Fish welfare management plans must be developed by individual companies that stipulate the OWI and the method for their consistent recording, scoring, and interpretation to maintain fish welfare.

## EVIDENCE TO BE PROVIDED

A Fish Welfare Management Plan listing the OWI's and how they are to be consistently recorded, monitored, and interpreted to maintain fish welfare.

## Table 1 – List of potential welfare indicators (WI)

Based on individual fish and groups of fish that can be monitored at each life cycle stage in all operations (adapted from Rey et al 2019 and Noble et al 2018[1]).

| | | |
|---|---|---|
| **Individual fish-based WI** | **Physical Health** | Mortalities<br>Opercula and/or gill damage<br>Colour changes (e.g., eye opacity or darkening, pale gills, skin colour)<br>Eye lesions (e.g., eye haemorrhaging, exophthalmia)<br>Fin damage<br>Gill health index<br>Snout damage<br>Deformities (e.g., vertebral deformities, upper jaw deformity, lower jaw deformity)<br>Skin damage and appearance: Lesions/Abrasions/Injuries/ |
| | **Physiology** | Scale loss and bleeding (Skin Index)<br>Body condition score (hepatosomatic index (HIS), Fulton condition index)<br>Standard growth rates (SGR)<br>Blood parameters (Clinical pathology - cortisol, glucose and/or c-reactive protein (biochemistry) and haematocrit and white blood cell count (haematology))<br>Muscle pH<br>Smoltification state |
| **Group based WI** | **Behaviour** | Feeding response and anticipatory behaviours and recovery time after stress<br>Avoidance behaviour<br>Spatial distribution (vertical and horizontal)<br>Abnormal (e.g., lethargy, not shoaling) / normal behaviours<br>Sickness behaviours<br>Reactions to carers<br>Activity (swimming behaviour)<br>Feed conversion ratio |
| | **Environment** | Water quality, which may include temperature, salinity, turbidity, pH, oxygen, $CO_2$, ammonia, and nitrites<br>Water flow rates and current speed<br>Lighting/Shading<br>Algal and jellyfish blooms<br>Algal and biological toxins (e.g., jellyfish toxins)<br>Predators<br>Stocking density<br>Scales in water<br>Net-pen design/Substrate access |

1 Noble, C., Gismervik, K., Iversen, M.H., Kolarevic, J., Nilsson, J., Stien, L.H. & Turnbull, J.F. (eds.) (2018) Welfare Indicators for farmed Atlantic salmon: tools for assessing fish welfare
https://nofima.no/wp-content/uploads/2018/11/FISHWELL-Welfare-indicators-for-farmed-Atlantic-salmon-November-2018.pdf

## Table 2 - Potential Operational Welfare Indicators (OWI)

Potential OWI that can be monitored in relation to risk factors/ stressors over the lifecycle of King salmon in New Zealand for use in Fish Welfare Plans (adapted from Rey et al 2019 and Noble et al 2018).

| Life Stages | Risk Factors/Stressors | Operational Welfare Indicators |
|---|---|---|
| **Broodstock**<br>(10-20kg, ~1500 eggs/ kg) | Same as one/two winter salmon, see below | **Same as one/two winter salmon, see below** |
| **Eggs** | Transport<br>Handling<br>Water quality<br>Disturbance (removal of unviable eggs)<br>Light levels<br>Egg density | **Mortalities**<br>**Colour changes**<br>**Presence of fungus**<br>**Water quality measurements -pH, DO, flow rate, temperature**<br>**Lighting (should be dark/dimmed) Stocking density not exceeded for trays** |
| **Young Stock – Alevin**<br>Yolk still attached | Light<br>Water quality<br>Substrate access<br>Handling<br>Weaning strategies (e.g. once yolk sac depleted transition to formulated feed) | **Mortalities**<br>**Presence of fungus**<br>**Behaviours-feeding, orientation, activity**<br>**Aggressive interactions**<br>**Water quality measurements -pH, DO, flow rate, temperature**<br>**Lighting (should be dark/shaded/ dimmed)**<br>**Presence of substrate on emergence**<br>**Stocking density**<br>**Weaning index (time of weaning)** |
| **Fry**<br>First sorted for size ('graded') | Transfer between tanks<br>Netting/Handling<br>Corralling<br>Grading<br>Water quality<br>Water flow<br>Access to food<br>Conditioning<br>Agonistic behaviours<br>Tank disturbance (cleaning)<br>Light levels<br>Stocking density<br>Predators (if outside tanks) | **Mortalities**<br>**SGR**<br>**Lesions/injuries/abrasions/fin damage**<br>**Deformities/appearance/colour changes**<br>**Social/aggressive interactions**<br>**Feeding and anticipatory behaviours**<br>**Activity (swimming behaviours)**<br>**Normal/abnormal behaviours**<br>**Spatial distribution**<br>**Water- (pH, DO, ammonia, nitrites, nitrates, flow rate, temperature)**<br>**Lighting (if tanks inside)**<br>**Stocking density**<br>**Predator control (nets/lids on tanks etc.)** |

| Life Stages | Risk Factors/Stressors | Operational Welfare Indicators |
|---|---|---|
| **Parr**<br>Development of skin colouration for camouflage | **Same as fry with the addition of:**<br>Vaccination<br>Anaesthetic<br>Transport to freshwater | **Same as fry with the addition of:**<br>**Body condition indices (liver, gill, skin)**<br>**Ventilation rates/heart rates**<br>**Health checks (blood haematology and blood biochemistry (cortisol, glucose, c-reactive protein, haptoglobin, etc.))** |
| **Smolt (Salmon)**<br>The stage of adaption to salt water, depending on when smolting induced | **Same as fry (excluding tank transfer) with the addition of:**<br>Transport to on-growing pens (loading, transport, unload)<br>Saltwater tolerance<br>(osmoregulation) | **Same as fry with the addition of:**<br>**Body condition indices (liver, gill, skin)**<br>**Ventilation rates/ heart rates**<br>**Health checks (blood haematology)**<br>**Smoltification state**<br>**Salinity** |
| **One/Two Sea-Winter Salmon**<br>Matured after one year | **Same as fry (excluding tank transfer) with the addition of:**<br>Harvesting (brailing, pumping)<br>Transport to harvest/ harvest<br>Infectious diseases/ Vaccinations<br>Treatments for disease/ parasites and toxicity levels of treatments<br>Environment (weather, temperature, water quality) | **Same as fry with the addition of:**<br>**Body condition indices (liver, gill, skin)**<br>**Tissue sampling (e.g., pH and blood spots in muscle from poor harvest techniques)**<br>**Parasites**<br>**Ventilation rates/Heart rates**<br>**Health checks (blood haematology)**<br>**Salinity**<br>**Wind speeds, current flow** |

# HUSBANDRY

All King salmon in New Zealand will be farmed in a safe, efficient, effective, and low-stress manner, which represents an integrated, comprehensive, and holistic approach to fish husbandry.

The following must be addressed in a Fish Welfare Management Plan to address husbandry related risks to fish welfare at all life stages:

## 1. Genetic Selection

Any salmon farmer with a brood stock programme must manage genetic selection to minimise inbreeding and ensure that trait selections do not introduce welfare issues.

- Genetic selection must ensure the risks of inbreeding are managed (NB - continue to collect evidence of this).
- Monitoring must be done to ensure trait selection outcomes do not induce welfare issues (e.g., deformities).

## 2. Stocking Density

Stocking density is one of a range of parameters (like water temperature and dissolved oxygen) that can act together to affect the welfare of farmed salmon. Salmon are schooling animals by nature; therefore, fish tend to congregate at relatively high densities naturally. However, maintaining lower stocking densities can reduce the risk of aggression, stress, injuries (e.g., fin damage), and disease.

- Stocking densities must be maintained at a level that reduces the risk of physiological stress and minimises external damage to the fish.

## 3. Spatial Distribution

Spatial distribution of fish in culture environments are indicative of welfare status. Therefore, changes in the spatial distribution in each rearing environment are likely to indicate an emergent welfare issue. Shoaling of fish and the vertical/horizontal distribution of fish changes under stress. Salmon corral together at the bottom of the tanks and pens when stressed and swimming patterns change. Distribution will also be affected by preferred environmental conditions and management characteristics such as stocking density.

- Fish distribution in the rearing environment must be monitored as an OWI.

## 4. Fish Health Monitoring

Regular and standardised recording of OWI (Table 2) will ensure fish health status is monitored and understood.

- Fish Welfare Management Plans listing the OWI's and how they will be consistently recorded, monitored, and interpreted to maintain fish welfare.
- Regular monitoring and removal of mortalities and classification of causes of death.
- Consultation by a suitably qualified fish health professional when appropriate.

### EVIDENCE TO BE PROVIDED

- A Biosecurity Management Plan, that addresses the requirements of the A+ New Zealand Salmon Biosecurity Standards is in place and is reviewed regularly.
- Daily monitoring of fish behaviour and distribution during feed-outs.
- Routine fish health checks and mortality removal (Table 2).
- Records and classifications of causes of death.
- Records of consultations by suitably qualified fish health professionals.

# ENVIRONMENT

As fish are in constant contact with the environment through the gills and skin, the quality of the growing environment is an important factor in maintaining welfare.

The following must be addressed in each company's Fish Welfare Management Plan to address environmental risks to fish welfare:

## a. Growing Environment / Farm Design and Location

- Net-pens, ponds, and raceways must be appropriately designed to minimise stress to the fish.
- Screens and net sizes must be appropriate to the size of the fish and weighted and tensioned appropriately to reduce fish damage and stress.
- Net-pens, ponds, and raceways must be cleaned regularly to maintain adequate oxygen, water flow, and clean water.
- Net-pens, ponds, and raceways must be inspected regularly and repaired, when necessary, to ensure no fish loss through holes.
- Net-pens, ponds and raceways must be designed and sited in such a way that they are not likely to be damaged by adverse weather conditions.

## b. Minimising Escapees

Escapees may be unable to survive in the wild and may become stressed. To reduce the risk of fish being stressed by wild conditions:

- Fish farms must be designed and managed in such a way as to prevent fish escaping.
- Contingency plans must be developed to prevent or minimise escapes.

## c. Wildlife (bait fish, marine mammals, and birds)

Wildlife can introduce additional stress to the fish through competition for food and predation. To reduce the risk of undue stress from wildlife:

- Wildlife entry into net-pens, ponds and raceways must be minimised.
- A plan for removal and return to the wild – as per relevant legislation – must be developed and implemented.
- Extraneous wildlife species must be treated in accordance with the relevant legislation.

## d. Protection from Predators

Flight responses from predators can cause fish to damage themselves during escape responses, which can lead to increased stress. To minimise predator related stress:

- Farm structures must be designed to provide adequate protection from predators.

## e. Ultraviolet (UV) Light and Lighting

Ultraviolet lighting can be harmful to fish particularly small fry, and therefore, appropriate protection from UV light should be provided. Lighting is predominately used to manage fish maturation; however sudden light transitions can introduce additional stress. To minimise stress from UV light and lighting:

- Appropriate protection from UV must be provided to reduce undue damage.
- Sudden light transitions must be avoided.

## f. Algae/Jellyfish Blooms

Blooms of marine (and occasionally freshwater) phytoplankton (algae) and jellyfish (e.g., Aurelia sp.) have the potential for causing severe damage and heavy losses of farmed salmon. Algae may affect the fish by producing toxins, by reducing oxygen levels at night and when the algae die off, and by being directly irritant to the gills and skin. Similarly, jellyfish can be directly damaging by stinging, irritating, accumulating within the gills, and by reducing water flows and oxygen levels.

To reduce the risk of the effects of algae or jellyfish blooms on fish welfare salmon farms must:

- Develop algae and jellyfish monitoring and response plans to monitor for blooms at times when blooms commonly occur.
- Establish appropriate procedures to mitigate algae/jellyfish blooms (e.g., appropriate stocking densities, conditioning, and avoiding any stress to the fish at high-risk bloom times, and the use of aeration systems/skirts where appropriate).

## g. Water Quality and Flow

Poor water quality is detrimental to fish health as demonstrated through slow growth and higher than normal mortalities. Water quality parameters should be monitored daily, and key parameters should include:

- suspended solids
- temperature
- dissolved oxygen (DO)
- carbon dioxide ($CO_2$)
- pH
- ammonia
- nitrite
- nitrate

Monitoring of sea pens pose more logistical challenges than land based freshwater sites, however, temperature, DO and salinity should be monitored in any aquaculture facility where feasible, and where possible should be real-time monitoring.

### To reduce the risk of water quality affecting fish welfare:

- At a minimum temperature and DO must be measured and maintained at appropriate levels at all times where possible to ensure a reduced risk of fish stress.

In tanks, ponds and raceway systems, water flow rates should be managed to allow the fish to at least 'hold station', a natural behaviour for salmon when they are pre-smolts or parr and live under natural conditions.

In sea pens, extreme oceanic conditions with high currents and large waves can drive them to exhaustion and compromise fish welfare. Storm conditions that deform net pens can also potentially compromise fish welfare, through physical abrasions or trauma.

### To reduce the risk of water flows affecting fish welfare:

- Fish behaviour must be monitored to ensure a reduced risk of fish stress; and
- Where appropriate water flows must be measured and monitored.

### EVIDENCE TO BE PROVIDED

- Water quality summary data.
- Response plans - where appropriate (e.g., Low DO response plan, high temperature response plan, low/high flow response plan).
- Monitoring fish behaviour and, where appropriate, water flow rates.
- Management plan for nets/screens/sea pens to ensure structural integrity and minimise escapes.
- Routine maintenance plans for net pens and moorings.
- Where appropriate a contingency plan for fish recapture should be maintained.

# FOOD AND FEEDING

To ensure that fish maintain good health and welfare, they will have sufficient access to high-quality diet, appropriate for their life stage, that allows full health to be maintained. Food must be distributed in such a way that fish can eat without undue competition. Feeding must be such that the quality, quantity, and frequency are optimal for the fish's stage of development.

The following must be addressed in a Fish Welfare Management Plan to address food and feeding related issues:

## a. Food Content

- All feed must be supplied by appropriate feed companies, with sustainably sourced raw ingredients.
- All feed must be manufactured from constituents that are free from active parasites and known fish pathogens and contamination.
- All feeds must be produced in accordance with all relevant legislation.
- No feedstuffs containing growth regulators or hormones are permitted.
- The use of veterinary medicinal products in food is prohibited except for essential therapeutic use (a disease outbreak or where welfare will otherwise be compromised as advised by a veterinary surgeon).
    - » Treated fish must be well labelled and tracked, and all withhold periods followed.
    - » Treatment records must be maintained.

See Agricultural Compounds and Veterinary Medicines Act 1997 for list of approved additives.

## b. Food Management

- Feed must be stored securely to prevent spoilage, exposure to sunlight, pests, and moisture.
- Feed quality must be assessed regularly to detect rodent incursion/contamination, mould, spoilage, and degradation.
- Use of different feed manufacturers and pellet sizes must be documented and records maintained.

## c. Feeding Methods and Access

- Food must be dispensed and distributed in such a way that fish can access feed and eat without undue competition.
- Fish must be observed during feeding.
- The person observing the feeding must check that fish on the periphery of the tank or net-pens receive adequate amounts of food.
- Fish must be fed adequate amounts of food to maintain normal healthy growth.
- Overfeeding must be avoided.

## d. Conditioning

- Conditioning must be used appropriately and is an important mechanism used to reduce stress to fish during production phases.

**<u>For harvest fish - conditioning time must:</u>**

- Be appropriate to ensure minimal fish stress (Seek advice: by the suitably qualified fish health professional for fish welfare reasons).
- Be recorded.

**After any period of conditioning, food must be reintroduced in a way that:**

- Encourages the fish to resume feeding.
- Minimises waste.
- Farmers can demonstrate that it does not compromise fish welfare.

## EVIDENCE TO BE PROVIDED

- Records of feed manufacturers, pellet size and content.
- Records of feed quality assessments.
- Records of feeding observations.
- Records must be kept of the period for which the fish were conditioned and when feed was reintroduced.
- If any approved veterinary medicines have been added to feed, records must be maintained and records of the type of medicine and amount.

# HANDLING AND CORRALLING

Handling and corralling are both important stressors for fish and are integral to many stages of the aquaculture process. Improved fish welfare can be achieved by avoiding any unnecessary handling and corralling of fish as it can give rise to a range of detrimental welfare outcomes including poorer biosecurity, health problems, external injuries, degradation of the external environmental conditions (DO, stocking densities, etc).

Any procedure that requires handling or can lead to corralling stress should be avoided and replaced, if possible, by a less stressful procedure. For example, human handling can be replaced by mechanical pumping during transport and grading or other technologies, such as use of underwater cameras to monitor the behaviour or feeding response, and automatic biomass estimations. In general, conditioning is used for a period to allow fish to empty their digestive tracts (RSPCA, 2018) and thus help maintain water quality and therefore reduce stress during handling and corralling.

The following must be addressed in a Fish Welfare Management Plan to address handling and corralling related issues:

- Fish must be conditioned appropriately prior to corralling to reduce activity and stress.
- Corralling must only be done by appropriately trained staff.
- Corralling and handling must be kept to a minimum.
- Soft nets or appropriate screens must be used in preference to reduce stress and damage to the fish.
- Fish must be monitored during and following corralling, to ensure stress is kept to a minimum.

## Culling/Stripping/Grading/Harvest/Vaccination (immunisation)

Within the New Zealand salmon industry follows global best practice and automated percussive and electrical stunning systems are commonly used. Where appropriate, an overdose of sedative is also a permitted killing method. Electrical stunning is also used to render fish immobile prior to percussive killing. All methods are followed by exsanguination.

Acceptable methods of euthanasia must ensure rapid and irreversible loss of consciousness with minimal pain or distress prior to losing consciousness. Each salmon farmer commits to developing and implementing guidelines for acceptable methods of euthanasia with associated training of site staff.

There are several welfare issues at the pre-harvest, stunning and harvest stages including:

1. Conditioning
2. Handling
3. Handling related procedures (e.g., corralling, time out of water, pumping)
4. Insufficient stunning force or inaccurate blows that do not render fish immediately unconscious.

Poor stunning and harvesting techniques can be identified and rectified by auditing the fish welfare during culling/stripping/grading/harvest and assigning numerical scores to a list of welfare indicators for a set number of samples (e.g., Table 3).

## Table 3 - Audit for welfare indicators during culling/ stripping/ grading/ harvest

| | |
|---|---|
| % effectively stunned at first attempt (can be determined in fish by several behaviour indicators such as body movement, eye roll or reaction to tail pinch). | |
| % rendered insensible | |
| % physical body defects (e.g., damaged/eroded fins and abrasions) | |
| % bruised carcasses | |
| % other carcass defects | |

The OIE has provided advice for mass culling of stock for disease control purposes that can be found here:

https://www.oie.int/index.php?id=171&L=0&htmfile=chapitre_killing_farm_fish.htm

The following standards relating to culling/stripping/grading/harvest, and immunisation must be carried out under conditions that minimise injury and stress to the fish and must be addressed in a Fish Welfare Management Plan:

### a. Culling

- Must only be carried out by appropriately trained staff.
- Fish must be humanely euthanised: rapid, with minimal pain and distress, rendering the fish insensible until death supervenes.
- Records of culling audits for welfare indicators must be kept (Table 3).
- A contingency plan for mass culling for disease control purposes must be developed and maintained (and may be covered under the sites Biosecurity Management Plan).

### b. Stripping

- Stripping must only be carried out by appropriately trained staff.
- Fish stripped for eggs must be humanely euthanised.

### c. Grading

- Smooth pipes and grading table must be used to minimise damage and stress to the fish.
- Adequate water flow must always be provided.
- Out of water time must be minimised.
- Must only be carried out by appropriately trained staff.
- Fish health must be checked, and only healthy fish graded.
- Fish must be conditioned appropriately prior to corralling to reduce activity and stress.
- Records of grading and mortalities must be kept.

### d. Harvest

- Harvest equipment must be designed, maintained, and operated to minimise damage and stress to the fish (e.g., use smooth pipes, and adequate water flows at all times).
- Out of water time must be minimised.
- Must only be carried out by appropriately trained staff.
- Fish health must be checked, and only healthy fish harvested.

- Fish must be conditioned appropriately prior to harvest to reduce activity and stress.
- Fish must be humanely euthanised.

### e. Vaccination/Immunisation

- Fish of 1-gram live weight must only be treated by immersion method.
- All fish must be suitably anaesthetised prior to any injection.
- Must only be carried out by appropriately trained staff.
- Where necessary a sample of fish must be used for calibration.
- Fish health must be monitored before, during and after, and only healthy fish vaccinated/immunised.
- Records of vaccinated fish must be maintained, and those records must allow identification of vaccinated fish throughout their life.
- Appropriate needle hygiene processes must be used.

## EVIDENCE TO BE PROVIDED

- Records of culling audits.
- A contingency plan for mass culling for disease control purposes.
- Records of grading and mortalities.
- Records of health checks and conditioning prior to harvest.
- Records of welfare checks at harvest.
- Fish health monitoring records before, during and after vaccination and immunisation.

# TRANSPORT AND TOWING

These standards follow international guidance for the various methods used to transport fish[1]. King salmon for example, are moved at different stages by land and at sea using adapted trucks and boats, however all require fish to be conditioned appropriately prior to movement.

In general, conditioning is used for a period to allow fish to empty their digestive tracts (RSPCA, 2018) and thus help maintain water quality and therefore reduce stress during subsequent transportation. Monitoring of Dissolved Oxygen (DO) is required to ensure appropriate levels are maintained throughout the transporting period. Transportation of fish is demanding as both corralling and handling, two of the most stressful events for fish, are required. Observation of the environment and welfare when the stock is under water can be challenging but monitoring of DO and temperature is feasible to ensure appropriate conditions are maintained throughout transportation.

Transport systems must be designed, maintained, and operated to ensure that fish are not caused unnecessary distress or discomfort. The transport and handling of fish must be kept to an absolute minimum. Persons involved in transport need to be thoroughly trained and competent to carry out the required tasks.

The following standards relating to transport and towing must be addressed in a Fish Welfare Management Plan:

## a. Stock Transport

Stock transport includes trucks and boats including well-boats.

**NB: All relevant standards relating to fish handling and corralling apply to transportation.**

- Conditioning for a suitable period prior to transportation.
- Fish health must be assessed prior to transfer to ensure fish are able to be transferred without undue health compromise.
- Injured and ill fish (e.g., displaying clinical signs of disease; having significant physical injuries or abnormal behaviour; recently exposed to stressors that adversely affect behaviour or physiological state (for example extreme temperatures); have had insufficient or excessive conditioning), must not be transported.
- Transport systems must be designed, maintained, and operated to ensure that fish are not caused unnecessary distress or discomfort.
- Critical water quality parameters (e.g., oxygen, air, temperature) must be maintained and monitored prior, during and after transport.
- Appropriate stocking densities during transport must be used to reduce fish damage and stress.
- Equipment used to handle fish, for example nets and dip nets, pumping devices and brailing devices, must be designed, constructed, and maintained to minimise physical injuries.
- Accidents during transportation can occur.
  - » Emergency procedures must be developed in case of accidents or other emergencies or systems failures.
- Post-transport observations must be made, and appropriate records kept.

1 OIE Aquatic Code 2012: https://www.oie.int/index.php?id=171&L=0&htmfile=chapitre_welfare_transport_farm_fish.htm

- A contingency plan must be in place that identifies the important adverse welfare events that may be encountered during transport, the procedures to manage each event and the action to be taken in such an event, including the responsibilities of each party involved, communication and record keeping. The contingency plan must also enable humane culling of the fish at the start and at the end of transportation, as well as during transportation, if required.
- Significant problems associated with transport should be evaluated to prevent recurrence of such problems.

### b. Towing in Net Pens

Towing fish in net pens can cause fish damage and stress. All the relevant standards relating to fish handling and corralling above apply to towing.

- Critical water quality parameters (e.g., oxygen, temperature, water current and tidal flow) must be monitored prior, during and post- towing.
- Appropriate stocking densities must be used during towing to ensure minimal stress.
- Accidents during transportation can occur,
  - » Emergency procedures must be developed in case of accidents or other emergencies or systems failures.

## EVIDENCE TO BE PROVIDED

- Records of conditioning, transport, and post-transport observations.
- Water quality data.
- Emergency procedures in case of emergencies during and after transportation and towing, including a contingency plan to enable humane culling of stock if required.
- Records of reviews of transport procedures and contingency plans if problems are identified or emergencies occur.

# TRAINING

Appropriate training procedures relevant to the requirements of these standards must be developed. This should include procedures for identifying and monitoring training requirements and progress by means of regular reviews and management observations. The establishment of induction training for new personnel and a system of recording training requirements, provision, and performance is required. Although most of the management and husbandry procedures have some effect on the health and welfare of the fish, some specific areas of training requirements are needed:

- Record keeping.
- Recognition and evaluation of signs of fish stress or disease symptoms (Table 2).
- Investigation of health and welfare concerns.
- Relevant parasite monitoring (e.g., isopods).
- Monitoring fish health.
- Monitoring water quality.
- Mortality management: removing, recording, and disposal.
- Handling, corralling, and grading fish.
- Euthanasia.
- Humane harvesting.
- Transport.
- Vaccination/immunisation.

## EVIDENCE TO BE PROVIDED

- Records of staff training on fish welfare.

# NOTES

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