

# WELFARE AND HUSBANDRY

“A subgroup of the Aquaculture Health Joint Working Group, with additional co-opted members as required, will be set up by the summer of 2003 to study the implications of fish welfare considerations for current aquaculture practices, and report by the following summer. Its report will translate into a series of recommendations to the Scottish aquaculture industry. Building these into Codes of Best Practice will signal that welfare is being positively addressed by the industry ...”

Strategic Framework for Scottish Aquaculture

## 1.1 Introduction

The Welfare Subgroup was made up of stakeholder interests covering animal welfare, the industry, scientists, vets and government. Details of members and the remit of the Subgroup can be found in Annex 1.

This Code takes account of current legislation, recommendations from advisers to Government on animal welfare, the latest published scientific research, veterinary advice and the practical experience of the aquaculture industry. This Code should not be looked upon as the final word in farmed fish welfare management, but as a document that will continue to evolve as **science based knowledge** improves further and industry knowledge increases – particularly in the farming of new species.

This Code adopts the principles of the “Five Freedoms” and the structure of the code is based on the Government’s Response to the Farm Animal Welfare Council’s report on the Welfare of Farmed Fish, the five freedoms being:

- Freedom from hunger and malnutrition;
- Freedom from discomfort;
- Freedom from pain, injury or disease;
- Freedom to express normal behaviour; and
- Freedom from fear and distress.

Sub sections within Welfare and Husbandry are:

1.2	Sites/equipment/environmental control	1.7	Grading
1.3	Stockmanship and inspection	1.8	Transport of live fish
1.4	Feeding	1.9	Disease and Parasitism
1.5	Breeding	1.10	Harvest and Euthanasia
1.6	Stocking density	1.11	Farming of more than one species on a site

## **1.2 Sites, Equipment and Environmental Control**

- Companies must follow all statutory regulation and should follow official guidelines and the recommendations of this Code

### **1.2.1 Veterinary Health Plan**

- In order to ensure that fish farm operators are operating to the highest possible standards of welfare, all businesses should compile a written Veterinary Health Plan, which is updated regularly
- Each farm should have access to a veterinary surgeon experienced in fish health to advise on fish health matters and medicine usage and to be available to attend at short notice in case of disease

### **1.2.2 Fish Farm Locations**

- Sites should provide an adequate water supply of suitable quality with emergency back-up systems to maintain water quality at all times
- Sites should be located and operated to minimise the possibility of environmental conditions having an adverse effect on the fish

### **1.2.3 Design and Planning of Farms, Equipment and Operating Systems**

- The siting of tanks and enclosures should be carefully considered with regard to fish welfare, health and safety and minimising adverse effects upon the environment
- Equipment and farm design should protect the fish from predators, using means which minimise harm to predators and which use methods conforming with this Code
- Equipment should be designed to safeguard the welfare of the fish and be capable of being cleaned and disinfected
- Farm design should allow for daily inspections of all stock
- Farm design and equipment should provide an adequate system for the regular removal of moribund or dead fish at intervals specified in the Veterinary Health Plan
- Farmers should be aware of and consider implementation of technological developments that advance welfare
- Farmers should have a reliable conduit to relevant information, for example through membership of their trade association
- Contingency plans should be in place in case of failure of the water supply or of automatic or other equipment

### **1.2.4 Tanks and Other Land Based Enclosures**

- Tanks, ponds or raceways should be designed to safeguard fish welfare as determined and updated by scientific research
- Farms and Holding Units, including inlets and outlets, should be designed to prevent fish escapes, and ingress of wild stock or predators
- At all times flow rates should be suitable for fish to be able to hold their position within the water column. Water flow rates are determined by the requirement for input of oxygen and flushing of waste products, and are dependent upon the degree of in-tank remediation systems such as aeration or oxygenation.

### **1.2.5 Pens or Floating Enclosures**

- The location of pens should allow an adequate flow of clean water but should be protected from exposure to extreme conditions that may harm fish or damage enclosures
- The current should not be so strong as to prevent fish from holding their position
- There should be suitable access from the shore to allow adequate inspections
- The size and proportion of the pen should be suitable to allow the fish to express normal behaviour
- Netting used in construction of enclosures should present a smooth, non-abrasive surface to limit injuries to fish
- Natural biofouling should not be allowed to build up on pen nets beyond a level which impairs water exchange
- Nets should be checked regularly for holes or biofouling and remedial action should be taken immediately to rectify any unsatisfactory situation
- Nets should be adequately tensioned and weighted to prevent distortion
- Nets should be of a suitable mesh size, quality and strength appropriate to their purpose
- Net depth should be such as to ensure that there is no contact between the net base and the seabed

### **1.2.6 Water quality**

Water quality parameters are **the most important** aspects of maintaining good welfare conditions for fish. Water should therefore be maintained at a suitable composition for the fish's stage of development in terms of levels of dissolved gases, particularly oxygen and carbon dioxide, temperature, pH, ammonia and sediment levels. Farmers should aim to maintain water quality parameters within the range shown in Annex 1.

- Water monitoring should be carried out to ensure that fish welfare is not prejudiced. Parameters measured and monitoring interval will depend on the system, species, stage of development and time of year
- Should water quality values depart from the acceptable range, steps should be taken to identify the problem and effect a remedy as soon as possible
- Automatic equipment with appropriate alarms should be used to monitor water quality where applicable. Where the welfare of the fish is critically dependent on air/oxygen supply or powered water supply, automatic oxygen and water level monitoring equipment should be used, with appropriate alarms and back up systems which are tested on a daily basis
- Farmers should be familiar with water quality parameters for their stock and be able to recognise visual indicators of poor water and behavioural indicators of poor water quality

### **1.2.7 Light**

- Exposure to light should be maintained at a level suitable for each stage of development or species in question
- Optimum lighting patterns for fish welfare on each site should be determined by practical experience, research outputs and specialist advice
- Fish should be protected from distress caused by high levels of visible or UV light for example by providing light screening covers
- Sudden changes in lighting levels should be avoided wherever possible
- Photoperiod control is an established practice for much of aquaculture. However, this acceptance should be kept under review subject to change in scientific knowledge

### **1.2.8 Inspection and Testing**

- Weather permitting, having regard to health and safety requirements, husbandry staff should undertake daily visual inspections of all equipment. Any defect should be immediately reported to supervisors
- Automatic and emergency back up equipment (particularly generators or oxygen production/injection systems) should be inspected and tested according to manufacturer's recommendation
- All defects should be immediately rectified, or if not possible, measures should be taken to safeguard fish welfare

### **1.2.9 Predator Control**

Fish farms in both marine and freshwater sites are exposed to a variety of predatory wildlife that can cause considerable losses of fish. Equally destruction of wildlife is of major public concern. The destructive control of wildlife should be used only as a last resort.

- Effective predator control is site specific.

- Fish should be protected from predators, and every effort should be made to use humane non-destructive means
- Adequate preventative measures should be incorporated into all farms at the planning stage, and should be reviewed regularly in light of future research
- Where destructive means are used these must minimise suffering to the individual predator
- Fish farm managers should ensure that proper procedures are adopted to reduce the impact of predators on farmed stock

#### ***Birds***

- Exclude birds by deploying nets, strings, gas guns, scarecrows or other systems designed for that purpose
- Where properly applied anti-predator measures fail to control the problem and predatory birds are causing serious stock loss or damage, or fear to the fish stock, an application must be made to SEERAD if the fish farm site wants a licence to destroy them. Be aware there are a number of protected species for which a licence will not be granted

#### ***Seals***

- Exclude seals by deploying nets, scarers or other systems designed for that purpose
- The legal destruction of a particular animal should only be considered after all reasonable attempts have been made to exclude seals from farms
- Where properly applied anti-predator measures fail to control the problem and seals are causing serious stock loss or damage, or fear to the fish stock, lethal methods of control must comply with legislation
- Seals may only be shot by a proficient named person using the appropriate weapon
- Companies should ensure the proficiency of nominated marksmen

#### ***Mink***

- Exclude mink by deploying nets, or other systems designed for that purpose
- Only after all reasonable attempts have been made to exclude mink from farms should humane destruction be considered

#### ***Record keeping***

- Records of losses to predators and use of control systems should be kept
- Records should be kept of predators which have been destructively controlled

## **1.3 Stockmanship & Husbandry Operations**

### **1.3.1 General Provisions**

- Companies should ensure that staff working with stock (defined as stock-keepers) are trained and competent in aspects of fish husbandry and welfare – relevant to their duties. Written records of staff training should be maintained
- Companies should ensure that all stock-keepers have access to a copy of this Code at each site, are familiar with and understand its content
- Companies should have measures in place to minimise the risks associated with emergencies such as fire, leaks, problems with transportation. This may be accomplished as part of a Veterinary Health Plan, International Standard Organisation (ISO), fish health and welfare Hazard Analysis Critical Control Point (HACCP) or Control of Substances Hazardous to Health (COSHH) provision
- Stock-keepers should be aware that certain procedures, including netting, handling, crowding or euthanasia, have the potential to compromise welfare and should carry out such procedures in a manner to minimise any discomfort or distress to stock
- Stock-keepers should be able to recognise indicators of poor welfare in fish including abnormal behaviour, physical injury and symptoms of disease and to take remedial action

### **1.3.2 Handling live fish**

- Removal from water and handling of live fish should only be carried out when absolutely necessary
- If fish are handled, adequate support should be given to the body (live fish must never be held by the gills or tail only)
- Different species have different tolerance to time out of water but all fish must be given the benefit of the doubt; the time must never be so long as to produce signs of distress. Even for tolerant species, eg flatfish, times must be reduced when the air temperature is particularly high or low. In all cases, fish must be kept wet.
- Where pumps, pipes and grading equipment are used, these should be designed for the purpose and should not injure or unnecessarily stress fish
- When hand nets are used they should be:
  - Of a suitable size (physical and mesh size)
  - Designed to minimise the occurrence of physical damage
  - Kept clean and disinfected and in good repair

### **1.3.3 Transfer to sea**

- Prior to transfer of Atlantic salmon to sea, the degree of smoltification of a population should be monitored for several weeks before the expected transfer date so that the optimal time for transfer can be identified

- To aid the identification of this transfer window, salt water tolerance testing should be encouraged. Fish showing morphological and behavioural indications of smolting should be held in full strength seawater equivalent (34 to 35 parts per thousand (ppt) for 24 hours after which time they will be killed and the blood subjected to testing for appropriate physiological parameters
- This procedure can be aversive in non-smolting fish so it is the duty of the operator immediately to kill any moribund fish and to terminate the test if the fish begin to show signs of distress. Operators should be trained in this procedure to minimise any negative welfare impact.
- Any procedure involving the exposure of fish to salt concentrations greater than 35 ppt is highly aversive to all stages of Atlantic salmon and is unacceptable
- Similar principles should be incorporated in the Veterinary Health Plan for other salmonids

### ***1.3.4 Crowding***

- There should be a written procedure for crowding and personnel should be trained in the appropriate techniques
- Crowding, in terms of frequency and duration, should be kept to the minimum.
- Stock-keepers should:
  - Monitor fish behaviour during the crowd and take action if fish are showing signs of stress or damage
  - Remove and cull any moribund or damaged fish
  - Ensure that enclosure nets and screens are kept clean in order to avoid water quality problems during crowding
  - Monitor oxygen levels during crowding and take corrective action if they are falling; urgent remedial action is required if levels fall below 6mg/l

### ***1.3.5 Removal and disposal of dead or moribund fish***

- Daily inspection (weather permitting) and removal of dead or moribund fish should take account of the need to:
  - Minimise handling at inspection and dead fish removal to avoid stress to the live fish within the tank/enclosure
  - Take prompt remedial action in accordance with the veterinary health plan to deal with any health or welfare problems
  - Full records of each inspection, to include the number of mortalities removed, and the likely cause of death as determined by a suitably competent person
- Where problems are identified during an inspection, the stock keeper should act promptly to discover the cause and take remedial action, in consultation with a veterinary surgeon, or fish health expert, when appropriate

- **Dead fish must be disposed of in the manner which takes account of biosecurity provisions and methods of disposal approved by regulating authorities (Refer to Health Section)**

### ***1.3.6 Quality Assurance***

Quality assurance schemes require accurate and up to date records to be maintained. This is an essential element for Companies and Stock-keepers to consider and implement in order to be able to demonstrate that they are operating to the highest health and welfare standards.

### ***1.3.7 Training***

Staff should be given appropriate training. Well trained and disciplined staff are essential for maintaining the required levels of welfare and adherence to protocols. Written protocols, including risk assessments, regularly audited, will increase security and are particularly important for activities on remote sites. These should be formally audited through the existing quality assurance schemes.

### ***1.3.8 Marking***

- **Marking methods that cause undue distress or injury to fish should not be employed**

## **1.4 Feeding**

### **1.4.1 Food Withdrawal**

Before transport or harvest, fish should be fasted to reduce metabolism and excretion of waste products during transport or to eliminate the presence of food and/or faecal material in the guts at harvest to minimise microbiological contamination during processing.

- **The period during which fish may be deprived of food prior to certain management procedures or harvest shall be incorporated into the Veterinary Health Plan and be appropriate to the species, taking into account environmental conditions**
- **Complete withdrawal of food should not be used as a way of conditioning fish**
- **Food withdrawal may form part of the response to adverse environmental conditions and as the therapy for certain diseases (eg Pancreas Disease of Atlantic Salmon); veterinary advice may be sought on this as appropriate**

## **1.5 Breeding**

- **The breeding process should pay proper regard to the welfare of the parent stock**
- **Handling, in order to carry out breeding procedures, should be kept to the minimum necessary for the task being undertaken**
- **Procedures used in breeding should only be carried out by properly trained and competent personnel**
- **Live fish which are to be stripped or milked should be properly anaesthetised if that is appropriate for the species**
- **The use of anaesthetics should be addressed in the Veterinary Health Plan**
- **Anaesthetics should not be regularly used for repeat-spawners such as halibut and turbot, but care should be taken in handling fish and in returning them to the broodstock tank.**
- **Shading of the eyes of the repeat-spawning fish is a useful technique during the brief period out of water**
- **Repeat-spawners which are regularly removed from the broodstock tank should be appropriately marked (e.g. pit tagging) by a trained stock-keeper so that individuals can easily be located without stress to the remainder of the population**

## 1.6 Stocking Density

As a general rule, stocking density should be adjusted in line with the biological needs of fish with regard to the prevailing environmental conditions in addition to health and welfare. The farming system used, in particular the ability to maintain water quality and the feeding technology, should also be an important factor in determining stocking density.

- **The fish shall have enough space to allow them to express normal behaviour, according to species**
- **Stocking density should be based on a range of variables over and above water quality parameters. For marine salmon farms, welfare indicators such as condition factor, fin condition, glucose and cortisol levels should also be taken into account. Further guidance is given in Annex 2. Research on stocking density for other species is less well developed. Veterinary surgeons should familiarise themselves with practical experience and keep abreast of relevant research.**
- **Stocking density should be monitored in relation to health, fish behaviour and water quality to ensure that welfare is not compromised, with immediate attention being given to any problems arising**

## **1.7 Grading**

Grading is a stressful operation for fish. Limited grading may be advantageous to welfare by preventing aggression, reducing feeding competition and removing maturing fish from a population. However good feeding techniques can also limit size spread within a population and thus limit the frequency of grading.

- **Minimisation of injury and stress to fish should be a primary consideration when deciding the method of grading employed**
- **Fish should be graded where failure to grade would adversely affect welfare**
- **Grading equipment should be designed and maintained so as not to cause damage to fish**
- **Details of planned frequency and procedures for grading should be included in the veterinary health plan**

## **1.8 Transport of Live Fish**

- **Anyone involved in the transportation of fish should be aware of all relevant legislation**
- **Crowding before collection for transport should be kept to a minimum**
- **Fish should not be transported in a way that causes or is likely to cause injury or suffering**
- **Biosecurity and fish welfare should be considered before transporting fish populations**
- **Sick or seriously injured fish must not be loaded for transport**
- **Regular observation and monitoring is essential, but regular visual inspection of fish in transport is stressful and should be minimised**
- **For lorry and wellboat transport, remote monitoring and control of oxygen levels (above 6mg/l) from the cab are required**
- **Supplementary oxygen or aeration should be available for the full duration of the journey, especially where fish are transported by helicopter. For guidance, oxygen supplies should be sufficient to last at least 50% longer than the anticipated journey length**
- **Excessive or rapid changes in water temperature and pH in transport tanks should be avoided**
- **Dead fish must not be loaded for transport. Any fish that die during transportation should be separated from live fish as soon as possible after arrival and cause of death determined by a competent person. Records of deaths or injuries during transportation should be made**

## 1.9 Disease and Parasitism

### 1.9.1 Medicinal products

Fish farmers have a responsibility to safeguard the health of the fish on their farm. Where appropriate, farmers may ask their veterinary surgeon to help them discharge this responsibility. A veterinary health plan tailored to the needs of the farm and identifying those areas of management that are likely to reduce the need for medication is recommended. There should also be a regular periodic review to assess the efficacy of treatments, so that medication regimes can be modified as appropriate.

Fish farmers can play a major role in ensuring the responsible use of medicines by following the guidelines below. Similar guidelines form part of all farm assurance schemes.

- **Regard therapeutic medicinal products as complementary to good management, vaccination and general site and farm hygiene.**
- **Prepare a veterinary health plan that outlines biosecurity protocols, preventative measures and treatments (for example vaccination, fungus control, lice control etc.). Delay in initiating treatment causes welfare problems and may ultimately lead to increased medicine use.**
- **Obtain formal veterinary approval before using any medicines which are subject to a veterinary prescription. In the case of in-feed medicines this will be provided by a Medicated Feedingstuff (MFS) Prescription.**
- **Provide accurate information to the attending veterinary surgeon so that correct dosages can be calculated for the fish concerned. Ensure that clear instructions for medication, dosage and administration are obtained and are communicated to the staff responsible for treatment.**
- **Make sure that the prescribing veterinary surgeon is aware of any other medicines being administered; adverse reactions sometimes occur.**
- **Always complete the recommended course of treatment at the correct dosage. Ensure that the medicine is dispensed in an effective manner and carefully administered.**
- **Ensure the end of medication is accurately determined, cleaning the feed bin or hopper, as appropriate.**
- **Comply fully with all requirements for medicine withdrawal periods prior to the slaughter of fish for human consumption. In general the withdrawal period is specified on the MFS Prescription or advised by the veterinary surgeon.**
- **Maintain a fish medicines record book on the farm, together with copies of relevant regulations and Codes of Practice.**
- **Accurately record the identity, batch number, amount and expiry of any medicine used, together with any withdrawal period required and the date the medication was completed.**

- Keep on file, for reference, appropriate data for all medicines used – for example, product data sheets, package inserts or safety data sheets, as available.
- Report to the veterinary surgeon, the supplier, or direct to the Veterinary Medicines Directorate any suspected adverse reaction to a medicine in either the treated fish or farm staff having contact with the medicine. Record the adverse reaction on the farm either in the medicine record book or by keeping a copy of the VMD adverse reaction form.
- Co-operate with Farm Assurance schemes which monitor medicine usage, medication documentation and withdrawal period compliance. However, such schemes should not constrain the farmer from preventing suffering of his fish stocks.
- Monitor medicine usage and consider, with your veterinary surgeon, the potency of various products that might be used.
- Be aware of your responsibilities for the safe use, storage and disposal of medicines. Adopt recording systems which provide a framework for identifying disease problems and allowing appropriate changes to management practice. This can lead to a reduction in medicine use.

## Sealice

- Sealice pose a particular problem for the salmon farming industry. Companies, in discussion with their veterinary surgeon, should agree the preferred treatment to feature in the Veterinary Health Plan (VHP)
- Companies should take all reasonable steps to minimise gravid lice population
- Stock-keepers should be able to recognise symptoms of lice infestations
- Fallowing of sites should be practised to help control sea lice populations, preferably at the same time as neighbouring farms within a Management Agreement Area (see Section 1.2 Sites/Equipment/Environmental Control) as part of a co-operative measure
- Companies should plan to use as wide a range of licensed treatments as possible, in rotation, in order to reduce the risk of resistance within the lice populations
- Wrasse, as one of a number of methods to control sealice, have a role to play and the farm manager should deploy them if they are deemed to be beneficial in that location

### 1.9.2 Vaccination

- The VHP should incorporate a vaccination programme to protect fish from diseases for which an effective licensed vaccine is available and which may represent a risk to the fish
- Records should be kept of all vaccination procedures and should include the following:
  - Date of vaccination
  - Identification of the groups of fish vaccinated

- **Vaccine used (including batch numbers)**
- **Details of dosage and the names of the personnel involved**
- **Vaccinations should only be carried out by named competent persons under veterinary supervision**
- **Vaccines must be used in accordance with veterinary advice**
- **Vaccines must be stored in an appropriate container and must not be used after the expiry date**
- **Equipment used in vaccination must be maintained in a hygienic manner**
- **Vaccination procedures must be conducted with care and with the minimum possible distress caused to the fish**
- **Booster vaccinations carried out must be administered whilst the fish is still protected from the previous vaccination**

## **1.10 Harvest and Euthanasia**

### **1.10.1 General Provisions**

- In the harvesting of fish, the following should be taken into consideration:
  - Slaughter methods must result in rapid and irreversible loss of consciousness. (This is a statutory requirement under the Welfare of Animals (Slaughter and Killing Regulations 1995))
  - Traditional slaughter methods for some sectors, which may not cause sufficiently rapid and irreversible loss of consciousness, should be phased out of usage over the next 5 years, subject to full-scale validation of new technologies which are being or have recently been developed
  - The use of carbon dioxide for routine slaughter of fish is not permitted. Only when new scientific developments improve welfare aspects should this method be considered
  - Transfer, stunning, bleeding or killing should be carried out to avoid pain, suffering, fear or distress
  - Fish should be fasted for the minimum period necessary to clear the gut
  - Crowding prior to harvesting should not be so prolonged or severe that unnecessary suffering is caused. Particular care is needed where more than one crowding is necessary to complete the harvest
  - Staff should have the necessary knowledge and skill to perform their tasks humanely
  - Killing efficiency should be monitored by an appropriate person to ensure fish do not regain consciousness prior to death
  - The management of the process of harvesting should be such that welfare is not compromised through staff becoming tired or inefficient
  - When fish are percussed the blow should cause immediate unconsciousness. Following the blow, fish should be bled by cutting gill arches or the dorsal aorta

### **1.10.2 Emergency Euthanasia**

- Any seriously sick or injured fish, or fish found not to be recovering, should be humanely killed without delay:

#### **Freshwater**

- Freshwater fish should be culled by an overdose of anaesthetic using immersion, or by any other method which renders them rapidly insensible

#### **Seawater**

- Seawater fish should be dispatched by a non-recoverable blow to the head, using a priest or mechanical percussive device, of sufficient force to render

**the fish immediately insensible and result in rapid and irreversible loss of consciousness**

- **The use of carbon dioxide may be permitted for large scale culling for fish disease control purposes under statutory order**
- **Seriously injured or sick fish should never be left to die in air**
- **Only suitably trained and competent staff should cull sick or injured fish**

## **1.11 Holding More Than One Species on Site**

- **Any wild fish, whether deliberately introduced or not, present in the pen (or other unit) at the end of a production cycle must be culled and not released into the environment.**

## INDICATIVE WATER QUALITY PARAMETERS FOR SCOTTISH AQUACULTURE FINFISH

	Atlantic Salmon	Rainbow Trout	Atlantic Halibut	Atlantic Cod	Turbot
<b>Oxygen (mg/L or % saturation )</b>					
Juveniles	6.5-16.5 (70%)	70%			
	120%				
Adults	6-7 (60%)	5 (60%)	5	5	5
<b>Ammonia (mg/L unionised NH3))</b>					
Juveniles	0.004	0.006			
Adults	0.005	0.01	0.2	0.2	0.2
<b>Carbon Dioxide (mg/L)</b>					
Juveniles					
Adults	10 (at 15-16 ° C)	20	40	40	40
<b>pH (Acceptable Range)</b>					
Freshwater	6-8.5	5.5-8.5			
Seawater	7-8.5	7-8.5	6.5-8.5	6.5-8.5	6.5-8.5
<b>Temperature (° C Acceptable Range)</b>					
Juveniles	<8-10 ( <i>embryos</i> )	12-14			
Adults	6-18 (optimum range))	<18	6-15 (optimum range))	6-18 (optimum range))	8-18 (optimum range))
<b>Salinity (g/L Accpetable Range)</b>	Max 35	Max 35	15-37	15-37	15-35

## NOTES

1. Source is work-in-progress for Council of Europe Welfare Working Group
2. Parameter levels may change as C of E work proceeds
3. Blank spaces indicate no information

**SUMMARY OF FINDINGS OF LINK AQUACULTURE SPONSORED RESEARCH ENTITLED “WELFARE OF FARMED ATLANTIC SALMON (*SALMO SALAR*): A NOVEL MULTIVARIATE INDEX TO EXAMINE THE EFFECTS OF STOCKING DENSITY”**

The Welfare of farmed animals, including fish, is an area receiving increasing attention. Attempts have been made to control welfare in farmed fish through regulation of management practices, including stocking density. However, there have been no successful studies of the influence of stocking density on welfare of fish in marine cages. This study examined Atlantic salmon (*Salmo salar*) in cages on a commercial marine farm and recorded a wide range of variables from fish and from the cage system. Following analyses of all available data, a multivariate index (higher values = better welfare) was derived from condition factor, fin condition, glucose and cortisol. This index was used as the dependent variable representing welfare and agreed well with expert evaluation of fish welfare and recorded mortality rates. The welfare index remained stable with increasing stocking density up to an inflection point c. 25 kg/m<sup>3</sup> after which increasing stocking density was associated with reduced welfare. From this study it was clear that stocking density is only one aspect of husbandry practice that can influence the welfare of farmed Atlantic salmon and, on its own, cannot be used to accurately predict or to control welfare.

**LIST OF MEMBERS OF  
AQUACULTURE HEALTH JOINT WORKING GROUP  
WELFARE SUBGROUP**

Ms Jinny Hutchison, SEERAD, Chair (Until August 2003)

Mr Dave Wyman, SEERAD (Chair from September 2003)

Mr Charles Allan, Fisheries Research Services

Mr Paul Hook, Compassion in World Farming

Mr Paul Shave, SEERAD

Mr Richard Slaski, Federation of Scottish Aquaculture Producers

Mr Ronnie Soutar, Fish Veterinary Society

Mr Brian Speed, Scottish Society for the Prevention of Cruelty to Animals

Professor Phil Thomas, Responsible Use of Medicine in Agriculture

Mr Andrew Voas, State Veterinary Services

Dr John Webster, Federation of Scottish Aquaculture Producers

**SECRETARIAT**

Ms Carrol Herbertson, SEERAD

Mr Neil Sinclair, SEERAD

**TERMS OF REFERENCE**

The Terms of Reference of the Welfare Subgroup were as follows:

“A Welfare Subgroup of the Aquaculture Health Joint Working Group will be established to consider the welfare of farmed fish. The Subgroup will provide a first draft of the welfare codes to the parent Group by the end of 2003 and, by August 2004, produce a science based, referenced report with recommendations for inclusion as appropriate to industry codes of practice.”

## LEGISLATION COVERING WELFARE OF FARMED FISH

### SUMMARY OF WELFARE LEGISLATION APPLYING TO FARMED FISH

1. There are 5 main pieces of domestic legislation dealing with the welfare of farmed fish.

a. The Protection of Animals (Scotland) Act 1912 (The Protection of Animals Act 1911 applies in England and Wales): Article 1 of this Act makes it an offence to cause or permit any unnecessary suffering to any domestic or captive animal by wantonly or unreasonably doing or omitting to do any act. The Act defines animal as any domestic or captive animal. Guidance has been received from our Legal Department that this Act does apply to farmed fish, whether they be held in fresh or salt water. Clearly under this legislation any act or omission which causes suffering to farmed fish at any stage of production including slaughter would be an offence. The Act does, however, specifically exclude fish from the power given to a police constable to summon a veterinary surgeon to slaughter an animal which is diseased or injured.

b. The Agriculture (Miscellaneous Provisions) Act 1968; Article 1 (i) states that *"any person who causes unnecessary pain or unnecessary distress to any livestock for the time being situated on agricultural land and under his control or permit any such livestock to suffer any such pain or distress of which he knows or may reasonably be expected to know shall be guilty of an offence under this section"*. Under this Act livestock are defined as *"any creature kept for the production of food"*. Fish fall within the above definition, however, there is a question as to whether they are kept on agricultural land. Legal advice suggests that this Act only applies to fish held captive for the purpose of food production in tanks or in ponds on agricultural land. Consequently this Act does not apply to fish being reared for sporting or recreational purposes and also to fish farmed at sea. Legal opinion is that this legislation applies to farmed trout and also to the fresh water stages of salmon production but not to fish held in pens at sea or in estuaries.

c. The Welfare of Animals (Slaughter or Killing) Regulations 1995; these regulations implement Council Directive 03/119/EC, Article 1.1 of which states that the Directive *"shall apply to the movement, lairaging, restraint, stunning, slaughter and killing of animals bred and kept for the production of meat, skin, fur or other products .....*". This clearly includes fish. Article 4.1 of the Regulations state the *"no person engaged in the movement, lairaging, restraint, stunning, slaughter or killing of animals shall"*:

- (a) *cause any avoidable excitement, pain or suffering to any animal; or*
- (b) *permit any animal to sustain any avoidable excitement, pain, or suffering"*.

Furthermore, Regulation 4.2 states that: *"no person shall engage in the movement, lairaging, restraint, stunning, slaughter or killing of any animal unless he has the knowledge and skill necessary to perform those tasks humanely and efficiently in accordance with these Regulations"*. The consequences of the above requirements are that fish should be slaughtered humanely by competent staff. Failure to do so would be an offence under these Regulations.

d. The Welfare of Animals (Transport) Order 1997; this Order requires that all animals, including fish, are transported in a way that does not, and is not likely to, cause injury or unnecessary suffering.

e. The Welfare of Farmed Animals (Scotland) Regulations 2000; these implement Council Directive 98/58/EC concerning the protection of animals kept for farming purposes. These Regulations require that owners and keepers of animals kept for farming purposes (defined to include fish) must take reasonable steps to *"ensure the welfare of animals under their care"* and *"to ensure that the animals are not caused any unnecessary pain, suffering or injury"*. The Regulations also cover access to statutory welfare codes for employees and provide for the service of "improvement notices" by authorised persons under Regulation 11 where the authorised person considers that animals are being kept in a way which is likely to cause unnecessary pain, suffering or injury. However, as these Regulations are made under the Agriculture (Miscellaneous Provisions) Act 1968 and an "authorised person" means a person authorised under the Agriculture (Miscellaneous Provisions) Act they also presumably would not apply to fish in the sea, although they would apply to farmed freshwater fish.

2. A consultation on proposals to revise existing Scottish animal welfare legislation was issued on 31 March 2004.. It is proposed that new legislation will be introduced to update and replace the existing animal welfare legislation and will apply to farmed, domestic and captive animals that are dependent on man, including fish held in the sea. This will place an obligation on keepers of animals to ensure their welfare and to follow statutory codes of practice. The timing of the Bill is not yet certain but it is expected before 2007.

3. In addition to the legislation identified above there is other legislation which could have an impact fish welfare. This includes:

a. The Registration of Fish Farming and Shellfish Farming Businesses Amendment (Scotland) Order 2002 and Amendment (No.2) Order 2002 provides for the requirement to notify SEERAD of any escapes from a fish farm and to provide certain information in relation to these escapees.

b. The Animal By-Products (Scotland) Order 2003 lays down the health rules concerning animal by-products not intended for human consumption. It prescribes the disposal route for these products depending to which category the by-product fits. There is a derogation to allow burial in remote areas or during an outbreak of notifiable disease if there is a lack of capacity at

rendering plants and incinerators or because transport would spread the disease. Where permitted burial is to be carried out it will need to be done in a way that safeguards the environment and prevents the spread of disease.

- c. The Landfill (Scotland) Regulations 2003 brings farm dumps within the regulatory regime and prevents the dumping of waste (except under licence) on farm. Leachate from dumps can cause an environmental as well as a disease risk. Derogation exists under the Animal By – Products Order 2003, permitting burial of fallen stock, but only where a collection service is not available.
- d. The Waste Management Licensing Amendment (Scotland) Regulations 2003 tighten the landspreading exemptions to the WMLR1994 and prevents the spreading of untreated waste on land. Such controls reduce the possibility of disease spread to river waters