Animal Welfare and Food Safety in Farmed Fish

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EFSA’s Mission

The Authority shall provide **scientific advice and scientific and technical support** for the Community's legislation and policies in all fields which have a direct or indirect impact on food and feed safety. It shall provide **independent information** on all matters within these fields and **communicate on risks**.

**AHAW Panel - mandate**

The Animal Health and Welfare Panel deals with questions on all aspects of animal health and animal welfare, primarily relating to food producing animals, including fish.
Ethical, socio-economic, cultural and religious aspects are outside the scope of the EFSA’s remit.

Risk Managers (EC) deal with legitimate and legal factors, “including societal, economic, traditional, ethical and environmental factors and the feasibility of controls.”
Interaction among AW, AD and FS in EFSA's Scientific Opinions

- **Animal Welfare** has an overall impact, not only focused on welfare aspects, but also considering factors with possible incidence on animal diseases and food safety.

- The evaluation of the overall interaction between animal welfare, animal disease and food safety may support the development of control and monitoring plans at farm level through specific indicators.
<table>
<thead>
<tr>
<th>Scientific Opinions</th>
<th>Year</th>
<th>AW</th>
<th>AD</th>
<th>FS</th>
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</thead>
<tbody>
<tr>
<td>Stunning/killing of main species</td>
<td>2004</td>
<td>X</td>
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<tr>
<td>Fish vectors diseases (3 SOs): fish, molluscs, crustacean</td>
<td>2007</td>
<td></td>
<td>X</td>
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<td>Susceptible aquatic species</td>
<td>2008</td>
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<tr>
<td>Fish Welfare - Husbandry Systems (5 SOs): Salmon, Trout, Carp, Eel, Seabass-seabream</td>
<td>2008</td>
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<tr>
<td>Fish Welfare and sentience concept</td>
<td>2009</td>
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<tr>
<td>Stunning and killing of Farmed Fish (7 SOs): Salmon, Trout, Carp, Eel, Seabass-seabream, Tuna, Turbot</td>
<td>2009</td>
<td>X</td>
<td>x</td>
<td>X</td>
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Scientific Opinion on Fish Welfare

- Scientific opinion on the animal welfare aspects of husbandry systems for farmed fish.
- Where relevant, animal health and food safety aspects should also be taken into account.
- Main farmed fish species (Atlantic salmon, Gilthead sea bream, sea bass, Rainbow trout, Carp, European eel)
- Farming systems at a European level.
- Identification of factors that have potential to affect fish welfare (Abiotic, Biotic, Feeding, Management, Genetics, Disease/Disease control measures)
Factors increasing risk of exposing fish to challenges for which it is not adapted

Factors reducing the risk of exposing fish to challenges for which it is not adapted

Adaptation used in farm system and evidence of normal function and behaviour

Challenges from farm system for which fish is not adapted and evidence of abnormal function and behaviour

From Turnbull & Kadri, 2007
Risk Assessment Approach

- D and E may be translated into welfare hazards
  - species specific approach
  - typology of production systems is a prerequisite
  - life stages (including early stages) & husbandry system

- Risk in animal welfare is a function of the probability of occurrence and the consequences of occurrence
  - risk score = exposure x impact

- the probability of a given population to be exposed to a particular hazard is scored as combination of
  - the frequency of occurrence of the hazard, and
  - the proportion of the population affected;
  - the consequences of exposure have been scored by severity of the effect in the individual, and
  - the duration of the effect.
Hazard identification

Examples (Common carp, EFSA 2008)

✓ Abiotic factors:
  - Light period and intensity, Noise and vibration, Water flow, Water oxygen content, Total dissolved gases, Water temperature, Water pH, Suspended solids, Ammonia content, Pond size and morphology, Substrate of ponds, Environmental pollutants...

✓ Biotic factors
  - Algal blooms, Behavioral interactions, Stocking density, Food and feeding, Husbandry and management, Stocking, Handling, On-farm movements, Harvesting, Sorting and grading, Monitoring, Staff training on welfare, Genetics, Impact of diseases on welfare, Diseases control measures (Biosecurity, Monitoring mortalities & survival rates, Drug usage, Vaccination)...

Animal welfare aspects of husbandry systems for farmed fish

Salmon

MATURAZIONE
2-5 anni

Fase giovanile in acqua dolce
2 mesi-2 anni
APR–AGO migrazione oceano

RITORNO ACQUA DOLCE
2-6 anni

RIPRODUZIONE
SETT–NOV

SETT–DIC

GENN–APR

MAG–GIU
Animal welfare aspects of husbandry systems for farmed fish

Adult Salmon
Sea Bass/Sea Bream Welfare

Risk Assessment Outcomes

Eggs Tanks Recirculated

- Low water renewal
- Sudden change of temperature (considerably exceeding optimum range for embryogenesis 13-16°C)
- Inappropriate transport between units
- Sudden oxygen content change
- Inadequate air supplementation (too many bubbles, oversized bubbles)
- Inadequate water velocity
- Too much light (intensity)
- Too low salinity
- Inappropriate disinfection methods (inadequate solution)

Final Risk Scoring
Fish Welfare Messages

- Fish Welfare (FW) must be assessed through an explicit process based on both scientifically derived data and value-based assumptions.
- FW assessment is still hampered by diversity of fish species and overall lack of scientific data.
- RA Methodology provides a reliable approach for a qualitative ranking and identification of significant hazards. The scores provide an indication of why the hazard achieved a high score and support recommendations to improve the welfare of fish.
- Further challenges:
  - the paradox of generic vs specific approach
  - hazards considered individually: interactions between hazards should be taken into account.
Stunning and killing of farmed fish

• The Commission requests EFSA to issue a scientific opinion on the species-specific welfare aspects of the main systems of stunning and killing farmed fish.

• Animal health and food safety should be considered

• Species to be considered: Atlantic salmon (*S. salar*), rainbow trout (*O. mykiss*), European eel (*A. anguilla*), gilthead seabream (*S. aurata*), European seabass (*D. labrax*), European turbot (*S. maximus*), European carp (*C. carpio*), Farmed tuna (*Thunnus* spp.).

• Farming conditions and transport from farm to abattoir not covered

• Adopted in March (5) and April (2) 2009 – EFSA Web
Stunning and Killing pathways
## Risk and Magnitude in Fish S&K

### Hazard ID | Hazards | Description of adverse effects | Risk score | Magnitude
--- | --- | --- | --- | ---
**Shooting from above the surface** | | | 152 | 
1 | Medium density crowding | Some fish being caught in the nets, distress. | 67 | 67
2 | High density crowding | More fish caught in the nets, struggling and distress, hypoxia. | 75 | 75
3 | Shooting; 1. time, successful | | - | -
4 | Shooting; 1. time, not, successful | Fish probably stunned but may suffer from injury. | 10 | 100
5 | Spiking | | - | -
**Lupara with no back-up diver** | | | 89.25 | 
1 | Low density crowding | Few fish being caught in the nets, distress. | 30 | 33.3
2 | Die due to asphyxia | Distress and hypoxia until they die or are killed | 8 | 75
3 | Medium density crowding | Some fish caught in the nets, struggling and distress, hypoxia. | 50 | 50
4 | Shooting: 1. time, successful | | - | -
5 | Shooting: 1. time, not successful | Fish probably stunned but may suffer from injury. | 0.25 | 25
6 | Tied | Distress if conscious. | 0.5 | 50
7 | Hoisting on board | Distress if conscious. | 0.5 | 50
8 | Bleeding | Distress if conscious. | 0.5 | 50
9 | Coring | | - | -
Carbon dioxide and asphyxia generally recognised as having poor welfare for all species, and therefore should not be used for any fish species.

Some S&K Methods, may be applied with effective results to other fish species, to which has never been performed before.

Research should be recommended on the evaluation of the application of these S&K Methods to other fish species. In particular, Electrical Stunning.

Standard operating procedures should be introduced/validated improving the slaughter process.

Surveillance/monitoring programmes to make data available in the future for an improved risk assessment and to determine improvement over time.
Welfare and food safety?

“You can see by its smile that this halibut was humanely killed.”
Guiding principles

- **BIOHAZ assessments** focused on the **food safety relevance of pre-harvest and harvest factors** relating to fish welfare
- **Limited or unavailable evidence** of a **quantifiable and directly applicable relationship** between AW-relevant factor (on-farm) and safety hazard (at slaughter)
- **Various factors** (e.g. water microbial contamination, antimicrobials misuse, increased handling, invasive stunning, etc.) could **increase the risk of microbial contamination of fish**
- The closer the biological risks occur to slaughter, the higher is their importance in food safety
- **Post-slaughtering and processing not considered**
Farming System

- **Food safety hazards** associated with aquaculture products vary greatly according to **methods of production, farm management and location**
  - i.e. mud-bottomed farms have increased probability of occurrence of *Clostridium botulinum* type E spores in fish end-products
- Most of the **biosecurity and hygiene measures are specifically intended to reduce fish diseases**, they will influence also the safety of the fish product
- **Good aquaculture practices (GAP)** can reduce spore prevalence in fish and some of the pre-harvest risk reduction measures implemented are
  - removing bottom sludge, proper cleaning and disinfection of ponds,
  - good hygienic condition of feed (trash fish) used in fish feeding, and
  - the daily removal of weak, damaged or dead individuals
The location of the farm and possible contamination with faecal pollutants (run-off waters, human sewage and farm effluents, wild animals) should be addressed, as sources of faecal contamination (a/h) can occur accidentally in the vicinity of the farm. This will increase the prevalence of pathogens (*Salmonella*, *Shigella*, pathogenic *Escherichia coli*, enteric viruses, hepatitis viruses, parasites).

Introduction of aquatic species in new habitats for recreation or aquaculture can change parasite and bacteria prevalence.
Environmental conditions

- **Changes in the water quality and environmental conditions** may act as stressors, making fish more susceptible to infection and pathogen carriage.

- **Environmental conditions** (water temperature, salinity, oxygen levels, phytoplankton concentration, pH, light, nutrient conc. i.e., phosphorous, nitrogen) can modify the occurrence and concentration of indigenous aquatic pathogenic bacteria in water (Vibrio, Aeromonas, etc.).

- **Development of blooms (red tides)**, which could eventually lead to the presence of toxic microalgae in fish, has also a strong dependence on environmental conditions.
Other stressors and food safety

- **All farmed species are susceptible to stress factors** (i.e. stocking density, grading, mixing of species, predators, handling, transport, removal of fish from water, temperature changes, inadequate light)

- **Response to stress** is hormone dis-balance, osmoregulation disruption, immuno-suppression.

As a result, fish is more susceptible to disease, and possibly prone to bacterial carriage. May have an effect in the safety of fish products.

- **Particular importance for food safety when occurring close to slaughter**
Food Safety (FS) Con & Rec

- FS Risks associated with aquaculture products is very low
- GAP result in optimal AH-AW, increase fish infection resistance, and lead to a reduction of the FS risks
- Aquaculture Practices and conditions specific to some production systems may influence the product safety
- Pre-harvest/harvest measures to be complemented with the post-harvest best practices
- Further research should be encouraged to improve quantitative RA on:
  - the quantitative relationship between on-farm factors
  - FS Hazards associated with the resulting food product
- Coordinated AH-AW/FS research programs, should be encouraged and supported.
- Where factors promote AW but increase FS Risks, additional risk reduction measures should be implemented.
Acknowledgments

- Working Groups Experts:
  - Fish Welfare (5 WGs)
  - Fish Stunning&Killing (7 WGs)
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- Members of the EFSA BIOHAZ Panel (2 SOs)
- AHAW Staff: F. Berthe, A. Afonso, T. Grudnik
- BIOHAZ Staff: E. Liebana-Criado
For any additional info:

www.efsa.europa.eu
Thanks for your attention !!