European Food Safety Authority

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.

General Approach according to Regulation 178/2002

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.

Scientific Opinions 2004-2009

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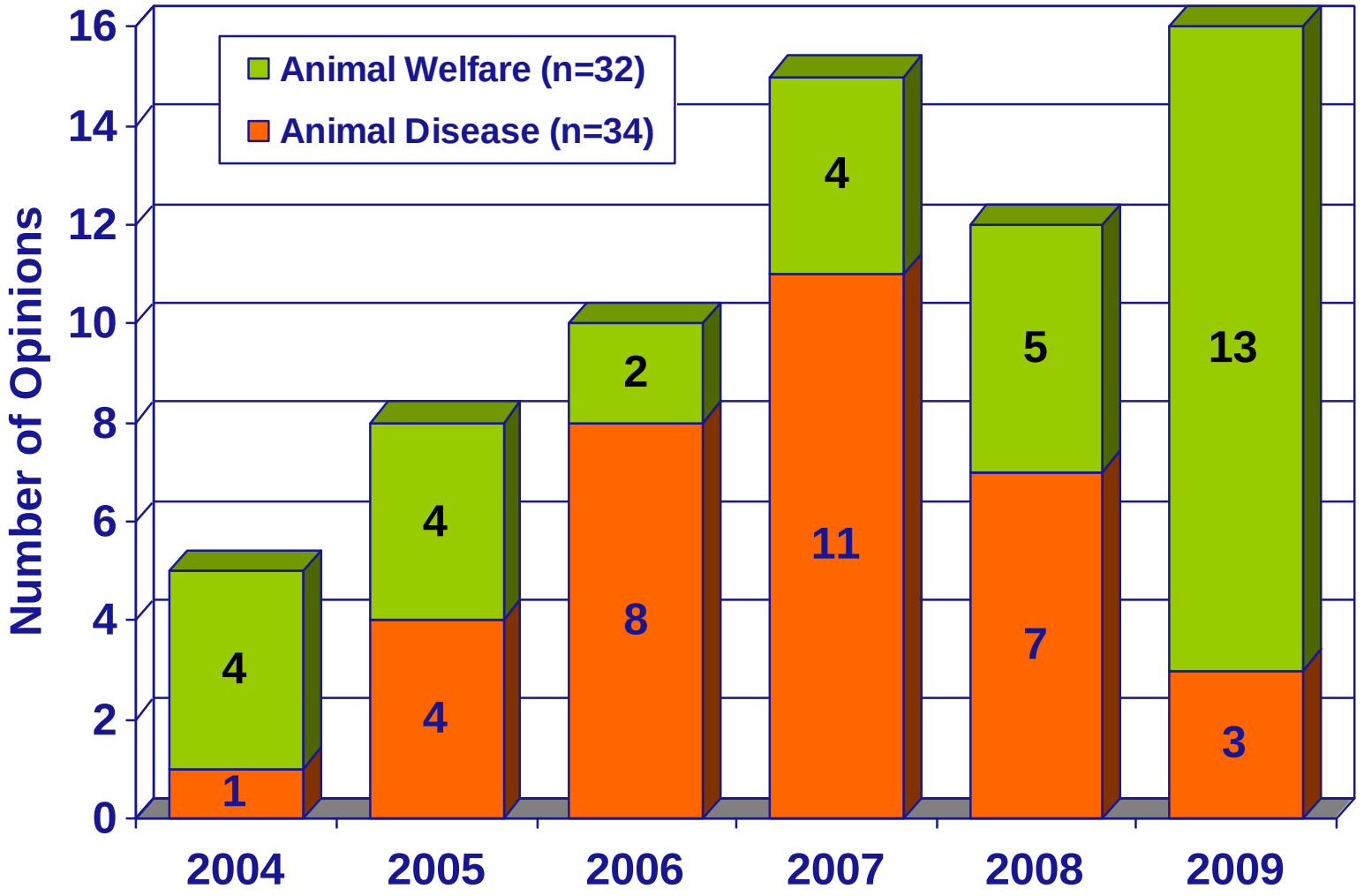

EFSA Scientific Opinions on Fish 2004-2009

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Scientific Opinions	Year	AW	AD	FS
Stunning/killing of main species	2004	X	x	
Fish vectors diseases (3 SOs): fish, molluscs, crustacean	2007		X	
Susceptible aquatic species	2008		X	
Fish Welfare - Husbandry Systems (5 SOs): Salmon, Trout, Carp, Eel, Seabass-seabream	2008	X	x	X
Fish Welfare and sentience concept	2009	X		
Stunning and killing of Farmed Fish (7 SOs): Salmon, Trout, Carp, Eel, Seabass-seabream, Tuna, Turbot	2009	X	x	X

Scientific Opinion on Fish Welfare

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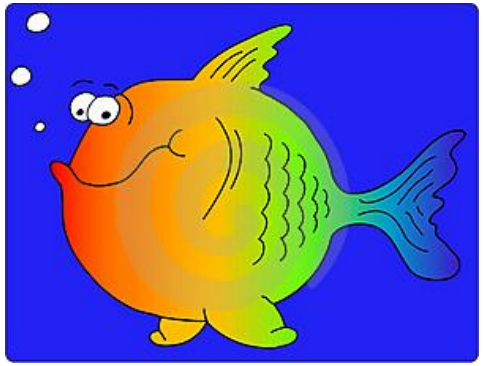
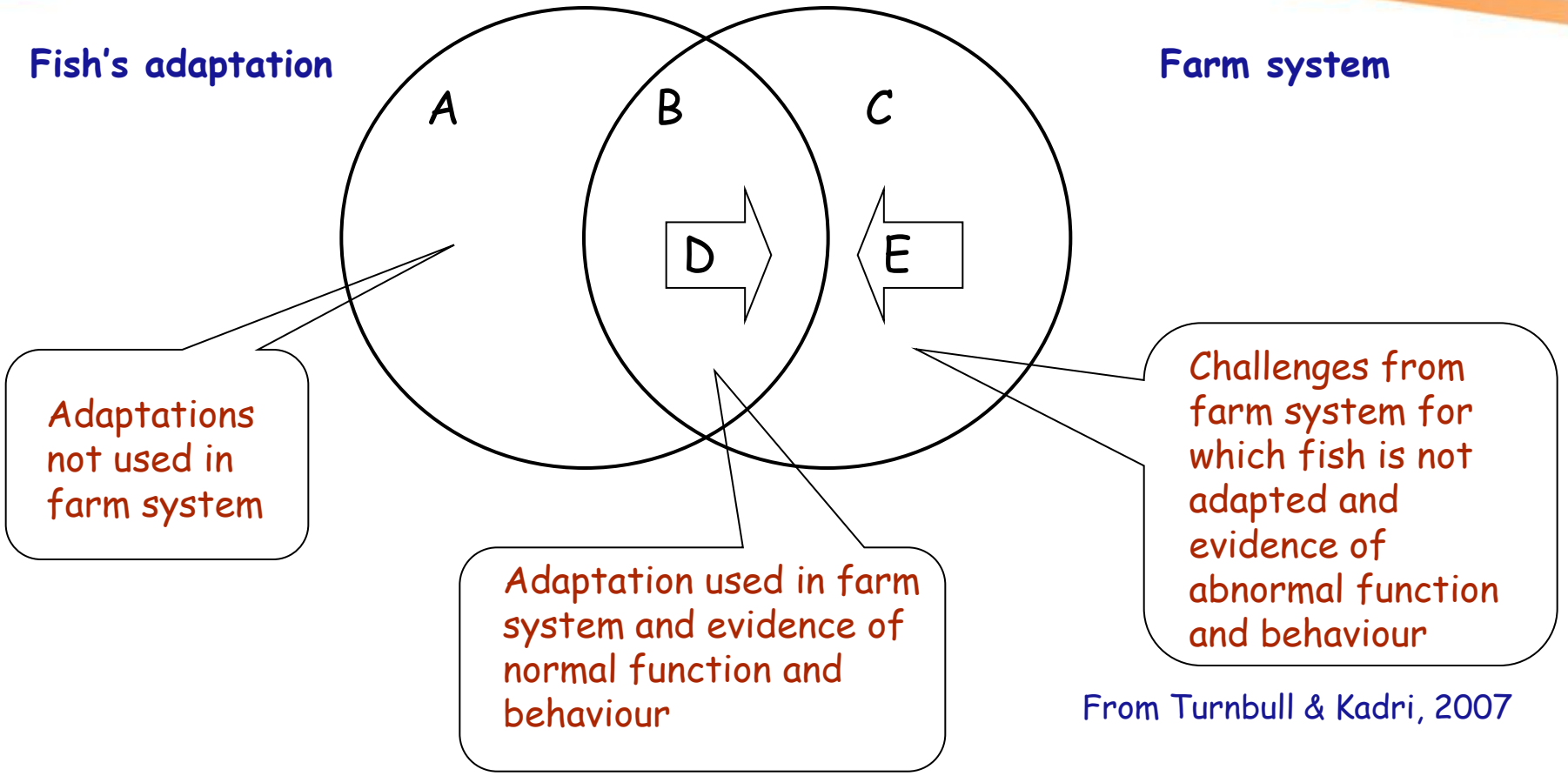
- Scientific opinion on the animal welfare aspects of husbandry systems for farmed fish.
- Where relevant, animal health and food safety aspects should also be taken into account.
- Main farmed fish species (Atlantic salmon, Gilthead sea bream, sea bass, Rainbow trout, Carp, European eel)
- Farming systems at a European level.
- Identification of factors that have potential to affect fish welfare (Abiotic, Biotic, Feeding, Management, Genetics, Disease/Disease control measures)



Venn diagram for fish welfare



From Turnbull & Kadri, 2007

E — Factors increasing risk of exposing fish to challenges for which it is not adapted

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

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

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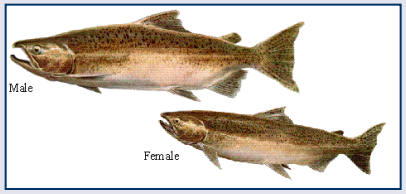
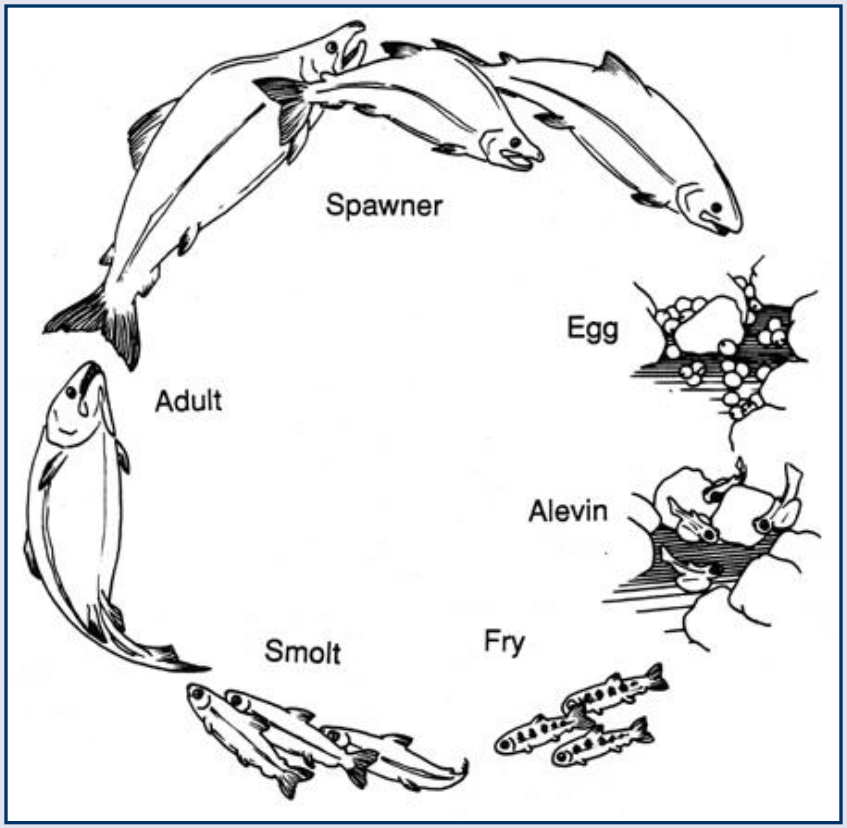
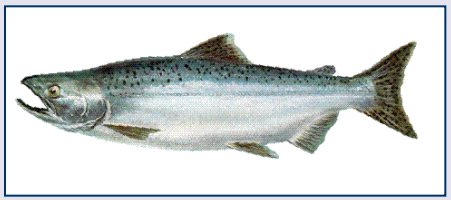
Salmon

RITORNO ACQUA DOLCE
2-6 anni

RIPRODUZIONE
SETT-NOV



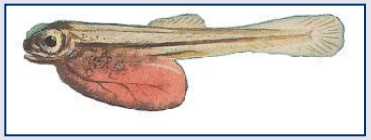




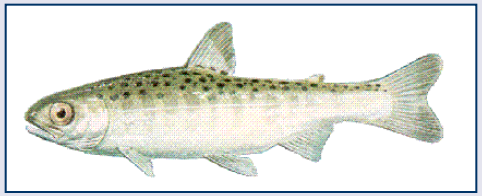
MATURAZIONE

2-5 anni

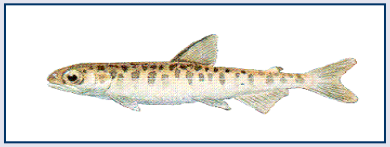
SETT -DIC



GENN -APR



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



MAG -GIU

Animal welfare aspects of husbandry systems for farmed fish

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Adult Salmon

Risk Assessment Outcomes

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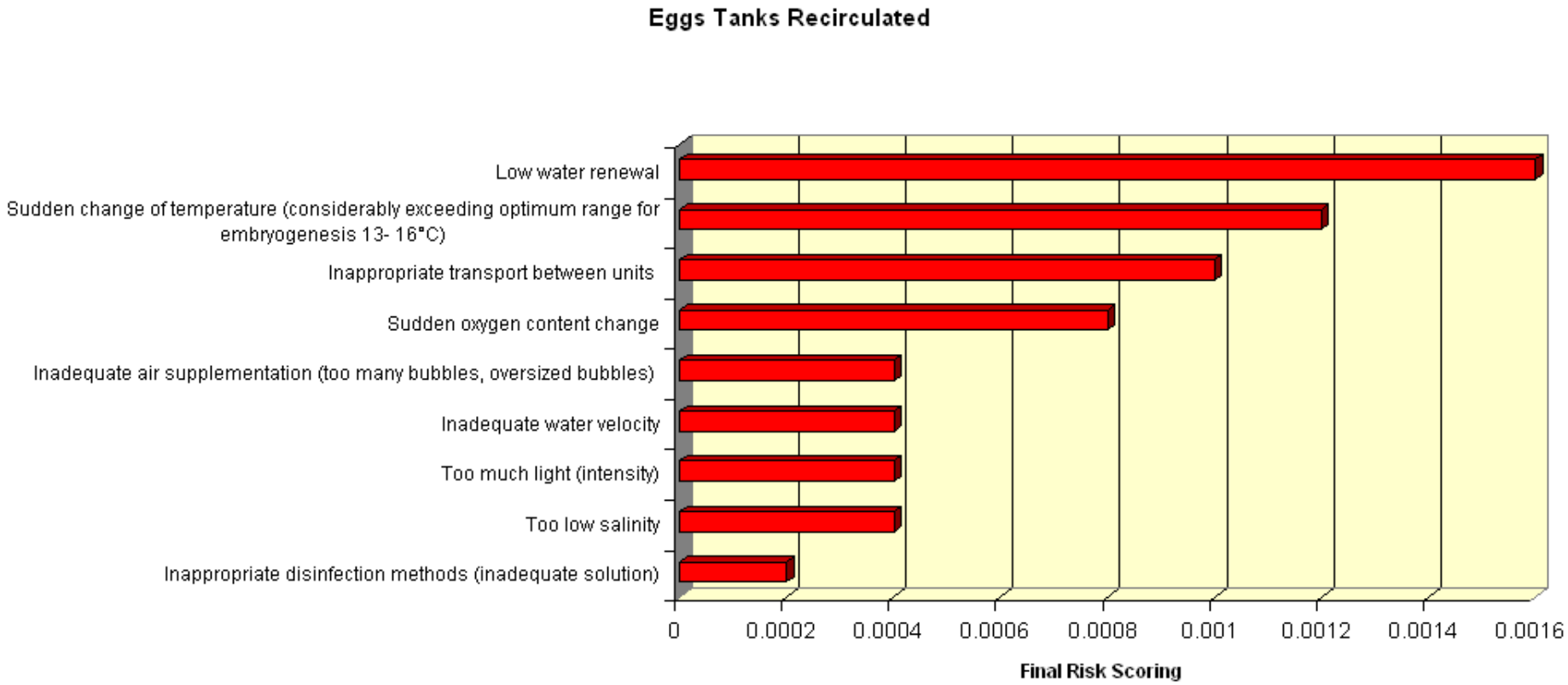
Sea Bass/Sea Bream Welfare



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 provides 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

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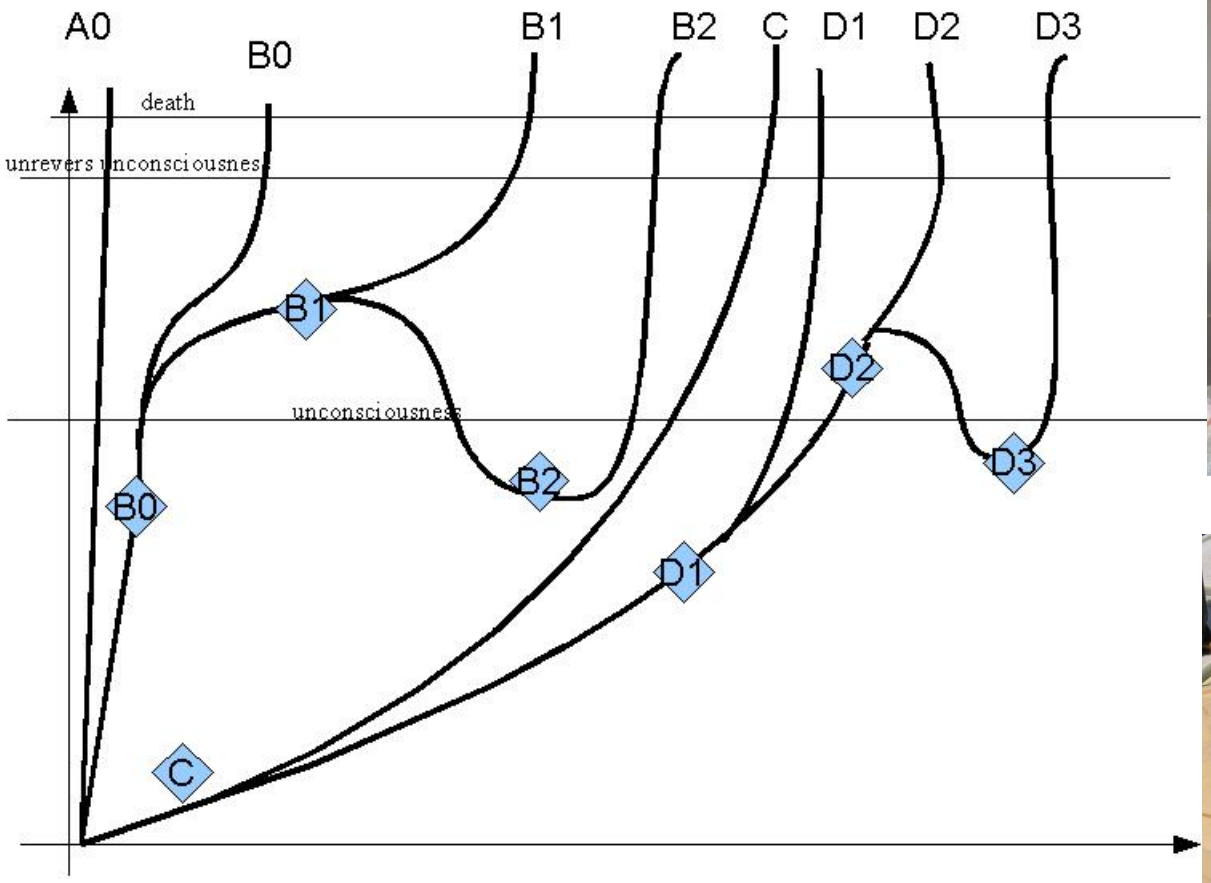
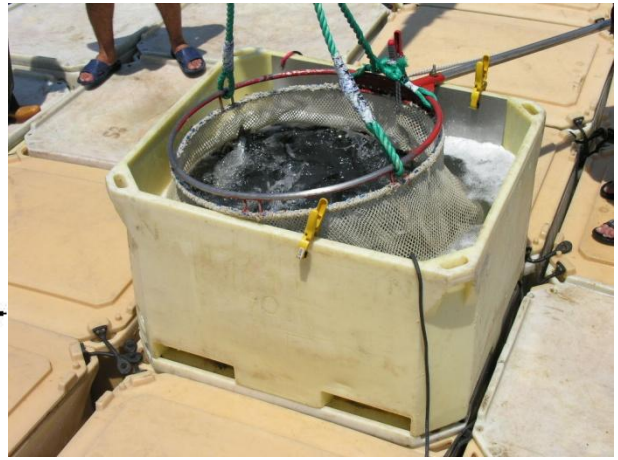
- The Commission requests EFSA to issue a **scientific opinion on the species-specific welfare aspects of the main systems of stunning and killing farmed fish.**
- **Animal health and food safety** should be considered
- **Species to be considered:** Atlantic salmon (*S. salar*), rainbow trout (*O. mykiss*), 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		-	-

Common Con & Rec on Fish S&K

- **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

Farm location

- **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)
- Members of the EFSA AHAW Panel (13 SOs)
- 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:

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Thanks for your attention !!