Module 24

Welfare of Farmed Fish and Aquatic Invertebrates (Fish Welfare Part 2)

This lecture was first developed for **World Animal Protection** in 2006 with extensive contributions from by Dr Larry Hammell of the Atlantic Veterinary College, Canada. It was revised by **World Animal Protection** scientific advisors in 2012 using updates provided by Dr Caroline Hewson.

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www.animalmosaic.org/education/tertiary-education/

This module will teach you about

Welfare concerns in farmed fish

Welfare assessment

Other uses of fish

- Angling
- Ornamental fish

Invertebrate aquatic species

Review

Many species of fish

Fish are sentient

Welfare concerns

- **Wild-caught fish – capture, landing and slaughter**
- **Aquaculture – husbandry, diseases, handling, slaughter**

Farmed fish: welfare concerns 1

Five Freedoms

Need for research

Farmed fish: welfare concerns 2

(Stevenson, 2007; Branson, 2008; Ashley, 2007)

Freedom from hunger and thirst

- Starvation before transport or slaughter
- Feed reduction / starvation to reduce the growth rate until market prices rise
- High protein requirement of carnivores – welfare of wild fish used to feed farmed fish? (Mood, 2010)
- Aggression
- Malnutrition in juveniles
- Water quality, including osmolarity

Farmed fish: welfare concerns 3
(Stevenson, 2007; Branson, 2008; Ashley, 2007)

Freedom from pain, injury and disease

Handling

Injuries

Diseases – parasites and behaviour (Barber, 2007)

Vaccination lesions

Morphological abnormalities

Overcrowding

Algal blooms and jellyfish

Credit: Dr. L. Hammell, AVC/UPEI

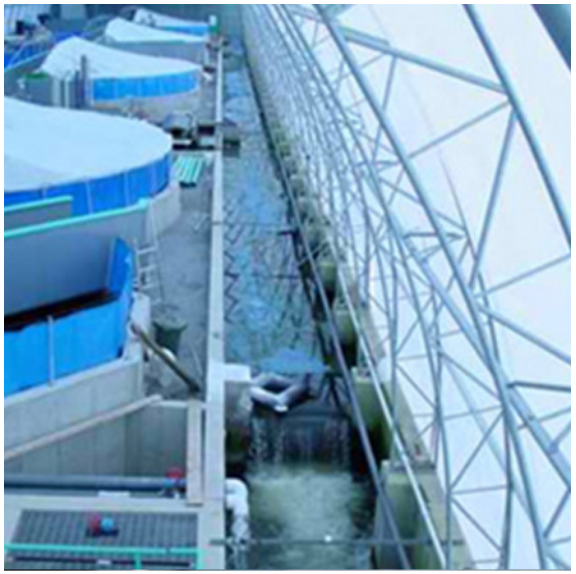
Farmed fish: welfare concerns 4

(Stevenson, 2007; Branson, 2008; Ashley, 2007)

Freedom from discomfort

- Exposure and extremes of temperature
- Lack of shelter – vulnerable to predators

Importance of water quality



Credit: Dr. L. Hammell, AVC/UPEI

Farmed fish: welfare concerns 5

(Stevenson, 2007; Branson, 2008; Ashley, 2007)

Freedom from fear and distress

- Vulnerable to predators
- Handling
- Transport
- Overcrowding
- Slaughter
- Escapees

Credit: Dr. L. Hammell, AVC/UPEI

Farmed fish: welfare concerns 6

(Stevenson, 2007; Ashley, 2007; Branson, 2008)

Freedom to express normal behaviour

- No environmental complexity and no environmental control
- Abnormal behaviours, e.g. vertical swimming, swimming in circles
- Assisted reproduction – salmon and trout

Transgenic fish
(Hallerman, et al. 2007; Stevenson, 2007)

Insert human or other fish gene(s) for

- Growth hormone expression ⇨ rapid and enhanced growth (~1.8 to 14× bigger)
- Disease resistance, tolerance of low levels of oxygen, etc.

But, e.g. physical deformities ⇨ breathing and feeding difficulties

Escapees?

Assessing welfare in fish

Water

- Flow rate
- Quality

Credit: Dr. L. Hammell, AVC/UPEI

Credit: Dr. L. Hammell, AVC/UPEI

Assessing welfare in fish

Environmental measures

- **Bird activity**

Credit: Dr. L. Hammell, AVC/UPEI

Assessing welfare in fish

Animal-based

- Colour
- Ventilation rate
- Behaviour
- Food intake
- Body condition
- Growth rate
- Morphology
- Injury
- Disease
- Reproductive performance
- Stocking density

(Huntingford et al., 2006)

- Mortality rate

Assessing welfare in fish

Other measures

- **Integrated index?** (Turnbull et al., 2005)
- Cortisol, glucose, body condition

Auditing welfare at slaughter (Grandin, 2010)

- **% stunned effectively with one application of stunner**
- **% rendered insensible before processing**
- **% with defects (e.g. eroded fins) that occurred in the pens**
- **% bruised carcass**
- **% with other carcass defects**

Welfare of fish killed for recreation

Background

(Cooke & Sneddon, 2007; Arlinghaus et al., 2009)

12 per cent of people globally

Types of recreational angling

- Leisure
- Competitive
- Game fishing
- Specimen fishing

Catch and harvest vs. catch and release

- Countries vary

Welfare concerns
(Cooke & Sneddon, 2007; Branson, 2008)

Physical injuries

- **Hooks – jaw, eye, throat, etc.**
- **Sub-lethal injury ⇨ survive but impaired?**
- **Nets: fin abrasion**

Stress

Mortality

- **0 (?) to 89 per cent**

Improving welfare
(Cooke & Sneddon, 2007; Branson, 2008)

Minimise duration of angling

- Use appropriate strength of line and land fish as quickly as possible

Minimise air exposure and improve handling

- Land by hand if possible, not net
- If net, it must have no knots
- Hold in coolers with good quality water, rather than in nets in the lake, etc.

Gear, e.g.

- Barbless hooks
- Avoid live bait

Don't fish if water temperature is very variable

Deep-sea fishing

- Swim bladder expansion. Pierce with needle to release air so fish can swim down again?

Kill by stunning first

Welfare of ornamental fish

Background
(Weber, 2010; Sloman et al., 2011)

Aquarium industry

- +350 million fish traded annually
- More than 1000 species

Relatively little protection

Relatively little research on, e.g.

- Stocking densities
- Mixes of species

Longevity

Husbandry

(Branson, 2008; Weber, 2010)

Water quality, e.g.

- Ammonia and nitrite from uneaten food

Nutrition

- Freezing increases thiaminase in some species ⇨ thiamine deficiency
- Iodine deficiency
- Hepatic lipidosis? From polyunsaturated fats

Husbandry
(Sloman et al., 2011)

Beneficial effect of angelfish on small shoaling species

Effect of group size

- Increased natural behaviour (shoaling) in some species

Environmental enrichment (EE)

- Plastic plant and plastic shelter at back of tank
- Benefit depended on group size and species,
  e.g. some sheltered in it, some defended it

Diseases
(Weber, 2010)

Infection

- **Mycobacterium species**

Cataracts, e.g.

- **Trematode (fluke) *Diplostomum***
- **Environmental**

Neoplasia

Euthanasia

- **Sodium pentobarbital (60–100 mg/kg of body weight)**
- **Tricaine methanesulfonate 300 ppm: buffer with 1:1 sodium bicarbonate:**
  - Keep in bath for 30 minutes after opercular movement ceases
  - Heart may beat for several hours after death – monitor with doppler if possible and check withdrawal reactions

Welfare of aquatic invertebrates

Background

Invertebrates

- **Molluscs**
- Cephalopods – squid, octopus
- Bivalves, e.g. clams, oysters, abalone
- Gastropods, e.g. mussels
- Sentience already recognised in octopuses and squid, e.g. octopuses learn from visual cues and can remember foraging areas (Mather, 2008)
- **Crustaceans, e.g. prawns, crabs, lobsters, crayfish**

Background

Global slaughter for food

- **Farmed birds: ~57 billion**
- **Farmed and wild-caught fish: ~3 trillion (Mood, 2010)**
- **Invertebrates (Elwood, 2012), e.g.**
- Tiger prawns = 12% crustaceans: 214 billion
- Total crustaceans: 1.7 trillion?

Sentience in crustaceans

Criteria for pain perception (Elwood, 2012)

- **Can they perceive adverse stimuli?**
  - No neocortex
  - Nociceptors and nociceptive nerves not described
- **Do they respond physiologically and behaviourally?**
- Acetic acid ⇨ prawns rub antennae
- Electric shock on abdomen ⇨ crabs rub abdomen
- Pulling off crabs' legs ⇨ increased lactate
- **Can they learn to avoid it?**
  - Crabs discriminate to avoid getting an electric shock
- **Trade-off in motivations**
  - Crabs can trade motivation to avoid electric shock with motivation for protection/shelter (shell)

Welfare concerns 1

Octopus (Malham et al., 2002)

- Stress – handling, withholding food
- May affect immunity

Transport of crustaceans (Fotedar & Evans, 2011)

- Many countries market live animals
- Exposure to air
- Disturbances (handling, capture)
- Fluctuating temperatures
- Guidelines, e.g. slow chilling, anaesthesia, banding of claws

Welfare concerns 2

Slaughter of lobsters (Gregory, 2005)

- **Drowning**
- **Boiling**
- **Spiking the head or chest**
- **Splitting**
- **May be preceded by chilling or freezing**

Alternatives

- **Chill to less than 4° C before killed**
- **Crustastun electrical stun and kill (Sparry, 2005; www.crustastun.com)**
- Batch stunner or single use
- Manufactured under licence in different countries

Summary

Welfare concerns in farmed fish

Welfare assessment measures

Other uses of fish

- Angling
- Ornamental fish

Invertebrate aquatic species

Feedback:
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- **How have you used this module?**
- **What did you like about it?**
- **What did you not like?**
- **Do you have any tips to share?**

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Your feedback will help other teachers like you

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