Species-specific welfare guidelines: a necessity in fish research?

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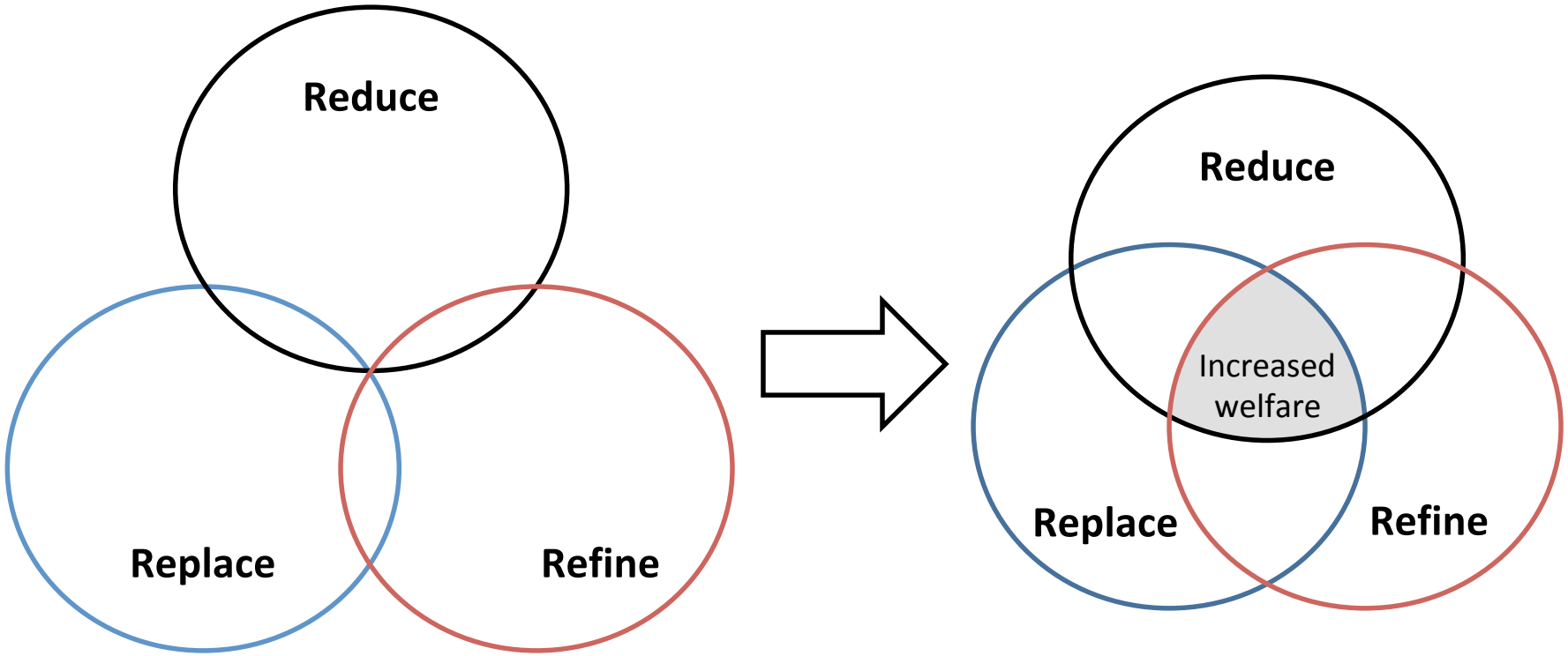
Fish as an animal model

•Well established in applied and basal experimental research disciplines.

•A wide variety of species with very different characteristics.

The biological diversity of fishes is not consistent with universal welfare guidelines.

The establishment of acceptable welfare guidelines specific for fish species is a prerequisite for implementation of the 3R's (Reduce, Replace and Refine) in fish research.



The mandate was to evaluate the needs for research in fish welfare in the following areas:

- Environmental needs of different fish species
- Fish welfare indicators
- Pain-induced procedures and ethically acceptable endpoints in fish.
- Pain relief treatment of fish
- Test and validation of fish vaccines

Aim

Increase knowledge within important fish welfare issues, to improve quality and to strengthen the implementation of the 3R's in fish research.

Role of the environment

- Species
- Life stage
- Season
- Interaction of environmental parameters
  - Temperature
  - Oxygen
  - Water flow

Role of the environment

- Scaling of experiments and group size
- Standardisation of tank environment
- Environmental enrichment

Zebrafish – a small fish with a big potential

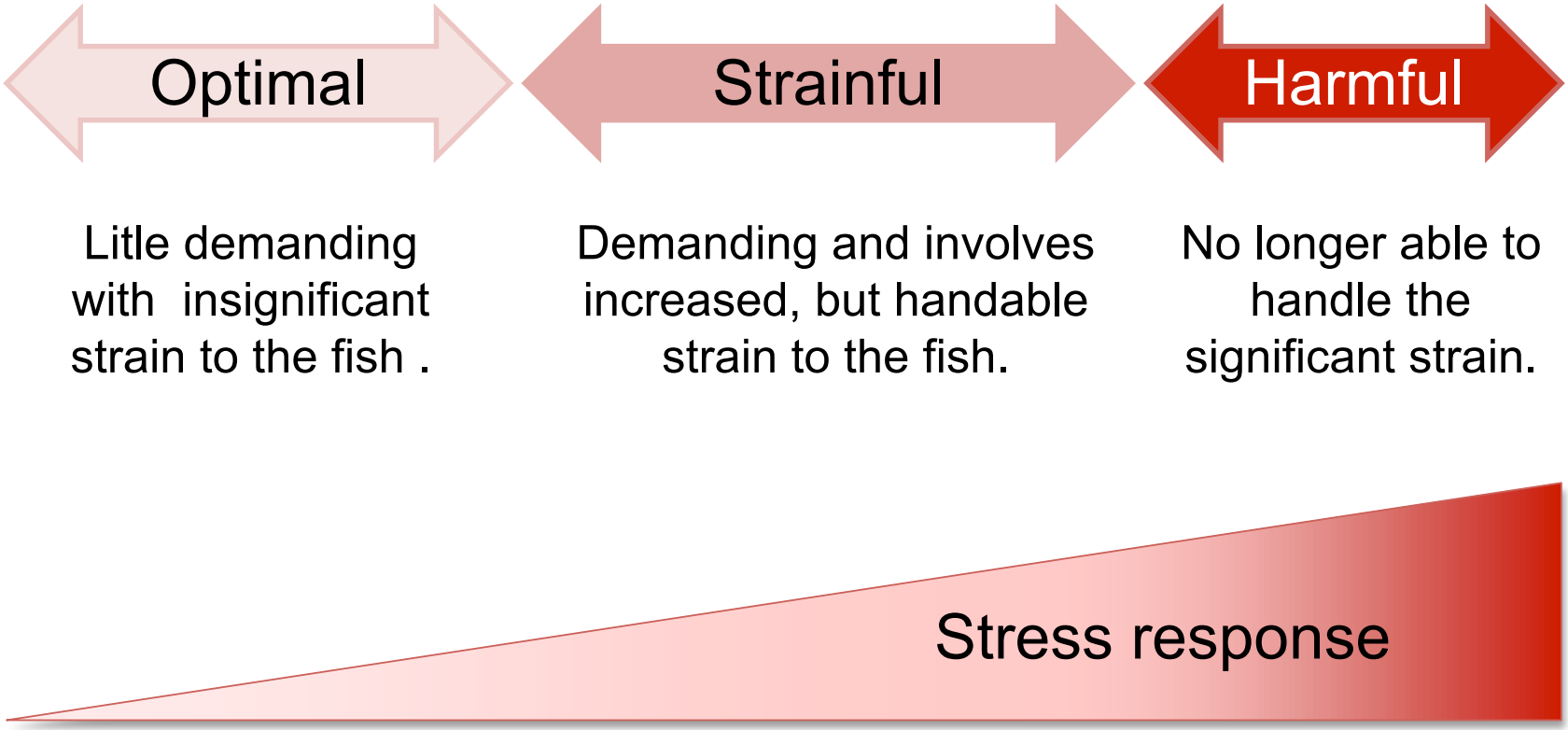
- Well characterised
- Good record in research
- Transparent emryo and larval stage
- Easy to modify genetically
- Low cost

Fish Welfare

The ability of an animal to cope physiologically, behaviorally, cognitively and emotionally with its physiochemical and social life environment, including the animal's subjective experience of its condition.

IMR

Welfare - the ability and resources used to handle stress



Welfare indicators

A welfare indicator is a measureable inner (fish) or outer (environment) parameter which variation is associated with the welfare status to the fish.

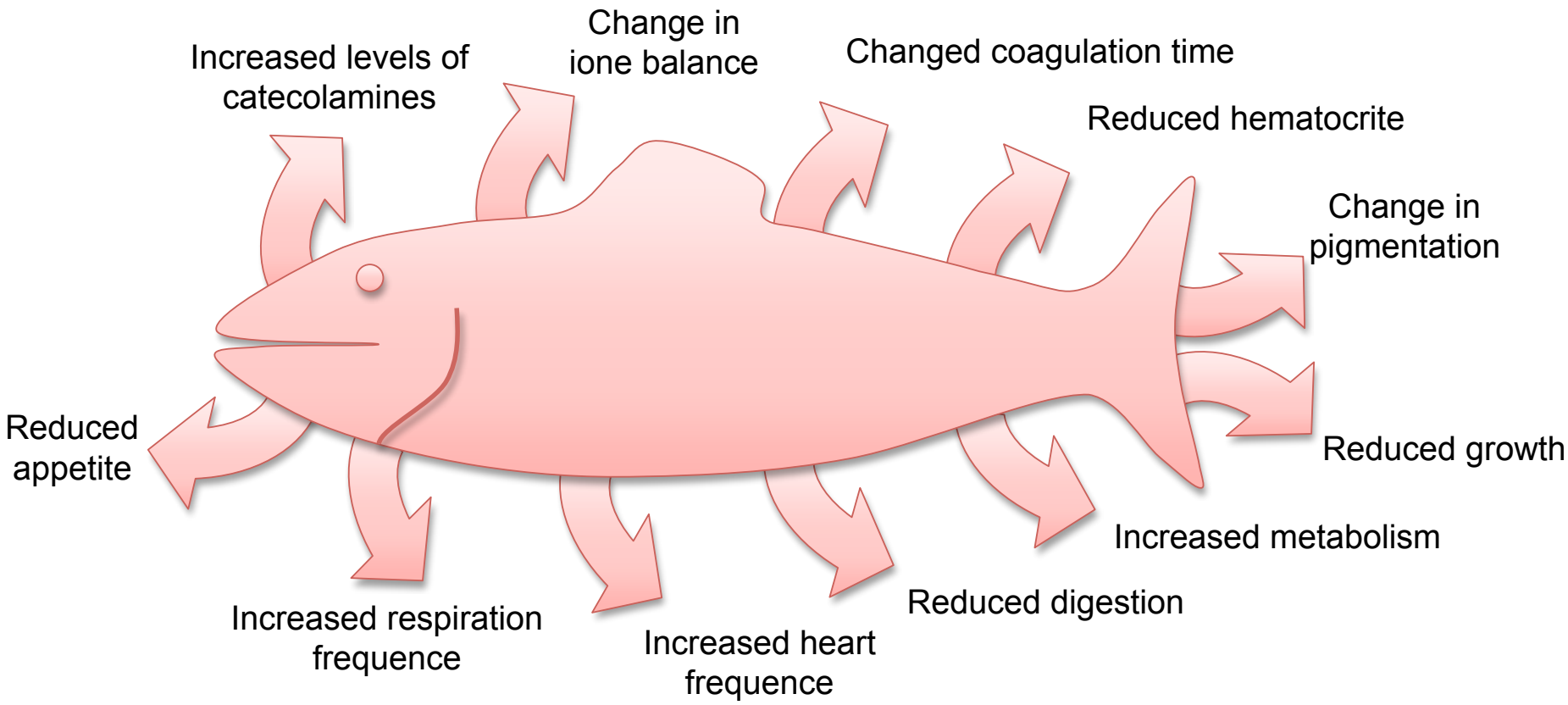
Criteria to welfare indicators

- Quantifiable – easy to measure without affecting the fish welfare
- Graded – response reflecting welfare status
- Sensitive – to all factors which have influence on fish welfare
- Specific – to avoid “noice” from factors irrelevant to fish welfare
- Objective and allow continuously observation of all individuals
- Applicable and comparable – life stage and species independent

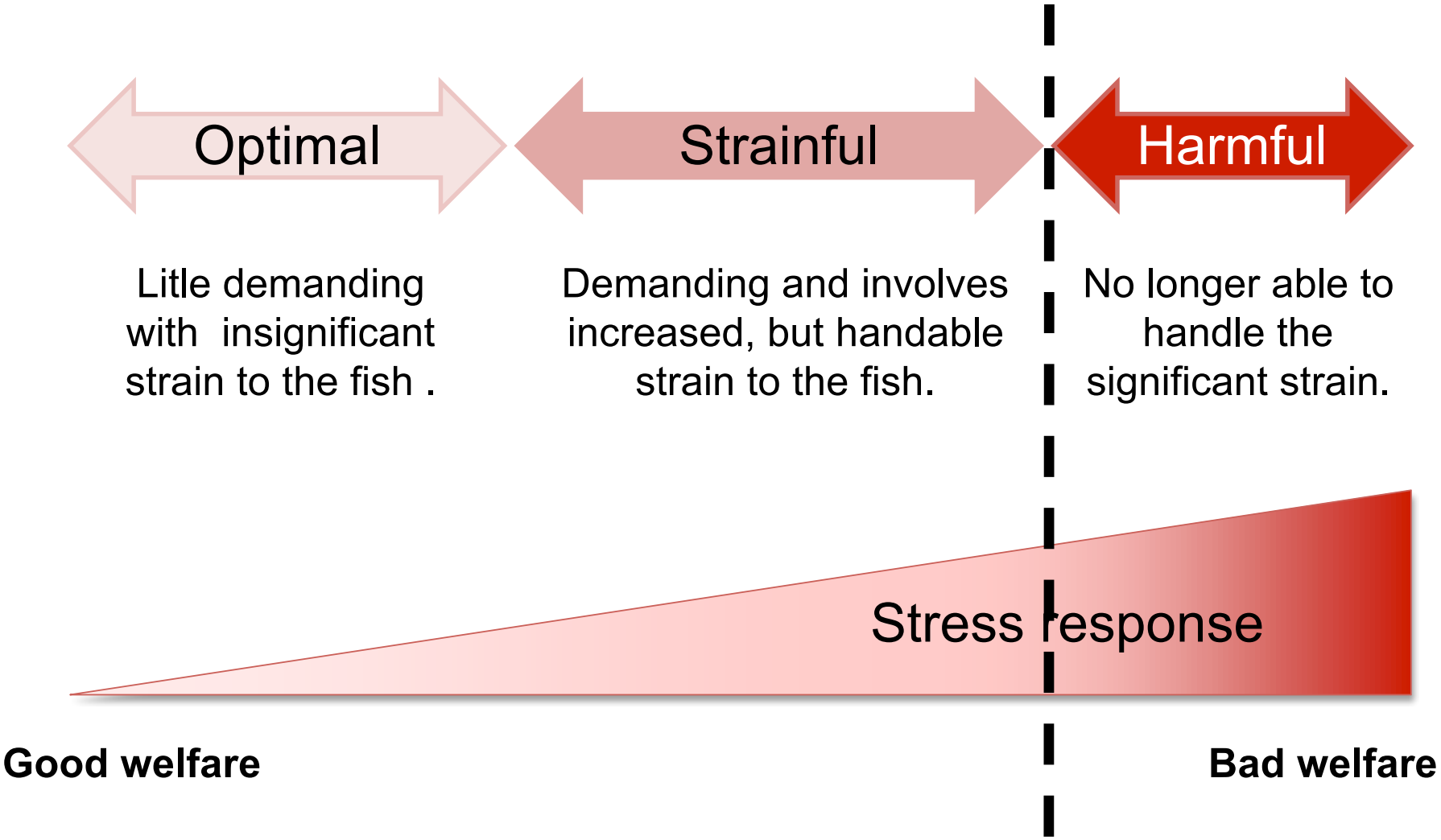
Welfare indicators

Neutral	Continuously	Biological
Environment	Behavior of tagged fish	Anatomy/histology
Observable	Telemetry	Molecular
Behaviour	Kannulation	Neuro endocrine
	Oxygen consumption	Immunological

Stress as welfare indicator



Positive and negative welfare indicators



Pain, painful procedures and ethical acceptable end points

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage.

Animal can feel pain if it meets the following criteria:

- **Receptors** sensitive to noxious stimuli are present in functionally useful positions on or in the body.
- **Brain** contains structures analogous to the human cerebral cortex.
- **Nervous pathways** link receptors sensitive to noxious events and the higher brain.
- **Receptors** in the central nervous system, especially the brain, are activated by **opioid substances**, implicated in pain control.
- **Painkillers modify** the response to noxious stimuli and are chosen by an animal given access to them when the experience is unavoidable.
- **The animal responds** to noxious stimuli by avoiding them or by minimising the damage to its body.
- The animal's avoidance of noxious stimuli is **relatively inelastic**. The response is largely **unchanged** irrespective of how much the animal is **rewarded** for a particular behaviour.
- The animal's response to noxious stimuli **persists and it learns** how to associate neutral events with noxious stimuli.

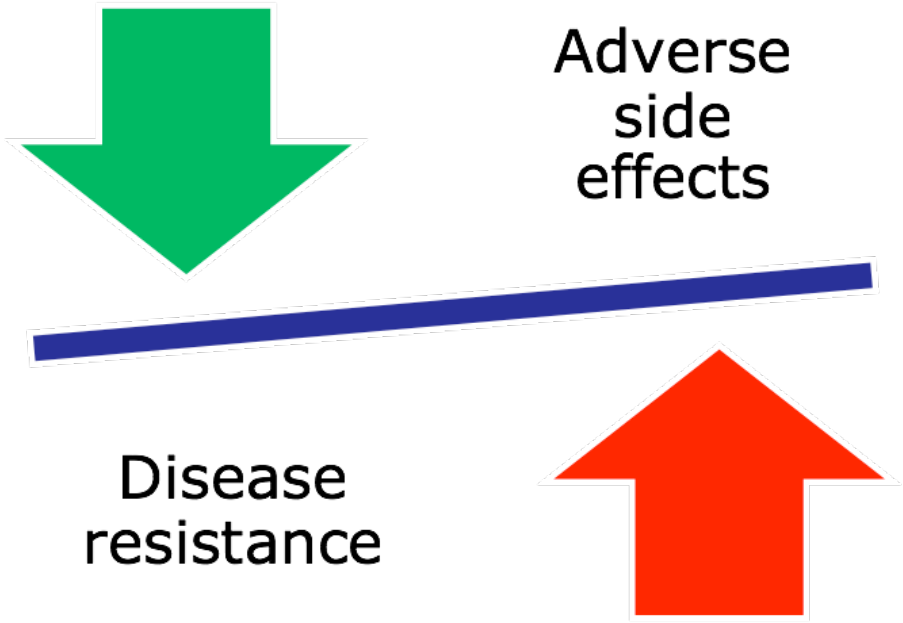
Bateson 1991

Pain relief treatment of fish

Administration

- Individual
- Group
- Gills
- Intestine
- Dip
- Injection
- Depots
- Osmotic pumps

Test and validation of fish vaccines



Humane / ethical acceptable end points in fish research

Environmental	Group level	Individual
Oxygen	Behaviour	Behaviour
Ammonium	Respiration	Respiration
Catecolamines	Appetite	Pigmentation
	Growth	Growth
	Condition	Physiological
	Homogenity	Pathology
	Health	
	Death rate	

Research requirements - Environment

- Temperature
- Recirculation Aquatic Systems (RAS)
- Environmental enrichment
- Standardisation of tank environment
- Group size and social environment
- Zebrafish as a model in ”aquatic translational research”

Research requirements – Welfare indicators

- Establish, identify and validate welfare indicators
- standardise methods
- knowledge of individual and group behaviour in relation to species and environment
- External welfare indicators
- Internal welfare indicators

Research requirements - Pain

- Better understanding of pain response
- Better understanding of the stress response
- Better understanding of stressful and painful experimental procedures
- Identify parameters in water, blood and behaviour as human / ethical acceptable end points

Research requirements – Pain relief treatment

- Identify what is painful
- Methods for careful and efficient analgesic treatment
- Response of analgesic treatment
- Dosage and mechanisms of functions
- Acute and chronic analgesia
- Is pain perception environmental dependent

Research requirements vaccine development

- Establish Specific Pathogen Free fish of commercial important species

- Improvement of pharmacopoeia monographs (reference work for pharmaceutical drug specifications)

Conclusion

Fish is an important research animal in Norwegian research.

The impact of environment and welfare of fish in experiments are of both ethical and scientific importance. Increased knowledge within important fish welfare issues, will therefore improve quality and strengthen the implementation of the 3R's in fish research.

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