

# Enrichment: concept and comparative aspects

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ENRICH FISH workshop:  
Optimising the rearing environment for juvenile salmon

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# Enrichment - what is that?

- Refers to improvements of the environment of captive animals
  - Physical environment
  - Social environment
  - Sensory enrichment
  - Dietary enrichment: feed and feeding
  - Other: exercise, training
- Benefit to the animals themselves
  - Getting what they are motivated for
  - Improved animal welfare
- + Benefit to humans
  - Improved animal functioning; fitness, growth, cognition
  - Sound science



# Definitions of enrichment

- Newberry (1995): Improvement in the biological functioning of captive animals resulting from modifications in their environment
- Näslund & Johnsson (2015): Deliberate increase in the environmental complexity with the aim to reduce maladaptive and aberrant traits (in fish) reared in otherwise stimuli-deprived environments



# Barren vs enriched

- Barren environment

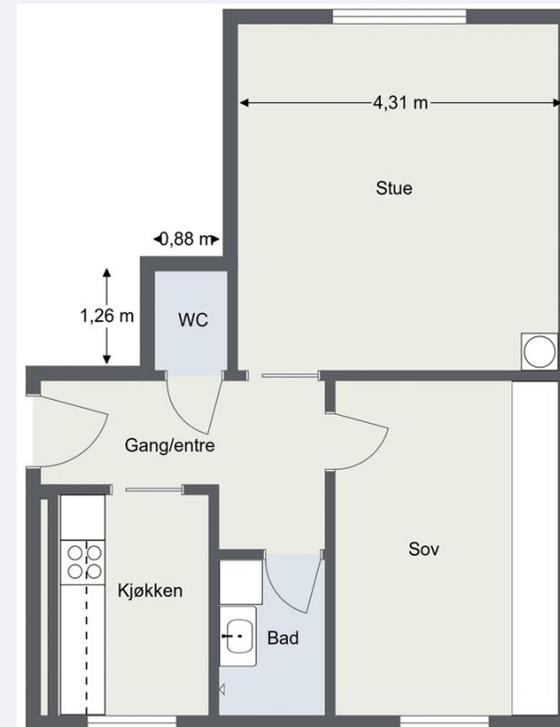


- Enriched



# Enrichment or rubbish?

- Knowledge of species and life stage crucial
- Any item/stimulus added to the environment is not an enrichment
- Has to be perceived as meaningful by the animal
- Should fulfill a need
  - Needs/preferences may vary
- Items meant for activity/exploration may need to be varied
- Restricted use of a resource or short duration of use is not identical to low importance
- Social enrichment
  - Important to social species
  - Balance company and social stress
  - Avoid competition for valuable and scarce resources
  - Motivate schooling behaviour over territorial behaviour



# Examples, enrichment effects in fish

- Atlantic pre smolt salmon: Shelters reduce the impact of other stressors and reduce fin damage (Naslund et al. 2013)
- Atlantic salmon: Environmental enrichment (temporally variable structures) promoted learning ability (Salvanes et al. 2013)
- Wild caught Brown trout: Fish in groups with familiar fish receive less aggression, have better fin condition and grow faster compared to fish in unfamiliar groups (Zavorka et al. 2015)
- Coho salmon prefer and are less aggressive in a darker environment (Gaffney et al. 2016)



# In research

- Enrichment should help us to produce reliable and relevant results
- Enrichment (like other environmental factors) may influence outcome, e.g. hiding or increasing effects of the factor under study
- Relationship between environmental factors is complex (and dynamic)
- Thus a need for research investigating enrichment candidates
- Suggest appropriate / optimal standard enrichment per species and stage



# What are important enrichments for animals, what do they want?

- To find out:
- Test preferences
- Which of two environments (barren vs enriched, and enriched vs enriched) do the animal prefer, i.e. spend time in?
  - Can vary with situation
  - E.g. a newly sheared sheep prefers a soft lying area (Færevik et al. 2005)
- Preferred: does not necessarily mean that the preference is important to welfare
- Preference may be influenced by early experience



# Willingness to «pay» for a resource

- The demand for a resource usually decreases with increasing price
- Vital or very important needs have a less elastic demand curve; the demand will still be present despite high prices
- To find the relative value of a resource: Let animals work, e.g. press a lever, push a door, swim against current, to get access to a resource, increase workload
- Mozambique tilapia (Ciclidae) work harder for social company than for additional space (Galhardo et al. 2011)
- Horses will work for access to an unfamiliar horse, if kept alone (Søndergaard et al. 2011)
- Horses will work for access to an outdoor arena, if kept indoors (Lee et al 2010)



# In egg production

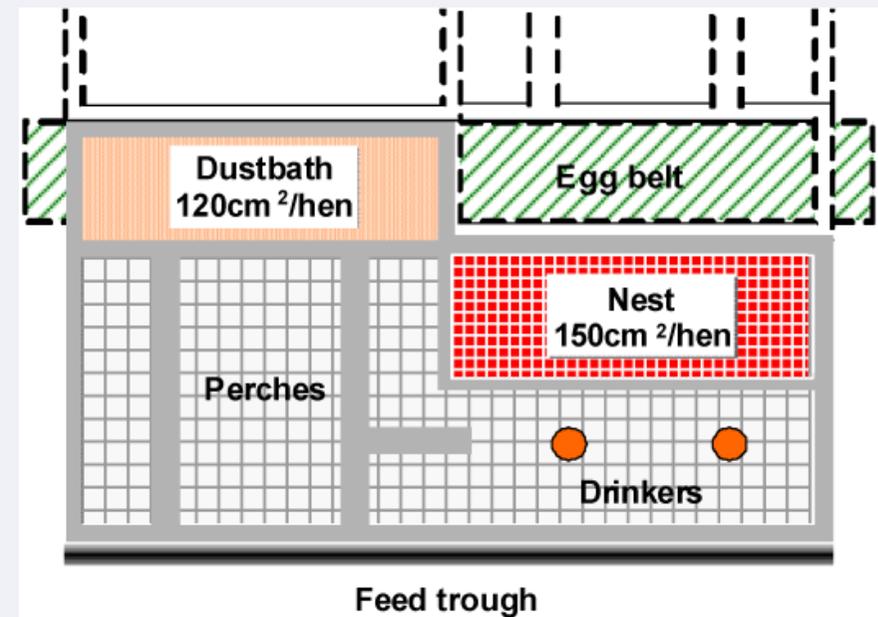
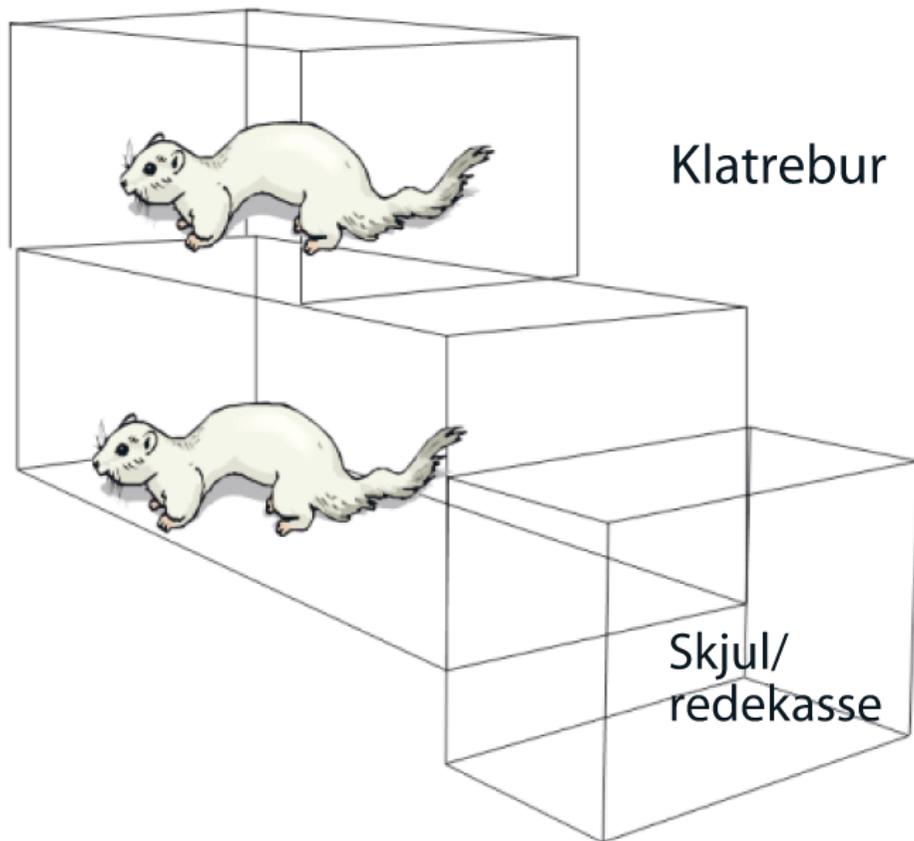
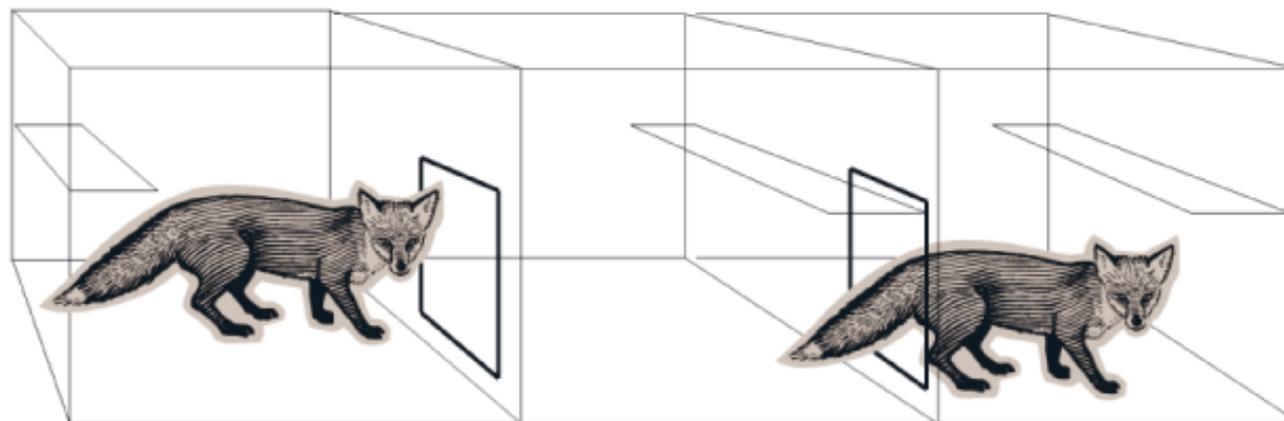


Figure 1. Schematic representation of the furnished cages used in the experiment (stocking density = 750 cm<sup>2</sup> per bird).



## In fur farming



# In research

- Important to control for environmental factors
- In practice, that used to mean barren cages
- Now: standardized environment



Photo: Carb-Sane



Photo: Animal Care System



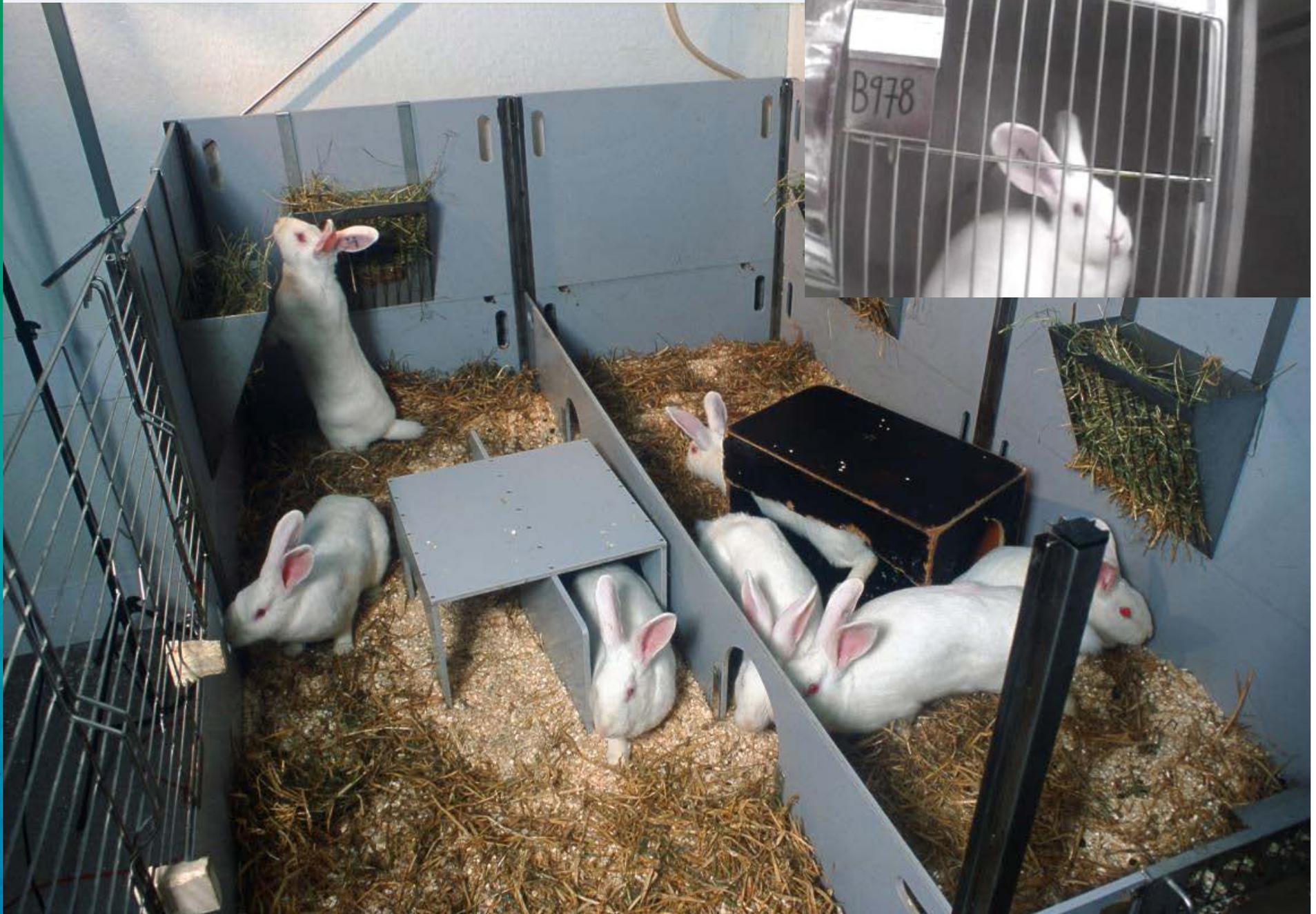


Photo: National Centre for the 3Rs, UK

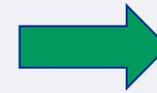
# What's in it for the animals?

- Enrichment increases the biological relevance of the living environment
- Means stimulation, prevents boredom
- Stimuli necessary for normal development
  - Cognition, learning, flexibility
  - Social competence
- Deprived animals may become mentally retarded
  - Not suitable models for studying biology
- Too much stimulation may cause stress!

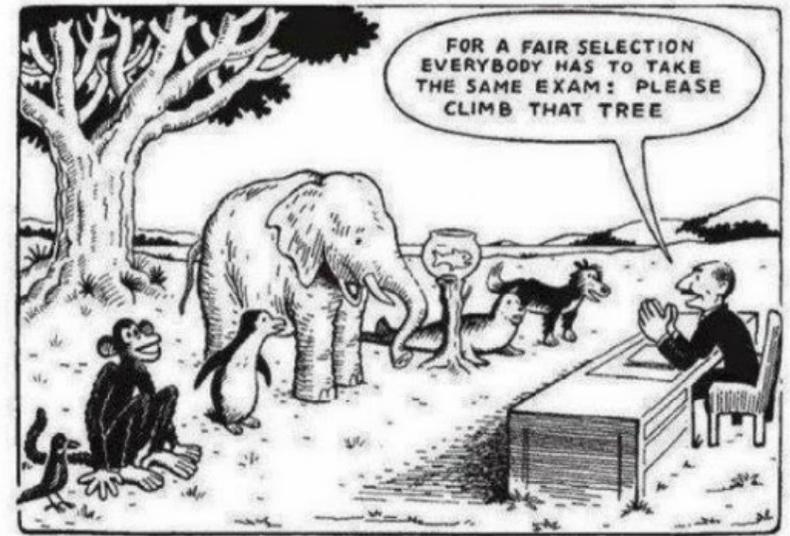


# What functions as enrichment

- Look to nature to be inspired
  - What do the animals do?
    - Resting, feeding, activity...
- Usually no need to copy nature to increase the biological relevance of the captive environment
  - Horses will graze for 16h/d
  - They have a need to chew
  - Free access to nutritious feed
  - So: Reduce eating speed
    - Give hay in a fine masked net
  - Add straw or branches to a restricted hay diet



# One size doesn't fit all



Our Education System

- Species specific enrichment
- Developmental stage specific enrichment
- Variability in responses between individuals
- Variability in responses within individual
- Tool box of enrichment items
- Enrichment for fish in research could be of interest for industry in general, to enhance fitness and improve welfare



# Different goals, different approaches?

- In breeding for release into wild (polar fox) / cultivation of fish for restocking:
  - Enrichment resembling nature is a goal
  - Animals should be prepared to survive in the wild
  - Cope with natural (changing) environment
- Farmed salmonids - ????
  - Survival of escapees is not what we head for!
  - Go for totally different types of enrichments?

