

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

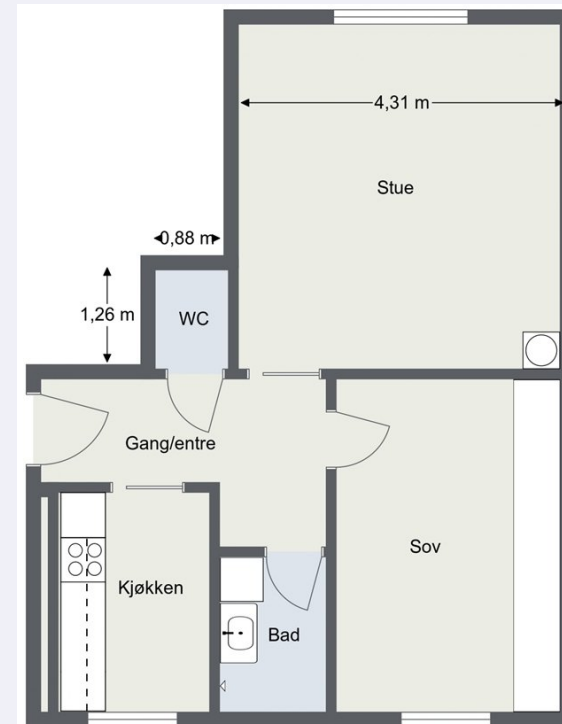


- Enriched



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

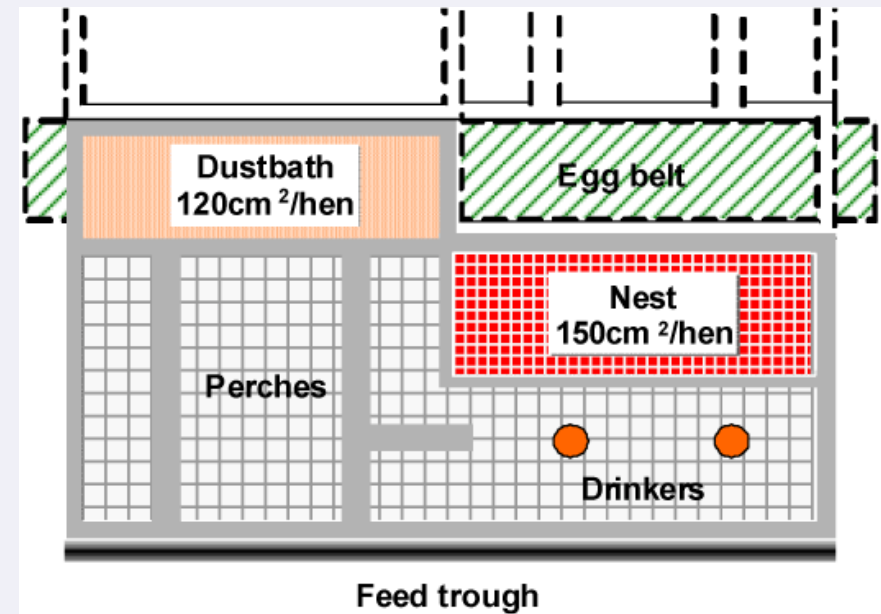
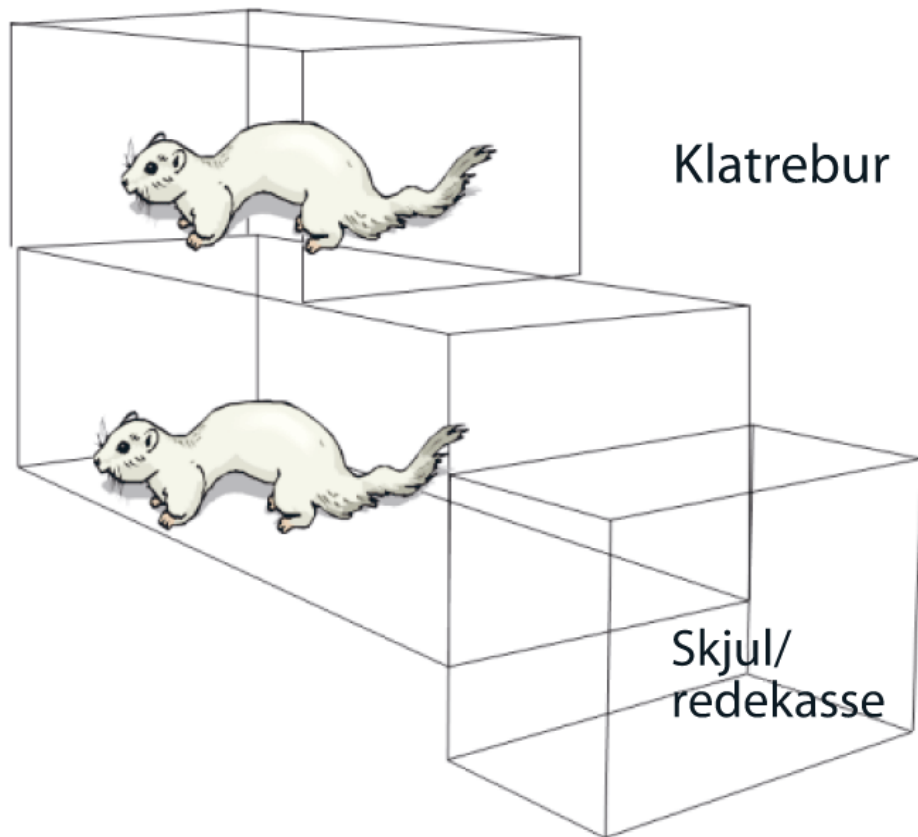
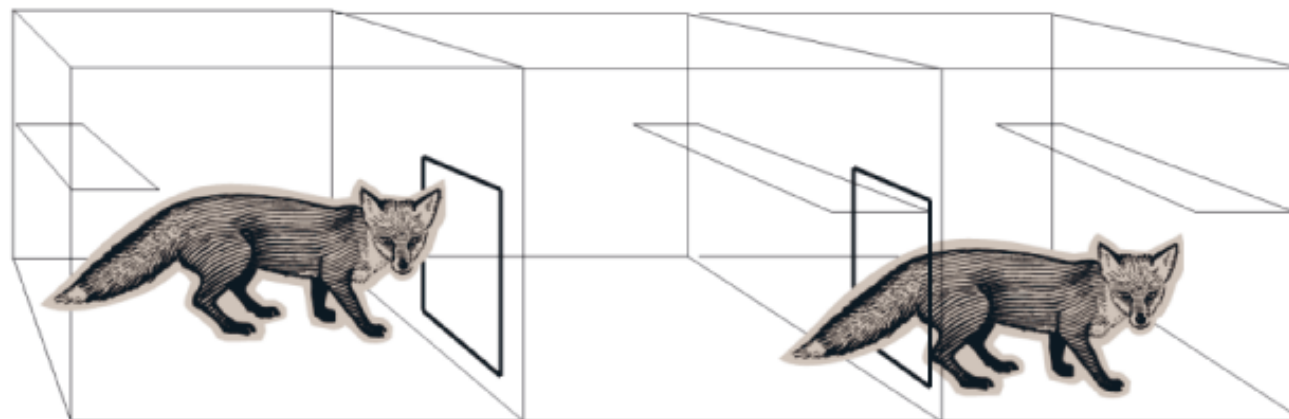


Figure 1. Schematic representation of the furnished cages used in the experiment (stocking density = 750 cm² per bird).





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!

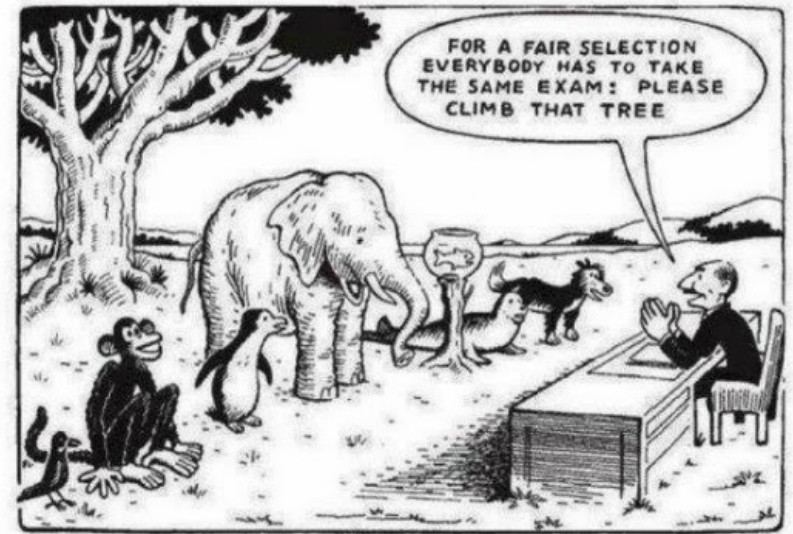


What functions as enrichment

- 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?

