UFAW International Animal Welfare Conference 2025

Scientific Programme

Welcome to the UFAW International Animal Welfare Conference 2025

It is our great pleasure to welcome you to this year's UFAW International Animal Welfare Conference, held online from 24-26 June.

By holding this event online, we are delighted to extend our reach globally, welcoming delegates from more than 50 countries to participate in an inspiring programme committed to advancing animal welfare science.

Over the next three days, you can look forward to presentations spanning all areas of animal welfare science. From animal behaviour, to policy and advocacy, and everything in between – there is something for everyone.

This year's poster session is hosted on the Genigraphics platform. We encourage you to view the posters and ask questions at any time; the corresponding author for a poster will receive notification of any questions and can respond when convenient, to take account of the many different international time zones represented. More details about how to access the posters can be found on page 4.

We would like to thank all those who have made this conference possible including our speakers, poster presenters, session chairs and delegates, as well as our dedicated UFAW office staff – Sam Griffin, Jane Moorman, and Tina Langford. A special thank you also goes to our conference sponsor, Charles River, for their generous support of this event.

Finally, at the close of the conference, please let us know what you thoughts by completing our online survey. Your feedback is important to us and helps us to shape and improve our future events. For specific comments or questions about the conference, please email us at: events@ufaw.org.uk.

Thank you for joining us. We hope this conference offers new insights and renewed inspiration for Science in the Service of Animal Welfare.

UFAW Conference Organising Committee
Huw Golledge, Stephen Wickens, Birte Nielsen, Liz Carter, Luisa Teear, Eilidh Muir and Carly Halliday

Headline Sponsor: Charles River

A huge thank you to our headline sponsor, Charles River, for supporting the UFAW Online Conference 2025.

UFAW Code of Conduct

The experience when participating in a UFAW event – whether online or in person – should be inclusive and safe. We therefore expect anyone taking part in one of our events to adhere to the UFAW Code of Conduct.

Please note that we reserve the right to ask anyone present at the event who is behaving inappropriately to leave the meeting.

We expect all delegates to…

- Treat all participants with respect and consideration
- Appreciate the diversity of opinions and views that exist among participants
- Critique only ideas and not the person voicing the opinion
- Not record video / audio presentations and discussions without prior permission
- Respect any request from presenters not to share their content on social media
- Ensure that others have the opportunity to speak in group discussions

The following are *examples* of unacceptable behaviour:

- Sending abusive messages to anyone involved in or present at the conference
- Bullying, harassment (psychological or sexual), and intimidation, including negative comments about anyone's ethnicity, religion, gender, sexual orientation, or disability, or sharing inappropriate images – including when meant as a joke
- Disruptive behaviour, including persistent interruption of presenters

For delegates experiencing unacceptable behaviour

Please contact the conference organiser or one of the UFAW staff members if you are (or have been) experiencing behaviour that does not live up to our Code of Conduct. We will deal with your concern in confidence and take appropriate action. This may include removing any delegate from the meeting, prohibit attendance for future conferences, blocking the individual on social media platforms, and/or reporting the incident to the person's employer or the relevant authorities.

Accessing the Conference Posters

UFAW has partnered with Genigraphics to provide the online poster session services for this year's conference. Posters will be available for viewing online in advance, during and after the conference, from 16 June onwards.

Please note that there is no scheduled presentation of posters planned (ie. where poster presenters have to be present to answer questions on their poster), because delegates and poster presenters are from different international time zones. Instead, the Genigraphics platform allows delegates to ask questions about a poster at any time. To do this, click the **'Chat'** button. The corresponding author for a poster will then receive an email notification that a question has been asked. This can be answered at a time that is convenient. The question and reply thread will be available to read by all who view a poster.

Please note, the access link is only available to registered delegates. If you are a registered delegate, please refer to the abstract book sent to you via email for the access link. If you didn't receive an email, please check your junk folder before emailing events@ufaw.org.uk.

Poster Competition

We will be awarding a prize for the best poster at the conference. This will be decided by a panel, who will assess each poster across a range of measures including scientific and animal welfare merit, and clarity of presentation. They will also take into account delegates views on each poster. You can 'like' a poster by clicking on the star icon at the top. The winner of the prize, which will take the form of a book from the UFAW/Wiley Blackwell Animal Welfare series, will be awarded at the end of the conference.

A second prize will also be awarded a couple of weeks after the end of the conference to the poster presenter and delegate who have engaged in the best question and answer thread, as assessed by the panel. The winners can also choose a book each from the UFAW/Wiley Blackwell Animal Welfare series.

The Universities Federation for Animal Welfare (UFAW)

The Universities Federation for Animal Welfare (UFAW) is an international and independent scientific and educational animal welfare charity and membership society. Our vision is a world where the welfare of every animal affected by humans is maximised through a scientific understanding of their needs and how to meet them.

DISCOVERING what matters to animals

DEVELOPING scientific solutions to animal welfare problems

DISSEMINATING evidence-based animal welfare information

Support Science in the Service of Animal Welfare

You can help make even bigger strides in animal welfare science by donating, leaving a legacy or becoming a member of UFAW.

Find out more: **ufaw.org.uk/support** or **ufaw.org.uk/membership**

Stay up to date with the latest developments in animal welfare science

There are many ways to stay connected and keep up to date with our latest news, opportunities and ways to support us, including via our website and social media channels:

Website: ufaw.org.uk
LinkedIn: linkedin.com/company/universities-federation-for-animal-welfare/
BlueSky: @ufaw.bsky.social
X: @UFAW_1926
Facebook: facebook.com/ufaw.org.uk

You can also sign up to receive updates via email at **ufaw.org.uk/ufaw/keep-in-touch**

UFAW Membership

UFAW is a registered, independent, international scientific and educational animal welfare charity and membership organisation. We receive no government or statutory funding.

Our vision is a world where the welfare of all animals affected by humans is maximised through a scientific understanding of their needs and how to meet them.

As a member of UFAW you will receive exclusive discounts on our publications and exciting updates on our work. Find out more and sign up at: **ufaw.org.uk/membership**

The Universities Federation for Animal Welfare (UFAW)

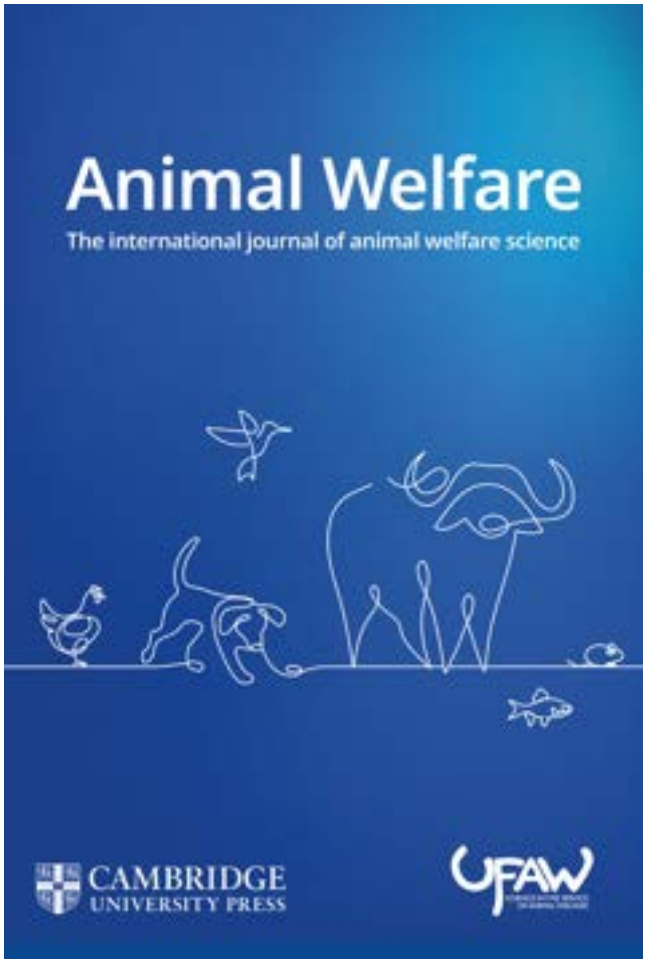
UFAW LINKs Scheme

University LINKs is an international network of UFAW Links people, members, and supporters at universities, research institutes, and colleges around the world, reflecting the ever-growing interest in animal welfare science within the participating institutions.

The aims of the University LINKs scheme are to promote animal welfare science and the objectives of UFAW while providing a forum for the involvement of members and supporters.

If your university is not currently part of the UFAW LINKs scheme but would be interested in applying to join, please contact Stephen Wickens: wickens@ufaw.org.uk or visit **ufaw.org.uk/links**

The *UFAW* Journal - *Animal Welfare*



Animal Welfare is an international scientific journal, and the official journal of UFAW. It publishes the results of peer-reviewed scientific research, technical studies, surveys and reviews relating to the welfare of kept animals (eg on farms, in laboratories, zoos and as companions) and of those in the wild whose welfare is compromised by human activities. Papers on related ethical and legal issues are also considered for publication. The journal also includes letters to the editor, opinion papers, horizon topics and commentary on topical issues such as developments in legislation and codes of practice relating to animal welfare, as well as book reviews.

Animal Welfare is a Gold Open Access journal published by Cambridge University Press on behalf of UFAW. The move to Open Access aligned with our mission to ensure that evidence-based animal welfare information is disseminated widely, and to all those who can make use of it, anyone can now read the articles in *Animal Welfare* without a subscription.

Find out more at: **cambridge.org/core/journals/animal-welfare**

UFAW Mentoring Partnership

UFAW is dedicated to advancing animal welfare science globally, particularly in areas where it is still developing. One of our key initiatives is supporting the next generation of animal welfare scientists.

Not all students have ready access to the help and resources required to plan a scientific research proposal. By providing early career guidance in project planning and experimental design, UFAW helps to ensure their research is meaningful and scientifically sound.

The scheme pairs students with mentors to guide them in project planning, ensuring a solid scientific foundation. Past pairings have shown that his partnership benefits both mentors and students.

Mentors, primarily early career researchers with expertise in animal welfare science, will support students, mainly undergraduates or master's level, including veterinary medicine students interested in animal welfare research.

If you would like to know more about the scheme, please email: carter@ufaw.org.uk or visit **ufaw.org/mentoring**

HSA Conference 2025

Animal Welfare Beyond the Farm Gate: Latest developments in humane slaughter and transport of animals

UFAW's sister charity, the Humane Slaughter Association (HSA), is hosting a two-day hybrid conference dedicated to advancing and promoting animal welfare during transport, slaughter and killing on **21 - 22 October 2025** at the Thinktank Birmingham Science Museum, UK and online.

Featuring presentations by invited speakers, submitted abstracts and discussion sessions, the agenda will cover latest developments in legislation and best practice techniques being used by industry, as well as exploring the latest scientific advancements and novel developments.

Abstract submission and in-person registration are now open. Details of online registration will be released closer to the event. Find out more: **hsa.org.uk/conf2025**


SCIENTIFIC PROGRAMME:
TALKS
Timetable and Speaker Abstracts

Conference Timetable

Day 1: Tuesday 24 June

All timings are GMT+1/UTC+1/BST

13.00 - 13.15 **Welcome and Introduction**: Huw Golledge *(UFAW, UK)*

13.15 - 14.35 Session One - Chair: Huw Golledge *(UFAW)*

13.15 - 13.35 **How does improving welfare improve cognition? Investigating the impact of housing conditions on neural markers in zebrafish**
Olga Burenkova, Rory Lippert, Michelle Lavery and Georgia Mason *(University of Guelph, Ontario, Canada; Open Philanthropy, USA)*

13.35 - 13.55 **The pain echo chamber effect: How cages and barren environments may amplify pain perception in animals**
Cynthia Schuck-Paim, Wladimir Alonso and Kate Hartcher *(Welfare Footprint Institute, Florida, USA)*

13.55 - 14.15 **Effect of pair housing on dairy calf welfare (a systematic review)**
Katarína Bučková, Ágnes Moravcsíková and Radka Šárová *(Iowa State University Ames, USA; Czech University of Life Sciences and Institute of Animal Science, Prague, Czech Republic)*

14.15 - 14.35 **Enhancing poultry welfare: AI-based vocalization analysis for stress detection and non-invasive monitoring**
Venkatraman Manikandan and Suresh Neethirajan *(Dalhousie University, Halifax, Canada)*

14.35 - 15.10 **Break**

15.10 - 16.20 Session Two - Chair: Clare Ellis *(University of Central Lancashire, UK)*

15.10 - 15.40 **Keynote Speaker**
Widespread post-approval animal studies: Implications for drug research
Pia Härvelid, Camille Glaus, Kerstin Vokinger and **Benjamin Ineichen** *(University of Zurich; University Hospital Zurich; ETH Zurich; and University of Bern, Switzerland)*

15.40 - 16.00 **Udderly important behaviours: The study of the behavioural needs of adult dairy cattle across common intensive housing systems**
Catherine Arpin, Rachel van Vliet, Marjorie Cellier, Nadège Aigueperse, Marianne Villettaz Robichaud, Abdoulaye Baniré Diallo and Elsa Vasseur *(McGill University, Quebec, Canada; Université Clermont Auvergne, INRAE, Saint Genès-Champanelle, France; Université de Montréal, and UQAM, Montréal, Canada)*

16.00 - 16.20 **A method for the assessment and economic valuation of improvements to farm animal welfare for use in policy appraisal**
Richard Bennett, Kelvin Balcombe, Heather Maggs, Siobhan Abeyesinghe, Gareth Arnott, Nick Bell, Andrew Butterworth, Jennifer Duncan, Cathy Dwyer, Marie Haskell, Fritha Langford, Siobhan Mullan, Christine Nicol, Niamh O'Connell, Elizabeth Rowe, Victoria Sandilands and Simon Turner *(University of Reading, Royal Veterinary College, Queen's University Belfast, Herd Health Consultancy, Animal Welfare Training Ltd, University of Liverpool and SRUC (Scotland's Rural College), Newcastle University, UK; University College Dublin, Ireland)*

16.20 - 16.50 **Break**

Day 1: Tuesday 24 June

All timings are GMT+1 / UTC+1/ BST

16.50 - 18.00	**Session Three - Suzanne Millman** *(Iowa State University, USA)*
16.50 - 17.10	**Flock characteristics associated with broiler chicken welfare issues during the pre-slaughter and slaughter phases** Samantha Vitek and Leonie Jacobs *(Virginia Tech, Virginia, USA)*
17.10 - 17.30	**Errorless learning in the laboratory: Teaching rhesus macaques in brain-computer interfacing studies** Kylie Thurman and Autumn Sorrells *(Neuralink Corp., California, USA)*
17.30 - 18.00	**Short Talks:** **Replacing the "Canary in the coal mine" with environmental health monitoring** Megan LaFollette and Joseph Garner *(The 3Rs Collaborative, Denver, and Stanford University, Stanford, USA)* **The implementation of a positive reinforcement training program with group-housed pigtail macaques *(Macaca nemestrina)*** Sarah Hart, Rita Bellanca and Jessica Toscano *(Washington National Primate Research Center, Arizona Breeding Center, University of Washington, Mesa, and Seattle, USA)* **Qualitative behaviour assessment captures emotional states related to acute pain in Angus beef calves** Mostafa Farghal, Francoise Wemelsfelder, Ed Pajor and Maria Camila Ceballos *(University of Calgary, Alberta, Canada; Minia University, Minia, Egypt; Scotland's Rural College (SRUC), Edinburgh, UK)* **Evaluating electro-euthanasia as a humane method for zebrafish across developmental stages** Jennifer Bowman, Mikaila Hishaw and Jackson Gross *(University of California Davis, USA)* **Understanding drivers and barriers to lameness management on UK sheep farms** Beth Clark and Niamh Mahon *(Newcastle University, Newcastle upon Tyne and The James Hutton Institute, Aberdeen, UK)*
18.00	**End**

Day 2: Wednesday 25 June

All timings are GMT+1 / UTC+1/ BST

10.00 - 10.10 **Welcome and Introduction** Birte Nielsen *(UFAW, UK)*

10.10 - 11.35 Session Four - Chair: Birte Nielsen *(UFAW)*

10.10 - 10.30 **The role of animal expectations in the welfare of captive animals**
Benjamin LeCorps - Winner of the 2025 UFAW Early Career Researcher of the Year Award *(University of Bristol, UK)*

10.30 - 10.50 **Scientific advocacy for animal welfare: the role of evidence-based engagement**
Elena Nalon *(Eurogroup for Animals, Brussels, Belgium)*

10.50 - 11.10 **Promoting fish welfare: Ethical and practical implications of recognizing fish sentience in Nigeria's aquaculture industry**
Felix Onyeka Nwose *(Delta State University, Abraka, Nigeria)*

11.10 - 11.35 **Short Talks:**

Evidence-based husbandry into husbandry-based evidence - evolving how zoos consider animal welfare concepts
Paul Rose and Jack Lewton *(University of Exeter, Exeter and Nottingham Trent University, Southwell, UK)*

Owner demographic factors are associated with pet rabbit vaccination
Heather Lambert, Emma Tipton, Barbora King, Clare Ellis *(Harper & Keele Veterinary School, Keele, People's Dispensary for Sick Animals (PDSA) and University of Lancashire, Preston, UK)*

Facilitating dairy cow posture transitions with permissive lying cubicle design
Stijn Brouwers, Michael Simmler and Pascal Savary *(Federal Food Safety and Veterinary Office (FSVO) and Digital Production, Agroscope, Switzerland)*

Fur marker pens: an alternative to ear notching for identification
Robbie McLaren-Jones *(Astrazeneca UK Ltd, UK)*

From Rudolph to reality: Assessing the welfare of captive reindeer in festive events
Tayla Hammond *(Animal Insights Research and Consulting and OneKind, Edinburgh, UK)*

11.35 - 12.10 **Break**

12.10 - 13.55 Session Five - Chair: Bas Rodenberg *(Utrecht University, The Netherlands)*

12.10 - 12.50 **Keynote Talk**
What is animal welfare? Beats us: the extent and implications of disagreement among animal welfare researchers about what animal welfare is
Eva Read, Andrew Crump, Heather Browning, Ganga Shreedhar and Jonathan Birch *(London School of Economics, Royal Veterinary College and University of Southampton, Southampton, UK)*

12.50 - 13.10 **Detecting wing fractures and dislocations in chickens using deep learning and computed tomography (CT) scanning**
Kacper Libera, Dirk Schut, Effrosyni Kritsi, Louis van Steijn, Timothy Dallman and Len Lipman *(Utrecht University, Utrecht, Centrum Wiskunde & Informatica (CWI), Amsterdam and Meyn Food Processing Technology B.V., Oostzaan, the Netherlands)*

13.10 - 13.30 **Environmental enrichment as a confounding variable in applied fish behaviour research**
Andrew Vowles *(University of Southampton, Southampton, UK)*

Day 2: Wednesday 25 June

All timings are GMT+1 / UTC+1/ BST

13.30 - 13.55 **Short Talks:**

Perspectives of Western Canadian cow-calf producers on cattle welfare, handling, and training in livestock handling
Nathanael Lutevele, Karin Orsel, Meagan King, Ed Pajor and Maria Ceballos *(University of Calgary, Alberta, and University of Manitoba, Manitoba, Canada)*

What behaviour is important behaviour? A systematic review of how wild and zoo-housed animals differ in their time-activity budgets
Robert Kelly, Marianne Freeman and Paul Rose *(University of Exeter, Exeter, University Centre Sparsholt, Hampshire and WWT, Slimbridge Wetland Centre, UK)*

Investigating gradual decompression as an alternative to carbon dioxide for killing laboratory rats
Sophia Bullock, Jasmine Clarkson and Matthew Leach *(Newcastle University, Newcastle Upon Tyne and University of Glasgow, Glasgow, UK)*

The fair-fish database: Review and assess welfare of aquatic species in aquaculture and fisheries
Jenny Volstorf, Caroline Marques Maia, María Cabrera-Álvarez and Paolo Panizzon *(fair-fish, Weiherweg, Switzerland; FishEthoGroup, Incubadora de Empresas da Universidade do Algarve, Faro, Portugal)*

A substantial volume of animal welfare policy is informed by systematic review methodology
Johann Liesner, Marianna Rosso and Benjamin Ineichen *(University of Zurich; University Hospital Zurich; and University of Bern, Switzerland)*

13.55 - 14.30 **Lunch**

14.30 - 15.30 **Session Six: Chair: Paul Rose** *(University of Exeter, UK)*

14.30 - 14.50 **Early life matters: intensification of smolt production in recirculating aquaculture systems (RAS) fundamentally compromises salmon welfare at sea**
Patricia Pereira and Cynthia Schuck-Paim *(Welfare Footprint Institute, Florida, USA)*

14.50 - 15.10 **Optimizing environmental enrichment for stress resilience in laying hens**
Aleksei Podturkin, Emma Malcolm and Lucy Asher *(Newcastle University, Newcastle upon Tyne, UK)*

15.10 - 15.30 **In vivo digital biomarkers: A collaborative blueprint for advancing animal welfare and translational research**
Stefano Gaburro and Megan LaFollette *(Tecniplast Spa, Italy; 3Rs Collaborative, United States)*

15.30 **End**

Day 3: Thursday 26 June

All timings are GMT+1 / UTC+1/ BST

08.00 - 08.10 **Welcome and Introduction** Huw Golledge *(UFAW, UK)*

08.10 - 09.40 Session Seven - Chair: Birte Nielsen *(UFAW)*

08.10 - 08.40 **Dissecting distress: Scientifically validating negative affective states relevant to animal welfare (and trying to explain it to students)**
Ngaio Beausoleil - Winner of the 2025 UFAW Medal for Outstanding Contributions to Animal Welfare Science *(Kunenga ki Pūrehuroa Massey University, New Zealand)*

08.40 - 09.00 **From wires to wireless: Can virtual fencing improve animal welfare?**
Ishaya Gadzama, Holiness Ayooluwa, Qazal Hina and Emmanuel Onche *(University of Queensland, Queensland, Australia; University of Ibadan, Oyo State, Nigeria; University of Veterinary and Animal Sciences, Lahore, Pakistan; Chungnam National University, Daejeon, Republic of Korea)*

09.00 - 09.20 **All fun and games? The connection between rule-based challenge and animal affect**
Fay Clark *(University of Bristol, Bristol, UK)*

09.20 - 09.40 **Five Domains washing: Operational challenges or a form of welfare-washing?**
Kat Littlewood and Ngaio Beausoleil *(AkoVet Limited, and Kunenga ki Pūrehuroa Massey University, New Zealand)*

09.40 - 10.10 **Break**

10.10 - 11.35 Session Eight - Chair: Beth Clark *(Newcastle University, UK)*

10.10 - 10.30 **Integrative analysis of heat stress effects and mitigation in dairy cattle: novel insights and implications**
Ishaya Gadzama, Qazal Hina, Takudzwa Gondo, Saraswati Ray and Isaac Mugweru *(University of Queensland, Queensland and University of New England, Armidale, Australia; University of Veterinary and Animal Sciences, Lahore, Pakistan; University of Saskatchewan, Saskatoon, Canada; Jomo Kenyatta University of Agriculture and Technology, Nairobi, Kenya)*

10.30 - 10.50 **From cages to cage-free: a qualitative exploration of Chinese egg producers' views on the opportunities and challenges to adopting cage-free egg production systems in China**
Qing Yang, Belinda Vigors, Fritha Langford, Ruqian Zhao and Cathy Dwyer *(Royal (Dick) School of Veterinary Studies, University of Edinburgh, Newcastle University and Scotland's Rural College (SRUC), UK; Nanjing Agricultural University, China)*

10.50 - 11.10 **Advancing farmed fish welfare in Africa: Lessons learned from Egypt and Kenya**
Wasseem Emam, Mohamed Bakr, Ahmad Hamza, Radi Mohamed and Mahmoud Eltholth *(Complutense University of Madrid, Madrid, Spain; Ethical Seafood Research, Glasgow and University of Stirling, Stirling, UK; Kafr El-Sheikh University and Aquavet Egypt, Kafr El-Sheikh, Egypt; Royal Holloway, University of London, London, UK)*

Day 3: Thursday 26 June

All timings are GMT+1 / UTC+1/ BST

11.10 - 11.35 **Short Talks:**

The causes of dog relinquishment in Taiwan: The pivotal role of owner's knowledge and motivation
Wan-Jhu Huang and Gordon Li *(National Taipei University of Technology, Taipei, Taiwan)*

Ethological and procedural assessment of ballistics euthanasia for stranded cetaceans
Rebecca Boys, Ngaio Beausoleil and Karen Stockin *(Kunenga ki Pūrehuroa Massey University, Auckland and Palmerston North, NZ)*

Bridging knowledge gaps: the role of training in improving equid welfare
Mathilde Merridale-Punter, Abel Wodajo, Belay Elias, Anna-Marie Bakos, Hanna Zewdu, Reta Tesfaye, Gizachew Hailegebreal, Teshale Sori, Charles El-Hage, Anke Wiethoelter and Peta Hitchens *(University of Melbourne, Victoria, Australia; Addis Ababa University, Bishoftu and Hawassa University, Hawassa, Ethiopia)*

BOAS in the Boston Terrier - Similarities to and differences from the bulldog breeds
Francesca Tomlinson, Ella O'Neill, Nai-Chieh Liu, David Sargan and Jane Ladlow *(University of Cambridge, Cambridge University Hospitals NHS Foundation Trust, Cambridge and Granta Veterinary Specialists Referrals, UK; National Taiwan University, Taiwan)*

Preliminary study on the current management of calves on Italian dairy farms: health and welfare issues
Valeria Bocchi, Angela Costa, Giulio Visentin, Martina Zappaterra, Marilena Bolcato, Leonardo Nanni Costa and Barbara Padalino *(University of Bologna, Bologna and Ozzano dell'Emilia, Italy; Southern Cross University, East Lismore, Australia)*

11.35 - 12.10 **Break**

12.10 - 13.30 **Session Nine - Chair: Huw Golledge** *(UFAW)*

12.10 - 12.30 **Animal advocacy in changing political and economic times: Opportunities and challenges in the African context**
Ambrose Otachi, Alice Weru, Thomas Ariga and Julius Mambo *(Farm Animals Voice and Panafric Animal Welfare Organisation, Kenya)*

12.30 - 12.50 **Space the final frontier in captive animal welfare?**
Jake Veasey *(Care for the Rare, London, UK)*

12.50 - 13.10 **Validation of a smart camera system for animal welfare surveillance in the slaughterhouse**
Bas Rodenburg, Annemarie Baars and Mona Giersberg *(Utrecht University, Utrecht, The Netherlands)*

13.20 **End**

HOW DOES IMPROVING WELFARE IMPROVE COGNITION? INVESTIGATING THE IMPACT OF HOUSING CONDITIONS ON NEURAL MARKERS IN ZEBRAFISH

Olga V. Burenkova[1], Rory D. Lippert[1], J. Michelle Lavery[1,2] and Georgia J. Mason[1]

[1]Campbell Centre for the Study of Animal Welfare/Dept. of Integrative Biology, University of Guelph, Ontario, Canada
[2] Open Philanthropy

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Housing conditions are fundamental to animal welfare, yet standard laboratory environments often fail to meet animals' needs. Thus, for zebrafish *(Danio rerio)*, conventional barren tanks are small and completely lacking in stimuli; and prior findings from our lab indicate that if given a choice between such conditions and well-resourced (WR) environments containing plants and a gravel floor, zebrafish prefer the latter and also show better survivorship there. Furthermore, fish raised in WR conditions have enhanced rates of learning in simple T-maze tasks. However, the specific neurobiological markers associated with these welfare-related cognitive benefits have not been characterized.

This study therefore investigated effects of long-term differential housing on key neurobiological markers of neuroplasticity, chosen primarily from rodent 'enrichment' work and rearing studies on different fish species. Using immunohistochemistry to quantify specific proteins within brain sections, we assessed two measures of neural proliferation: cell count, obtained using the nuclear marker DAPI; and proliferating cell nuclear antigen (PCNA). Additionally, brain-derived neurotrophic factor (BDNF) was measured: a protein that supports neuronal differentiation, survival, and growth as well as synaptic function. Finally, we assessed the acetylation of lysine 9 on histone H3 (H3K9ac), as an epigenetic modification associated with higher transcriptional activity that might support synaptic plasticity and learning.

Forty brains were collected from zebrafish previously kept in either barren or WR tanks containing gravel and grass, after approximately 6 months (n=20) or 20 months (n=20) of differential housing (half male, half female). Brain markers were assessed − blind to housing − in the dorsolateral telencephalon and dorsomedial telencephalon (both implicated in learning and memory), and the optic tectum (involved in visual processing and behavioral coordination as well as learning): all regions shown to be stress- or 'enrichment'-sensitive in fish studies.

As predicted, compared to barren-housed fish, WR fish had higher H3K9ac levels in the optic tectum (β = 214.74, SE = 91.87, 95% CI = [6.90, 422.56], p = 0.044); but against predictions, in the dorsolateral telencephalon the density of PCNA-positive cells was lower in WR fish (β = -1.53, SE = 0.61, 95% CI = [0.16, 2.91], p = 0.032).

This provides neurobiological evidence linking welfare-improving 'enrichment' to cognitive improvements, opening the door to future work on how poor welfare compromises learning. Given the widespread use of zebrafish, clarifying how housing affects brain plasticity − even when effects are puzzling − is vital for improving experimental models. This insight could impact reproducibility and translational value, as well as animal welfare and neuroscience.

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EFFECT OF PAIR HOUSING ON DAIRY CALF WELFARE (A SYSTEMATIC REVIEW)

Katarína Bučková[1], Ágnes Moravcsíková[2,3] and Radka Šárová[3]

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[2]Department of Ethology and Companion Animal Science, Faculty of Agrobiology, Food and Natural Resources, Czech University of Life Sciences, Prague, Czech Republic
[3]Department of Ethology, Institute of Animal Science, Prague-Uhřínevěs, Czech Republic

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Popularity of individual housing of young dairy calves tends to decrease due to animal welfare concerns and growing popularity of computer-controlled automated feeding systems. Therefore, it is important to provide researchers, practitioners and policy makers with accurate and reliable scientific knowledge on alternative housing systems for dairy calves. Our objective was to critically evaluate the scientific knowledge on pair-housed dairy calves. The outcomes investigated were the performance, behavior, reactivity to stress, health, learning abilities, and emotional states of pair-housed calves. Primary research papers were found through targeted Web of Science, ScienceDirect, PubMed, and Agricola searches. Studies were included when peer-reviewed, published in English, based upon original data, the full text could be obtained, and pair-housed calves were compared to individually housed calves. After applying the inclusion criteria, 34 articles published between 2002 and 2023 were left. With exception of social behavior, which tended to be better developed in pair-housed calves, behavior did not seem to differ between pair- and individually housed calves. Pair-housed calves coped better with stress although a limited number of studies suggests that they were less willing to engage in contact with a human. We found no consistent evidence of impaired health, or improved growth, learning abilities or emotional states in pair-housed calves. In conclusion, pair-housing provides calves with more benefits than individual housing, and improves or does not affect variables of a high value to the producer. Further research on longer-term effects of pair-housing, such as social behavior or productivity of dairy cows, is warranted because the number of long-term studies is limited.

This project was funded in part by Iowa Farm Bureau Federation and by the Ministry of Agriculture of the Czech Republic, Institutional Support MZE-RO0723.

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THE PAIN ECHO CHAMBER EFFECT: HOW CAGES AND BARREN ENVIRONMENTS MAY AMPLIFY PAIN PERCEPTION IN ANIMALS

Cynthia Schuck-Paim, Wladimir J. Alonso and Kate Hartcher

Welfare Footprint Institute, Winter Springs, Florida, USA

kate.hartcher@welfarefootprint.org

Research has shown that the perception of pain is highly plastic, and that complex environments can partially or completely suppress the experience of pain, whereas barren environments do not offer opportunities for pain-suppression and also amplify the experience of pain. Despite this knowledge, current practices and research approaches in animal welfare science assume that similar injuries produce similar experiences of pain, even if they are produced in different environments. This assumption compromises both welfare assessments as well as translational pain research, with critical implications for our fundamental understanding about how animals experience the world.

We examine ten factors that are relevant to common animal housing that have well-documented effects on pain processing: behavioral engagement, movement, social interaction, environmental control, fear, sleep, thermal conditions, stress, nutrition, and previous pain experience. For each factor, we review evidence demonstrating its mechanism(s) of action and subsequent effects on pain sensitivity. We then apply the principles of pain plasticity and environmental pain modulation to standard housing practices in commercial livestock industries, with a focus on layer hen housing systems. The results indicate that the systems offering the most environmental complexity, i.e. pasture-based systems with low stocking densities and rich environmental features, offer the greatest opportunities for pain suppression due to an enhanced behavioural repertoire, opportunities for uninhibited movement, complex social dynamics which are not encumbered by high stocking densities, and an increased ability to have control over their environment.

We combine results from the Welfare Footprint Framework to estimate the hours in pain in each type of housing system and how the results may in fact be interpreted very differently when we incorporate evidence regarding the subjective experience of pain due to modulating environmental factors. Understanding the relevance of pain plasticity in this context offers a new perspective and proposes a transformational paradigm shift regarding standard housing environments in the farming industries worldwide.

This review also reveals a striking scarcity of research directly investigating these effects in most species and housing systems. While the available evidence - particularly regarding behavioral suppression of pain, social modulation, and environmental control - raises serious concerns about pain perception in standard housing conditions, systematic studies examining these mechanisms across species and housing systems are urgently needed. Given that billions of animals are housed in conditions that may compromise natural pain-coping mechanisms, this represents a critical gap in animal welfare science.

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ENHANCING POULTRY WELFARE: AI-BASED VOCALIZATION ANALYSIS FOR STRESS DETECTION AND NON-INVASIVE MONITORING

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Employing Artificial Intelligence (AI) for decryption of poultry vocalizations is a revolutionary development in addressing issues of animal welfare and sustainable agriculture. Our study employs advanced models of Natural Language Processing (NLP), like Wav2Vec 2.0 and BERT, to classify poultry calls corresponding to distress, feeding, mating, etc. Results indicate that the chickens expressing stress produce vocalizations with higher pitch and reduced tonal complexity, correlating with physiological constraints like muscle tension and altered respiration. Increased negative sentiment during stress shows greater utility for real-time emotion and health monitoring with vocal pattern sentiment analysis. Our study also explores the fusion of acoustic data with precision livestock farming systems so that farmers can adjust proactively to environmental conditions restraints, maximize resource allocation and minimize productivity losses due to undue stress. Moreover, this study contributes to understanding poultry vocalizations in terms of their ecological role from a biodiversity and environmental stressors perspective. By fostering environmental consciousness and ethical farming as well as offering non-invasive and scalable monitoring, this AI powered strategy goes beyond conventional welfare approaches and supports intelligent systems. Using a non-invasive method helps us move towards a humane way of monitoring the welfare and health of our feathered friends. Traditional methods often use painful and stressful techniques such as blood samples or physically inspecting the bird. Our method eliminates the need for these techniques and hence improve their welfare.

Our approach lays the groundwork for an AI oriented future in animal welfare by linking poultry health and behavior with ecosystem interactions.

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WIDESPREAD POST-APPROVAL ANIMAL STUDIES: IMPLICATIONS FOR DRUG RESEARCH

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Objective: Animal experiments are often justified by their potential to benefit human health, particularly in developing drugs for human diseases using animal models. However, the extent to which animal studies continue after a drug has already received regulatory approval remains unclear. This study aims to analyze the publication trajectory and characteristics of animal studies testing FDA-approved drugs.

Methods: A systematic review of 41 drugs approved by the FDA between 2011 and 2014 was conducted using publication data from PubMed and Embase. The reasoning provided by authors for conducting these studies was categorized.

Results: Preliminary analyses of 26 drugs indicate that more than 73% of all animal studies were published after regulatory approval, sometimes years later (Figure 1). Some drugs, including Avanafil, Azilsartan, Metreleptin, and Netupitant, had 100% of their animal studies published post-approval. The primary focus of these post-approval studies was testing drug efficacy (37%, 225 studies), benchmarking against other drugs (27%, 169 studies), investigating drug mechanisms (15%, 92 studies), studying pharmacokinetics (8%, 51 studies), conducting toxicological investigations (6%, 39 studies), probing responses in novel animal models (3%, 16 studies), exploring new treatment regimens (2%, 14 studies), and translating findings to humans (<1%, 2 studies). Mice were the most frequently used species post-approval (46%), followed by rats (39%). Male animals were used more often than female animals (63% vs. 23%). The most prolific countries for post-approval studies were the USA (31%, 173 studies), Japan (10%, 55 studies), Germany (7%, 38 studies), China (6%, 32 studies), and the UK (5%, 26 studies).

Figure 1: Publication trajectory of animal studies testing FDA-approved drugs.

Discussion: Our findings highlight a systemic problem in animal research. While post-approval animal studies may be justified, for instance, to investigate drug mechanisms or targets for developing new candidates, the large number of post-approval studies assessing drug efficacy despite regulatory approval is concerning. Animal models are essential for understanding fundamental mechanisms but are less suited for establishing actual drug efficacy. This presents an opportunity to implement 3R measures in drug research.

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UDDERLY IMPORTANT BEHAVIOURS: THE STUDY OF THE BEHAVIOURAL NEEDS OF ADULT DAIRY CATTLE ACROSS COMMON INTENSIVE HOUSING SYSTEMS

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Behavioural needs represent behaviours that animals perform no matter the environment or their physiological state. If these needs are not met, the welfare of the animals has the potential to be compromised. Characterizing the behavioural needs of farm animals is pivotal in understanding how to satisfy them by for example modifying their captive environment. However, behavioural needs are not well understood, and both their definition and application are inconsistent across the literature, particularly in the case of dairy cows. The objectives of this review are to identify papers that study behavioural needs of dairy cows, identify which needs were studied, how they were studied, and how that changed over time. A scoping review (conducted according to PRISMA guidelines) was completed, where 11,512 articles were reduced to 144 through a multi-step screening process. The included papers were published between 1946 and 2024 mostly in Canada (15%), in the United States (14%) and in the UK (11%). Of the remaining articles, only 15% acknowledged the existence of behavioural needs, and there was a lack of consistency in the terms used surrounding this concept. Resting and feeding behaviours were the most studied (in 122 and 86 papers, respectively), as opposed to grooming and exploratory behaviours that were only studied in 16 and 9 studies, respectively. By examining the timeline of when different behavioural categories were studied, it was revealed that the study of behavioural needs in adult dairy cows has evolved greatly in time and was guided by the priorities and the tools available at the time. This review summarises where the concept of behavioural needs fits within the study of dairy cows and highlights the gaps in the literature observed in the past and the present. It is imperative that these concepts be better understood and defined in the literature for the study of dairy cow welfare to move forward.

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A METHOD FOR THE ASSESSMENT AND ECONOMIC VALUATION OF IMPROVEMENTS TO FARM ANIMAL WELFARE FOR USE IN POLICY APPRAISAL

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There is a need to assess the costs and benefits associated with policy change. This is true for policy that impacts on animal welfare as well as for other policy areas. Otherwise, the impacts of policy on animal welfare will not be adequately accounted for in policy decision making with the benefits to society of improving animal welfare being under-recognised. However, there is no accepted or standardized method for valuing the benefits of policy designed to improve the welfare of animals. The research presented here developed and tested a method for the rapid assessment of likely changes to farm animal welfare as a result of policy designed to improve welfare and provide robust and transferable valuations of these welfare changes which can be used to estimate the benefits of such policies.

A welfare assessment protocol involving a panel of thirteen independent animal welfare science experts was used to provide welfare scores on a 0-100 scale for a range of farm animal policy scenarios. Welfare scores were elicited from the panel using 12 welfare Criteria from the Welfare Quality framework but developed and much expanded to include all aspects that impact on welfare, including consideration of the affective states of animals and opportunities for positive welfare experiences as well as including the whole life experience of animals from birth to slaughter. The economic valuation used a stated preference choice experiment survey to estimate households' willingness to pay (wtp) to increase the welfare score of farm animals, based on the choices that survey respondents made from a series of 12 choice questions.

Findings from the project are presented in relation to welfare assessment scores for current animal production systems and for a range of possible policy changes, together with findings from the online wtp survey of over 3,000 UK respondents. Valuation tables for each farm system have been produced showing marginal wtp for a one-point increase in welfare score at various levels on the 0-100 scale. These can be used to calculate economic valuations of the benefits associated with policy to improve animal welfare. There is considerable potential for the tools developed and tested in this project to be rolled out to provide economic assessments of policy changes that impact on animal welfare.

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FLOCK CHARACTERISTICS ASSOCIATED WITH BROILER CHICKEN WELFARE ISSUES DURING THE PRE-SLAUGHTER AND SLAUGHTER PHASES

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The pre-slaughter and slaughter phases in commercial production involve practices that may adversely impact the welfare of broiler chickens. It is well-known that catching, loading, transportation, and slaughter can cause injury and early death. Less known is which flock characteristics play a role in these issues. The objective was to explore associations between flock characteristics and broiler chicken welfare issues occurring during the pre-slaughter and slaughter phases.

Data were obtained from 161 flocks representing 20,033,577 broiler chickens from 152 farms in the United States. Three slaughter plants provided data on flock size (mean±SD=124,432±65,169), breeder flock age (mean±SD=40±5 weeks), on-farm mortality rates (dead on farm, DOF; mean±SD=5.12±2.58%), live weight at slaughter (mean±SD=2.55±0.77 kg), and slaughter age (mean±SD=42±8 days). Pre-slaughter and slaughter welfare measures included dead on arrivals (DOA; % of flock), wing fractures (% of ≥200 birds assessed), leg bruising (% of ≥200 birds assessed), shackling ineffectiveness (% of ≥200 birds assessed), and conscious birds post-cut (% of ≥200 birds assessed). Associations were explored using Pearson correlations in JMP Pro. Data are presented as raw means with standard deviations.

DOAs (0.26±0.22%) were not correlated with any flock characteristics. Wing fracture prevalence (5.51±9.28%) was positively correlated with flock size ($r=0.227$; $p=0.004$), breeder flock age ($r=0.336$; $p=0.005$), DOF ($r=0.488$; $p<0.001$), slaughter weight ($r=0.745$; $p<0.001$), and slaughter age ($r=0.763$; $p<0.001$). Leg bruising prevalence (1.53±2.18%) was positively correlated with flock size ($r=0.265$; $p=0.007$), DOF ($r=0.437$; $p<0.001$), slaughter weight ($r=0.652$; $p<0.001$), slaughter age ($r=0.703$; $p<0.001$), and negatively correlated with breeder flock age ($r=-0.253$; $p=0.010$). Shackling ineffectiveness (0.94±3.44%) was positively correlated with slaughter weight ($r=0.469$; $p<0.001$), and slaughter age ($r=0.479$; $p<0.001$). Conscious birds post-cut (1.42±0.63%) was negatively correlated with slaughter weight ($r=-0.583$; $p<0.001$), and slaughter age ($r=-0.586$; $p<0.001$).

Flocks that are older and heavier are at greater risk for pre-slaughter and slaughter welfare issues (fractures, bruises, shackling issues), although neck cuts were more effective in heavier and older birds. Large flocks are at greater risk of wing fractures and leg bruising. Flocks from younger parent stock are at greater risk for leg bruising, while flocks from older parent stock are at greater risk for wing fractures. High on-farm mortality was consistently associated with more (pre-)slaughter welfare issues (wing fractures, leg bruising), suggesting a link between flock health (DOF) and quality (breeder age) with welfare concerns during processing. Future work in this project includes a multifactorial assessment of the complex relationships between these factors.

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ERRORLESS LEARNING IN THE LABORATORY: TEACHING RHESUS MACAQUES IN BRAIN-COMPUTER INTERFACING STUDIES

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In the laboratory environment, rhesus macaques *(Macaca mulatta)* are utilized for functionality neuroscience studies, which often require animals to learn complex cognitive tasks. Animals are typically taught utilizing a trial-and-error method, originally detailed by Edward Lee Thorndike, in which problem-solving is achieved through repeated, varied attempts until success is reached. However, because frustration has been found to be associated with negative welfare outcomes (Ziegler Hill and Shackelford 2017), errorless learning, a teaching method in which learners are provided prompts and cues to maximize success, is instead often implemented in clinical settings to prevent incorrect responses. In more recent publications, errorless learning has been shown to significantly lower frustration related responses in dogs learning a stimulus discrimination task (Handley et al., 2020).

It was hypothesized that by implementing an errorless learning teaching strategy for macaques in a neuroscience lab to acquire mastery of behavioral tasks, animals would learn with higher levels of engagement and would display significantly fewer frustration-related behaviors. To evaluate this, one cohort (n=4) of macaques were taught a simple stimulus response task utilizing an errorless learning framework tailored to the individual learner. A second cohort (n=4) used a software criterion-led model in which animals learned the game in stages and progressed through approximations upon obtaining mastery at the previous stage. The third cohort (n=4) was exposed to the final task criteria through trial-and-error.

We found on average macaques displayed fewer frustration-related behaviors and had higher levels of engagement in the errorless learning condition. Based on this pilot work, we anticipate that additional animals who learn with errorless learning will engage longer and become proficient at complex cognitive tasks more quickly than those who learn by way of trial and error. It is also expected that animals learning errorlessly will have reduced frustration and therefore may require less restraint and restriction, which will improve welfare overall.

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REPLACING THE "CANARY IN THE COAL MINE" WITH ENVIRONMENTAL HEALTH MONITORING

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Although traditionally rodent health surveillance used live Soiled Bedding Sentinels (SBS), increasing evidence is demonstrating that Environmental Health Monitoring (EHM) is more effective while also promoting the 3Rs and reducing costs. Still, as demonstrated in benchmarking surveys, some institutions have still not switched, sometimes citing lack of scientific evidence for EHM. Therefore, to fully establish the evidence-base for EHM, our team performed a systematic literature review to identify, summarize, and evaluate the efficacy of EHM as compared to SBS.

After systematically searching and evaluating articles from established databases published prior to October 15, 2023, there were 42 peer-reviewed publications included in the analysis. Although their design varied, they included evaluations of exhaust dust testing (n = 27), sentinel-free soiled bedding (n = 8), and direct colony sampling (n = 24). Analysis showed that all types of EHM were superior to soiled bedding sentinels at detecting pathogens, regardless of pathogen type.

Therefore, there is a strong evidence-base for replacing SBS with EHM. Furthermore, in conjunction with this project, the 3Rs Collaborative's EHM initiative has created an extensive resource hub on this topic including lists of institutions that have switched, downloadable SOPs and slide decks, advice on how to switch, a mentorship program, cost analysis, and more. This presentation will therefore provide the evidence for and resources to replace SBS with EHM which can be used as a case study for how new technologies can be integrated in animal resources.

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THE IMPLEMENTATION OF A POSITIVE REINFORCEMENT TRAINING PROGRAM WITH GROUP-HOUSED PIGTAIL MACAQUES *(MACACA NEMESTRINA)*

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The Washington National Primate Research Center (WaNPRC) facility in Arizona maintains the largest domestic breeding colony of pigtail macaques *(Macaca nemestrina)* in the United States, with animals housed in semi-naturalistic harem social groups. In 2023, a dedicated animal training program was developed with the goal of implementing positive reinforcement training (PRT) to aid in the comprehensive care of group-housed pigtail macaques. PRT is a well-recognized refinement to laboratory animal welfare that facilitates positive interactions between care staff and animals, relying on the voluntary participation of the animal with a specific aim of creating a cooperative environment. PRT is often utilized during simple medical procedures to monitor physical health as well as during animal movements for colony needs. Here we present a programmatic overview of our training program supplemented with specific case examples. Our animal training program has yielded significant improvements in cooperative care, staff development and involvement, and documentation. A refinement of practices at our facility includes relocating breeder males out of their social groups for a variety of colony needs. They have been target trained to shift and station while sectioned off from other areas of their enclosure; 10 of which have generalized this behavior from the trainer to 14 members of husbandry and veterinary staff. Another example implementing PRT is training group-housed breeder females to present for cage-side ultrasounds to monitor pregnancies up until birth; three of which generalized the behavior to allow the veterinarian to perform the scans. Finally, two infants under nursery care were trained to station on an in-cage scale to reduce unnecessary human handling when obtaining daily weights. Both infants generalized the behavior with veterinary technicians. Programmatically, protocols for group shifting, wherein a social group cohesively moves from one area of an enclosure to another for husbandry tasks, have been streamlined to minimize coercive methods of handling. Staff fills out daily shifting records for all 45 groups in the colony (n = 480) which are then reviewed by Behavioral Management Services (BMS). Methods of training are documented for specific equipment and any individualized accommodations needed for a particular group or animal. Taken together, the above refinements to our NHP training program has fostered an environment that contributes to a comprehensive approach to NHP behavioral management.

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QUALITATIVE BEHAVIOUR ASSESSMENT CAPTURES EMOTIONAL STATES RELATED TO ACUTE PAIN IN ANGUS BEEF CALVES

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This study aimed to apply Qualitative Behavioural Assessment (QBA) to evaluate acute pain-related emotional states in Angus beef calves, and assess its inter- and intra-observer reliability, construct, and criterion validities. Sixty-nine calves, 6-8 weeks old, were randomly assigned to either surgical castration (CAST, n=34) or sham castration (SHAM, n=35) groups. Calves were video recorded after treatment. A panel of ten cattle-experienced individuals viewed 20 videos (1-min long) displaying 10 CAST and 10 SHAM calves and, through discussion, generated a fixed-term list of 20 descriptors with short definitions for each descriptor. Ten different QBA-trained observers scored 40 videos (20 CAST, 20 SHAM) twice, 3 weeks apart, using the fixed-term list. Principal component analysis (PCA-1; no rotation) was conducted for both sessions to extract principal components (PC) scores. Intra-observer reliability (Kendall coefficient, W), using PC scores of PCA-1, ranged from strong to very strong on PC1 (W=0.55-0.90), PC2 (W=0.53-0.90), and PC4 (W=0.53-0.88), and from moderate to very strong on PC3 (W=0.37-0.83) and PC5 (W=0.42-0.80). Inter-observer reliability ranged from strong to very strong for PC1 (W=0.76, 0.57 for sessions 1 and 2, respectively), and from moderate to weak (W<0.50) for both sessions in other PCs. PCA-2 was performed (Varimax rotation) using the first assessment of 8 observers with intra-observer reliability ≥0.60 on at least 3 PCs from PCA-1. It produced 4 PCs, considering high-loading terms when (r>0.5), and explained 64.69% of the total variance. Emotional arousal, PC1, ranged from calm to frantic, fearful, anxious/worried, active, energetic, and agitated (31.99%). Positive mood, PC2, had high loadings for confident, comfortable, relaxed, and positively occupied (14.28%). Negative mood, PC3, had high loading for tense, lethargic, in pain, indifferent, and cautious (11.16%). Attention, PC4, had high loading for alert, attentive, and curious (7.26%). Construct validity was evaluated using generalized mixed effects model for PC scores from PCA-2. CAST calves had lower scores for emotional arousal and positive mood, and higher scores for negative mood, compared to SHAM calves (P<0.01). Criterion validity was evaluated using Spearman correlations (rs) of PC scores with other pain measures, including the calf grimace scale, activity, locomotion, activity-locomotion score, and miscellaneous behaviours. Emotional arousal and negative mood had moderate to strong correlations (rs=0.47-0.77, P<0.05) with all indicators, while other PCs had weak or no correlations. In conclusion, these results suggest that QBA is a valid and reliable tool for assessing acute pain-related emotional states in calves.

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EVALUATING ELECTRO-EUTHANASIA AS A HUMANE METHOD FOR ZEBRAFISH ACROSS DEVELOPMENTAL STAGES

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Zebrafish are the most utilized fish in research and are often euthanized using MS-222, sodium hypochlorite, or hypothermal shock, all AVMA-approved methods. These methods can pose a significant safety risk to those administering it, require extended exposure time and possibly an additional method of euthanasia, or result in aversive behavior. AVMA humane slaughter guidelines state that electrocution is an acceptable euthanization method, provided that the electric current is sufficient to immediately induce insensibility before or in conjunction with killing the fish. Mocho et al. (2022) showed electro-euthanasia to be effective on zebrafish at 12 hours and 5 days after fertilization with no aversive behavior, but data have not been collected on other life stages. This research will investigate the use of electro-euthanasia as a humane slaughter method for zebrafish across a range of ages and sizes.

We utilized wild-type (AB) zebrafish and two electrical systems, the WASP3 and EFS-WASP1. For all developmental stages, a maximum 60-second exposure was maintained using a rectangular DC waveform with a frequency of 50 pulses per second and a 50% duty cycle. Embryos were exposed to a voltage gradient of 30V/cm for 60 seconds and checked immediately and 12 hours after for survival. Trials for larvae and adults began with the manufacturer's recommended voltage gradient of 30V/cm for larvae and 2.8V/cm for adults. Exposure periods were determined using preliminary testing. If 100% mortality was confirmed 5 minutes post-exposure, the experiment was replicated until five consecutive successful trials were achieved, and the voltage was reduced by 5V/cm for larvae or .4V/cm for adults. If a treatment did not result in 100% mortality, trials stopped as treatment was ineffective.

We determined that embryos (n=5 replicates per treatment, 10 embryos per replicate) 12 and 24 hours post fertilization (pdf) experienced 100% mortality following a 60-second exposure at 30V/cm. The same treatment resulted in 4% survival in 48 hpf embryos. Larvae (n=5 replicates per treatment, 10 fish per replicate) 3- and 5-dpf exposed to 25V/cm for 120-seconds resulted in 100% mortality. However, 4dpf larvae required only 90-seconds at 30V/cm for effective euthanasia. Adult zebrafish (n=5 replicates, 3-5 fish per replicate) 21-25mm and 26-35mm required a 150-sec exposure, while 36-40mm required only 90 seconds to achieve 100% mortality at the lowest testing setting of 2.0V/cm. No aversive behavior was seen during trials. Results of these experiments show that electricity is a viable alternative to currently utilized methods of euthanasia."

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UNDERSTANDING DRIVERS AND BARRIERS TO LAMENESS MANAGEMENT ON UK SHEEP FARMS

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Sheep lameness is a longstanding concern within UK farming, having implications for animal health and welfare, farm productivity and the use of antimicrobials in treatment. Whilst recommended management practices exist, such as the five-point plan (5PP), farmers cannot and often do not always implement these on farm. For example, culling is recommended within the 5PP but is acknowledged as being difficult for farmers to do. Whilst research has looked to explore the uptake of practices such as the 5PP, there is little that looks to understand the role of animal caregivers and their drivers and barriers of lameness management behaviours.

Findings from 6 focus groups with farmers (n=19) and vets (n=4) were thematically analysed to explore the use of the 5PP, specifically culling, on farm. Themes identified from the focus groups were organised in relation to the COM-B model of human behaviour to give a more comprehensive understanding of the capabilities, opportunities and motivations that influence lameness management behaviour and use of the 5PP.

The 5PP was not always specifically mentioned in focus groups, rather set practices within it including different treatment protocols. Prompt treatment and culling were the most frequently mentioned being used by all participating farmers. Whilst universally used, culling protocols varied across farms including by farm type, e.g., pedigree vs commercial, flock size, type and value of the animal involved, e.g., ram vs ewe, and did not always follow recommended advice, e.g., after two incidences of infectious lameness. Regardless of the strategy adopted, good record keeping was essential. These identified factors largely related to 'opportunities' to enact best practice on farm. Whilst some of these were within farmers control constraints were identified including in relation to the resources available, environmental conditions and the wider actions of others selling livestock.

Focus group findings suggest a need to consider the degree of individual control and context involved in lameness management discussions. This included: factors self-controlled by farmers e.g., records kept; factors outside of their control e.g., space available to quarantine, and those factors controlled by others e.g., market prices, others breeding decisions. Within these considerations of the context of the farm and wider context of the UK sheep sector are important. This raises consideration of collective or collaborative actions needed to manage lameness and its associated welfare implications within the UK.

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THE ROLE OF ANIMAL EXPECTATIONS IN THE WELFARE OF CAPTIVE ANIMALS

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Animal welfare is not determined by external conditions alone—it is shaped by how animals expect and interpret their experiences. According to the Bayesian brain hypothesis, brains integrate sensory inputs through the lens of prior expectations built from past experiences. This framework offers a powerful lens for understanding animal affect, suggesting that welfare is rooted not just in what animals endure, but in what they predict. For instance, individual animals appear to differ in how they expect ambiguous events to unfold, with some displaying persistent negative expectations—akin to pessimism in humans. These negative expectations play a great role in determining how animals cope with stressors. Like humans, negative expectations may lead to poorer responses to stressors and increase vulnerability to depressive-like states in animals. Captivity may amplify these effects in two ways. The barren nature of most captive environments may prevent animals to fully develop important cognitive functions like predictive processing – expectations being dependent of the range of experiences an animal is exposed to. In addition, captive environments often expose animals to many stressors. This combination is likely to produce maladaptive predictions such as generalized negative beliefs often observed in humans suffering from mood disorders. By applying the Bayesian brain theories to captive animals, I argue for a more nuanced approach to welfare - one that targets not only the physical environment but also the cognitive landscapes animals inhabit and how these are constructed. Understanding animals as predictive beings opens the door to innovative strategies for promoting better psychological wellbeing in captive environments.

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SCIENTIFIC ADVOCACY FOR ANIMAL WELFARE: THE ROLE OF EVIDENCE-BASED ENGAGEMENT

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Academic advocacy is increasingly recognised as a valuable complement to traditional research, teaching, and service roles, helping scientists apply their expertise to real-world challenges. It involves activities such as public education, policy engagement, and the communication of scientific knowledge to ensure that evidence informs societal decision-making. While advocacy is becoming more common across disciplines, its acceptance and practice vary. In the life sciences, urgent global issues like climate change, biodiversity loss, or public health have spurred scientists to move beyond the old divide between activism and scientific impartiality and participate in public discourse and policy.

Veterinary medicine and animal welfare science offer a particularly relevant example of advocacy in action. These fields have long been grounded in empirical research and clinical practice but are also deeply connected to ethical issues surrounding animal well-being. Increasingly, professionals in these areas are engaging with policymakers, industry leaders, and the public to ensure that decisions and practices affecting animals are aligned with scientific evidence and ethical considerations. Through their efforts, veterinary and animal welfare scientists are thus contributing to shaping or reshaping legislation, industry practices, and public attitudes, driving positive change for animals.

This presentation will explore recent examples of advocacy from veterinary and animal welfare science, showing how experts in these fields are contributing to evidence-based decision-making and ethical debates. It will draw on advocacy efforts to ban brachycephalic breeds, the use of inhumane depopulation methods, and live exports and on other relevant examples to show how advocacy can bridge scientific knowledge and real-world impact, reinforcing its growing role within academia.

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PROMOTING FISH WELFARE: ETHICAL AND PRACTICAL IMPLICATIONS OF RECOGNIZING FISH SENTIENCE IN NIGERIA'S AQUACULTURE INDUSTRY

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Recognizing fish as sentient beings has significant ethical and practical implications for the aquaculture industry in Nigeria. As aquaculture grows to meet the increasing demand for fish, understanding the sentience of fish becomes essential to improve welfare practices and promote sustainability. Fish are capable of experiencing pain, stress, and suffering, which underscores the importance of incorporating humane practices into fish farming. This review examines the ethical considerations of recognizing fish sentience and how it can influence welfare standards and practices in Nigerian aquaculture.

The review highlights the importance of adopting humane fish welfare practices that encompass proper living conditions, stress reduction, and humane harvesting techniques. It addresses the widespread challenges in Nigeria's aquaculture sector, including overcrowding, inadequate water quality, and poor training for fish farmers. These challenges compromise fish welfare and hinder the growth of a sustainable industry. While fish welfare is gaining attention worldwide, its implementation in Nigerian aquaculture remains limited, with significant gaps in research, policy, and farmer awareness.

The review also discusses the need for improved regulatory frameworks and the role of the Nigerian government in establishing and enforcing welfare guidelines. Strengthening these frameworks, alongside comprehensive training programs for fish farmers, can ensure the ethical treatment of fish and enhance the quality of farmed fish. Training should focus on understanding fish sentience, reducing stress, and promoting sustainable feeding practices, which will ultimately improve the overall health and productivity of farmed fish.

Furthermore, the review advocates for increased research on the welfare of commonly farmed species such as *Clarias gariepinus* and *Oreochromis niloticus*, with a focus on their ability to experience pain and stress. Research into humane slaughter methods and technologies, such as low-cost stunning, is crucial to reduce suffering during harvesting. The review also stresses the need for promoting sustainable aquaculture practices, such as integrated multi-trophic aquaculture, to minimize environmental impact and improve welfare outcomes.

In conclusion, recognizing fish as sentient beings provides a foundation for ethical practices in aquaculture that can improve both fish welfare and industry sustainability. Addressing the challenges of overcrowding, water quality, and inadequate training will ensure the continued development of a humane and environmentally responsible aquaculture sector in Nigeria.

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EVIDENCE-BASED HUSBANDRY INTO HUSBANDRY-BASED EVIDENCE - EVOLVING HOW ZOOS CONSIDER ANIMAL WELFARE CONCEPTS

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Modern zoos operate under increasing ethical scrutiny, requiring improvements to animal care and welfare through evidence-based husbandry. However, a reciprocal process is also essential: transforming evidence-based husbandry into husbandry-based evidence. This approach utilises direct observations and practical experiences within zoo environments to refine and validate welfare-friendly husbandry practices. We explore how integrating empirical welfare assessments with daily care routines can create a robust feedback loop that enhances both animal well-being and operational effectiveness in zoos. We propose six key welfare concepts to help develop husbandry-based evidence: Coping, Comfort, Choice, Control, Challenge, and Compassion. These principles offer a structured means to evaluate welfare states and translate theoretical welfare science into practical applications. Coping and Comfort serve as primary indicators of an animal's ability to adapt to its environment, while Choice and Control reinforce autonomy and positive psychological states. Challenge introduces cognitive stimulation and problem-solving opportunities, promoting behavioural diversity and resilience. Finally, compassion accounts for the human dimension of husbandry, ensuring that zoo personnel are equipped with the knowledge and resources to uphold best practices. The transition from evidence-based husbandry to husbandry-based evidence necessitates a systematic approach. Multi-institutional surveys, longitudinal welfare monitoring, and species-specific adaptations allow zoos to validate welfare interventions. By embedding welfare metrics into routine husbandry assessments-such as behavioural observations, qualitative description of emotion, and enclosure usage analyses-zoos can generate actionable data that inform best practices across institutions. This ongoing evaluation process ensures that care standards evolve in response to the lived experiences of animals under human care. A compassionate approach that prioritises both animal welfare and staff wellbeing fosters an institutional culture of continuous improvement. Training programs that enhance keeper expertise, welfare-focused research collaborations, and adaptive management strategies all contribute to a cycle in which husbandry-based evidence informs future animal care protocols. This approach not only strengthens the scientific credibility of zoo management but also aligns with public expectations for transparency and ethical responsibility in wildlife care. By shifting from a unidirectional application of research findings to a dynamic, iterative process of learning from husbandry outcomes, zoos can better tailor their management practices to species-specific needs. This transformation of welfare assessment into an evidence-generating tool is essential for the continued advancement of individual animal and population management approaches, strategies and tools.

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OWNER DEMOGRAPHIC FACTORS ARE ASSOCIATED WITH PET RABBIT VACCINATION.

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Failure to vaccinate was identified as a priority welfare issue facing companion rabbits by a panel of rabbit welfare experts in 2019. There are currently no core vaccinations recommended for pet rabbits in the UK, however the BSAVA recommend a risk assessment approach to determine vaccination need as part of an annual health check for vaccination against myxomatosis and rabbit haemorrhagic disease strains 1 (RHDV1) and 2 (RHDV2). Given the symptoms associated with these health issues, including anorexia, apathy, lethargy, respiratory issues, and neurological changes, the welfare implications of contracting these diseases may be great, along with risk of fatalities.

To examine trends in the uptake of preventative healthcare practices for pet rabbits in the UK, along with reasons to not vaccinate, and to identify associations between household and owner demographics and the provision of preventative health care strategies, data was obtained from the PDSA's Animal Wellbeing (PAW) Report survey.

The PDSA PAW Report survey collected data from 1,806 UK pet rabbit owners in 2021, 2022 and 2023 using a nationally representative survey methodology run in conjunction with the data and insight organisation, YouGov. Participants were asked whether they had provided their rabbits with preventative healthcare treatments and, if not, their reasons for not having their rabbit vaccinated. Data regarding the owner and household demographics were also recorded. Chi-squared tests of association and binary logistic regression analysis (univariate and multivariate) was used to identify factors that could be associated with the provision of preventative healthcare in pet rabbits. Reasons for non-vaccination were coded into themes.

A total of 1,033 participants reported that their rabbits were vaccinated at some point, while 503 had not vaccinated their rabbits. Rabbits receiving a primary vaccination when young were more likely to receive booster vaccinations, worm treatments and flea treatments. Household size, gross household income, and education levels predicted rabbit vaccination status. Thematic analysis of reasons to not vaccinate suggested that rabbit owners do not provide preventative healthcare treatments to their rabbits based on their pet's limited outdoor exposure. The multivariate model-fit data suggested several other factors, which weren't identified in this study, were also responsible for the variation of preventative healthcare provisions for pet rabbits in the UK.

Vet professionals and those providing point of sale information to potential pet rabbit owners will benefit from advising owners of the long-term financial investments needed to maintain preventative healthcare practices for this species.

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FACILITATING DAIRY COW POSTURE TRANSITIONS WITH PERMISSIVE LYING CUBICLE DESIGN

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Cubicle partitions in free-stall housing systems divide the resting area into individual lying spaces, promoting hygiene and reducing competition. However, insufficient forward lunge space often restricts the natural head lunge movement during rising, potentially compromising cow welfare. This study investigated whether permissive cubicle designs-featuring open frame partitions and a flexible, high-positioned neck strap-could alleviate these constraints compared to restrictive cubicles with more lateral bar work and a lower, rigid neck rail. The study was conducted on 10 commercial Swiss dairy farms with exclusively wall-facing cubicles. Four farms employed the permissive design, while six used the restrictive type. Forward lunge space ranged from 55 to 70 cm, which is considered as insufficient for adult dairy cows to perform a forward head lunge. In total, 188 lactating cows were observed, with rising and lying down movements videotaped over 1.5 days. Atypical behaviours during these movements were recorded, and lying behaviour metrics-including daily lying duration, frequency, and lying bout duration-were collected using leg-mounted accelerometers. Results showed that cows in restrictive cubicles exhibited more staggered head lunges during rising (estimate of contrast and 95% CI: 0.31, 0.11-0.49) and more hesitance before lying down (0.19, 0.00-0.38). Additionally, cows in these cubicles displayed shorter daily lying durations (estimate of contrast and 95% CI: -1.9 h/day, -3.4 to -0.5 h/day) and lower lying frequency (-1.6 bouts/day, -3.1 to -0.2 bouts/day), suggesting reduced comfort. These findings indicate that permissive cubicle designs may enhance cow welfare in free-stall systems where increasing forward lunge space is unfeasible. This study highlights the potential of permissive cubicle designs to support natural rising and lying down movements, ultimately improving cow welfare in constrained housing conditions.

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FUR MARKER PENS: AN ALTERNATIVE TO EAR NOTCHING FOR IDENTIFICATION

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Reliable identification of individual animals is essential for oncology studies at AstraZeneca in Cambridge. No existing identification method for mice is perfect: microchipping requires anaesthesia; ear notches likely cause pain and can be difficult to read; and tail marks require regular refreshing.

Five Fine Science Tools marking pens were trialled to investigate their suitability as a means of permanent identification for lab mice. Eighty eight mice already enrolled on existing oncology studies were fur marked as secondary identification throughout the investigation. Pen marks were legible on female, white-furred mice (strains such as SCID (n=15) & NSG (n=10)) for at least 2 months after the initial application. White-furred mice (NSG males, n=30) were observed to groom for 25 to 60 minutes following marking but once the ink dried there were no lasting aversive behavioural responses to the marks. The marking itself elicited none of the pain behaviours sometimes observed with ear notching such as vocalisations or struggling against restraint. Pen marks were trialled on other mouse strains, but marks were not visible on black fur (BL6 females, n=3) and marks faded completely within 24 hours on the skin of nude mice (females, n=30).

A numbering system was devised for standardisation across users and studies, allowing for the unique identification of up to 36 individual animals. These marks are easy to apply and to read, and the system was designed to be usable by staff with colour vision deficiency.

While microchipping remains the gold standard for larger studies, fur marker pens can be reliably used to identify small-scale studies such as growth curves and tolerability studies on white mice. The fur marks don't cause pain, and they are easier to read than ear notches or tail marks, especially when viewed inside a closed cage. As such, fur marks represent a potential refinement for both mouse and handler when compared to other methods of identification.

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FROM RUDOLPH TO REALITY: ASSESSING THE WELFARE OF CAPTIVE REINDEER IN FESTIVE EVENTS

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Reindeer are a prominent feature in festive events, including winter wonderlands, Christmas markets, and parades. However, there is a growing concern about the welfare of these animals as they are transported, confined, and exposed to crowded and potentially stressful environments during such events. Despite their widespread use in seasonal entertainment, there is a lack of research on the welfare needs of reindeer and no standardised method for assessing their welfare in captivity. As such, this study aimed to (1) review existing research on reindeer to establish their needs through the lens of the Five Domains model and (2) develop and pilot a welfare assessment tool to evaluate the impact of captivity and public display on reindeer well-being.

First, I conducted a systematic review of peer-reviewed literature, analysing current research on reindeer welfare across the Five Domains: nutrition, physical environment, health, behavioural interactions, and mental state. The review highlighted a substantial knowledge base regarding the first four domains, particularly in wild and semi-domesticated populations. However, there was a significant gap in research on the emotional and cognitive experiences of reindeer, with a near-total absence of studies focused on those kept in captivity for entertainment purposes.

Using the knowledge gained from the literature review, I developed a 34-point welfare assessment checklist. The checklist was developed using existing validated frameworks, including the AWIN protocols and the Welfare Quality® protocols. This tool was revised and piloted using videos and photographic evidence, from eight UK-based festive events which displayed a total of 27 reindeer, provided by the animal welfare organisation OneKind. The analysis uncovered systemic welfare challenges, including frequent non-compliance with UK animal welfare legislation. Of particular concern was evidence of clear psychological distress exhibited by reindeer, a naturally stoic species, in the majority of events. Signs of fear, agitation, and social distress were commonly observed, raising serious ethical and legal questions about the use of reindeer in entertainment.

This study establishes a foundational framework for future research, offering a structured method for assessing captive reindeer welfare. Given the ethical and legal implications, there is a pressing need for further research, public awareness, and policy reform to ensure that reindeer used in festive events are afforded appropriate care and protection.

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WHAT IS ANIMAL WELFARE? BEATS US: THE EXTENT AND IMPLICATIONS OF DISAGREEMENT AMONG ANIMAL WELFARE RESEARCHERS ABOUT WHAT ANIMAL WELFARE IS

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There's disagreement among animal welfare researchers about what welfare is. This much is known. But how much disagreement? This is not known. In fact, there has been a distinct lack of research on questions to do with how those working on animal welfare understand the central concept of their field. We asked 327 animal welfare researchers to tell us what a definition of animal welfare should do (pick and rank), what their preferred definition of animal welfare is (free text), and how confident they are in their definition to do that important thing (0-7 Likert; extremely uncertain - extremely confident). Most respondents (65%) agreed that it is most important that 'animal welfare' captures whatever it is that animals value, with 30% considering it most important that it is scientifically measurable, and the remaining that it captures what the public (3%) or the industry (2%) understands by 'animal welfare'. Respondents were, on average reasonably confident that their definition satisfies the functions that they picked as important (mode = 5; median = 5). 59.2% of the given definitions could be categorised into reasonably prominent definitions in the literature, with welfare defined in terms of: physical and mental health (22.3%), coping (15.3%), valenced subjective experiences (13.1%), biological functioning, naturalness of behaviour and subjective well-being (6.7%), health and wanting (1.8%). Two welfare assessments - The Five Freedoms (4.9%) and The Five Domains (1.5%) - were given as definitions of the concept, and dozens of responses defined welfare not in terms of a state or quality of an animal at all, but rather a human (epistemic, practical, ethical) project. Many of the remaining responses mixed and matched components of well-known definitions while emphasising a range of other components, for example like thriving, choice, and safety. These results indicate a deeper and more wide-ranging disagreement than one would expect from reading the literature. This is interesting in its own right, given the previous lack of data here. However, I finish by discussing some implications and reasons - both ethical and epistemic - for thinking that this situation is a problem that that the field should aim to rectify. While we expect and endorse disagreement about welfare at the theoretical and philosophical level, responsibly handling the concept at the scientific and policy levels may require us, as a field, to have more clarity here than we currently do.

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DETECTING WING FRACTURES AND DISLOCATIONS IN CHICKENS USING DEEP LEARNING AND COMPUTED TOMOGRAPHY (CT) SCANNING

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Background:
Animal welfare monitoring is a key part of veterinary surveillance in every poultry slaughterhouse. Among the animal welfare indicators routinely inspected, the prevalence of wing fractures/dislocations is particularly relevant, because it is related to acute pain and suffering in injured birds. According to current practice, assessment corresponds to visual examination by animal welfare officers. However, taking into consideration the speed of the production line and limitations associated with human inspection (e.g. different visual perception, subjectivism and fatigue), new more objective and automated techniques are desirable.

Aim of the study:
Therefore, the aim of this study was to assess the applicability of a deep learning classification model (Model_CT) to detect fractures and dislocations based on computed tomography (CT) scans of the wings.

Materials and methods:
Model_CT was a binary image classification model with categories: 1. NON_FRACTURED and 2. FRACTURED. The used architecture was 3D ResNet34 and to train, validate, and test the model 306 CT scans were collected. The CT scanning was performed at the veterinary clinic.

Results:
The Model_CT reached an accuracy of 0.98, precision of 0.96, and recall of 1.0 on the test dataset (n=60).

Conclusions:
All in all, the combination of deep learning and CT scanning can help to objectively recognize wing fractures and dislocations. Consequently, it might lead to more accurate and objective animal welfare monitoring and, ultimately, to raised animal welfare standards.

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ENVIRONMENTAL ENRICHMENT AS A CONFOUNDING VARIABLE IN APPLIED FISH BEHAVIOUR RESEARCH

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Applied fish behaviour research that aims to inform conservation actions is important. This is because freshwater ecosystems are being rapidly degraded, leading to a sharp decline in fish populations (e.g. by 93% in Europe since 1970). Numerous human activities are driving this and in turn a wealth of lab-based research, utilising live fish, aims to understand and mitigate impacts, particularly those that affect important aspects of behaviour. Such research is expected to be reproducible and transferable, but this assumes that experimental animals are in a good welfare state, exhibiting "normal" or realistic behaviours in response to the factors being investigated, and that confounding variables have been controlled. Structural environmental enrichment (EE) is an important aspect of the husbandry environment. It can lower metabolic rates, stress and aggression, and increase brain development, growth and survival. Fish from enriched (vs. barren) husbandry environments also demonstrate greater rates of recovery from handling, cognitive abilities that enhance agility and lower behavioural variability during experiments in novel environments. EE therefore has important implications for fish welfare but also potentially the results of applied lab-based behavioural research. However, EE is poorly documented in scientific publications. This is problematic for a number of reasons. Firstly, it makes it almost impossible to precisely replicate most experiments as this should include the husbandry environment. Secondly, variability in the provision of EE in husbandry tanks within and / or between studies could act as a confounding variable, i.e. an irrelevant variable within the context of the study that might be influencing or obscuring the relationship between the independent variable(s) and behavioural outcome of interest. In this study, the interplay between preferred EE, welfare, and behaviour during an "applied" (fish passage) study is explored. Results will be presented on: 1) EE preference of brown trout, 2) their welfare when held under different levels of preferred EE and, 3) differences in fish passage performance relative to their EE husbandry environment. This will help shed light on EE as a confounding variable in applied fish behaviour research. It is hoped that outputs from this study will encourage researchers to more thoroughly consider and report on the husbandry environment, improving the welfare of laboratory fish as well as scientific rigor.

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PERSPECTIVES OF WESTERN CANADIAN COW-CALF PRODUCERS ON CATTLE WELFARE, HANDLING, AND TRAINING IN LIVESTOCK HANDLING

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Beef cattle handlers play a critical role in influencing the welfare of beef cattle through their handling practices. Similarly, training opportunities in cattle handling are essential for enhancing animal welfare by improving handlers' skills, attitudes, and handling behaviours. Fifteen ~1h semi-structured, audio-recorded interviews were conducted with cow-calf producers from Western Canada (Alberta, Manitoba, and Saskatchewan) to gather their perspectives on cattle welfare, handling practices, and training in cattle handling. The interviews were transcribed verbatim and analyzed using a thematic analysis approach, revealing seven themes (T1–7). T1: producers understand the complexity of animal welfare and its assessment. They acknowledged that animal welfare is multifaced, encompassing health, nutrition, and behaviour, and viewed it as providing for and responding to animals' needs. T2: public and consumer welfare concerns and producers' own sense of responsibility drive the prioritization of welfare practices. They highlighted that the growing interest from consumers in ethical livestock practices, along with their sense of responsibility for their animals, motivates them to prioritize better handling practices and welfare practices. T3 and T4: optimizing animal welfare enhances profitability, and cattle handling has a direct relationship with cattle welfare, respectively, highlighting the recognition that proper handling and stress reduction enhance animal performance and helps minimize treatment costs, as well-cared-for animals are less prone to disease. T5: producers are highly motivated to adopt low-stress cattle handling practices, acknowledging that implementation varies. Motivations include the recognized benefits of low-stress handling, such as improve cattle productivity, enhanced human safety, reduced stress for both cattle and handlers, and decreased occurrence of bruising in cattle. However, differences in handling experience and understanding of low-stress handling practices vary due to interpretations. T6: cattle handling training is a valuable learning experience that is linked with positive effects on the production system. They noted that handling training improves handling skills and safety during handling, ultimately improving animals' lives, motivation to work, and the operation's financial performance. T7: effective handling training must reflect both on-farm settings and handling situations. Participants emphasized the need for handling training reflecting handling scenarios, ensuring that the knowledge gained is applicable in daily handling practices. In conclusion, participants had a strong understanding of animal welfare and the connection between welfare improvement and operation profitability. They recognized the influence of handling practices on cattle welfare and the value of handling training in enhancing handling skills, insisting that such training should be practical, and reflect farm settings.

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WHAT BEHAVIOUR IS IMPORTANT BEHAVIOUR? A SYSTEMATIC REVIEW OF HOW WILD AND ZOO-HOUSED ANIMALS DIFFER IN THEIR TIME-ACTIVITY BUDGETS

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Natural behaviours are traditionally utilised as a metric to establish welfare for zoo-housed species, with an increase in natural behaviour associated with positive welfare. Captive settings are commonly designed to replicate ecologically relevant environments that facilitate the expression of species-specific, adaptive behaviours. However, spatial restrictions and the habitat complexity required by some species create challenges for zoo staff to implement management and husbandry practices that achieve this. Some species struggle to adapt or cope, leading to increased abnormal behaviour, which may negatively impact their welfare, whilst others demonstrate flexible behaviour patterns without compromising welfare. However, research indicating positive behavioural flexibility in captive animals is sparse. This systematic review aimed to categorise species as: fully behaviourally flexible (despite not performing all natural behaviours and with a change in behavioural repertoire, the species can still experiences good welfare); partially behaviourally flexible (some key activities are required but welfare may not be severely impacted if some other behaviours differ in the zoo compared with the wild); behaviourally inflexible (welfare is likely compromised if the species' behavioural repertoire in the zoo differs from that in the wild). Effect sizes (Hedges' g) were calculated to compare behavioural categories of animals in the wild and zoo, grouped by taxonomic Order (Testudines, Primates, Artiodactyla, Psittaciformes and Carnivora) to determine their level of behavioural flexibility. Effect sizes were also analysed to determine behaviours suggestive of good welfare that were absent in zoo species. Despite variation across all groups, abnormal behaviour was consistently highest in zoo animals, with reproductive and foraging behaviours most often compromised. Results suggest that complete positive behavioural flexibility was shown by Testudines (potentially a result from temperature variation to maintain homeostasis) and Artiodactyla (possibly resulting from enrichment provision to facilitate performance of natural foraging and exploratory behaviours). All other groups evaluated demonstrated partial behavioural flexibility or behavioural inflexibility. Abnormal behaviour prevalence and reduced foraging and reproductive behaviours in Primates and Psittaciformes may arise due to their advanced cognitive abilities, which may not be supported in barren or poorly enriched zoo environments. This necessitates more focused investigations that identify environmental features or aspects of managed environments that can meet a species' needs in the zoo.

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INVESTIGATING GRADUAL DECOMPRESSION AS AN ALTERNATIVE TO CARBON DIOXIDE FOR KILLING LABORATORY RATS

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In the UK, around 148,000 rats *(Rattus norvegicus)* were used for the first time in biomedical research in 2023. Of the Schedule 1 killing methods dictated by the Animal (Scientific Procedures) Act 1986 (ASPA), carbon dioxide (CO2) exposure remains the only high-throughput approach. Yet concerns about its impact on animal welfare, including pain and aversion from the acidic gas and improper practices, have led to calls for alternatives. Research on mice suggests that hypobaric hypoxia achieved through gradual decompression could provide a more humane alternative to CO2. Largely insidious in humans - hypobaric hypoxia via gradual decompression reduces air pressure and oxygen availability, much like high-altitude exposure, causing unconsciousness and death. Studies in mice demonstrate the presence of species-typical behaviours and fewer signs associated with negative sensations compared to CO2. Its effects on rats, which have different physiology, remain unclear. A scoping study aimed to determine whether hypobaric hypoxia could induce a non-recovery state with minimal gross pathological damage and provide a basis for exploring its potential as a humane alternative to CO2 for the killing of laboratory rats. Thirty-six anaesthetised Sprague-Dawley rats underwent one of two decompression rates (75 ms-1 and 150 ms-1) and three decompression profile shapes (gradual, linear, and accelerated) based on previous mouse studies. Behavioural observations and heart rate monitoring assessed any reflexive behaviour and physiological responses. All decompression profiles produced a non-recovery state in all rats. As expected, slower decompression rates resulted in longer latencies to becoming motionless (75ms-1: 411.6 ± 33.6 (95% CI 350-483) vs 150ms-1: 286 ± 22.7s (95% CI 244-334)). These latencies were longer than previously reported in mice. Histopathological assessment confirmed no evidence of tympanic membrane rupture in all animals. These results support the undertaking of further investigation into the welfare implications of hypobaric hypoxia via gradual decompression in conscious rats.

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THE FAIR-FISH DATABASE: REVIEW AND ASSESS WELFARE OF AQUATIC SPECIES IN AQUACULTURE AND FISHERIES

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Welfare of aquatic species in aquaculture has been a topic for some decades; welfare of aquatic species in fisheries has moved in focus recently. Which species is affected how much, what are the main welfare hazards, are there possibilities to improve the situation? These and other questions we tackle in the fair-fish database (fair-fish-database.net).

By reviewing the literature for everything welfare related on 10 selected criteria, for the farm branch (aquaculture), we compare wild needs and what species are offered in captivity; for the catch branch (fisheries), we home in on the steps along the catching process, aiming to identify the welfare hazards for a species caught with a certain gear.

For the WelfareScore, we rate the worst case scenario - e.g., smallest tanks in captivity or largest catch volume in a purse seine - and how probable the species is going to experience good welfare. In a second dimension, we gauge what the literature has to offer in terms of mitigation measures or ways of improvement. A third dimension reflects the quantity and quality of the sources we used.

This three-dimensional WelfareScore -developed and continuously refined by our team of experts as well as externally peer reviewed – allows for an assessment of what species are facing in many cases, whether improvement is in sight, and how certain we are of these evaluations.

By comparing WelfareScores between species, we may identify those that are rather not suited for aquaculture or suffer more in fisheries than those whose welfare is not impacted as much.Also, we pinpoint the knowledge gaps we come across to encourage further research. Besides researchers, other stakeholders to potentially profit from the open access fair-fish database

are interested consumers, NGOs, farmers/fishers, innovators, and policy makers. Our work may help raise awareness of welfare issues, motivate practitioners to implement changes, stimulate companies to develop species-specific solutions, and encourage legal coverage of recommended species and fishing standards.

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A SUBSTANTIAL VOLUME OF ANIMAL WELFARE POLICY IS INFORMED BY SYSTEMATIC REVIEW METHODOLOGY

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Despite the growing use of systematic reviews of animal studies, it remains unclear how often systematic review methodology-such as detailed search strategies, multi-database searches, critical appraisal, and study protocol registration-inform animal welfare policies, including the 3Rs. Therefore, we here aimed to assess the contribution of systematic review methodology to policy papers on animal welfare published by the European Food Safety Authority (EFSA). We analyzed 151 EFSA policy reports, focusing on employed study types and the reporting rigour of key systematic review items, including the presence of two independent reviewers, the number of databases searched, and risk of bias assessments. We find that literature reviews were the most common study type, present in 126 reports (83%), with 40 reports (27%) using systematic review methods, such as searching multiple databases and reporting clear research questions, inclusion criteria, and study counts. Eleven studies (27%) were explicitly labelled as systematic reviews, with their use increasing over time. However, reporting rigour varied: 64% listed more than one reviewer, 45% reported a risk of bias assessment, and only 36% registered a study protocol. In conclusion, while systematic review methods are increasingly used to inform animal welfare policy, there is a need for greater methodological rigor and improved reporting standards to enhance their impact on animal welfare.

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EARLY LIFE MATTERS: INTENSIFICATION OF SMOLT PRODUCTION IN RECIRCULATING AQUACULTURE SYSTEMS (RAS) FUNDAMENTALLY COMPROMISES SALMON WELFARE AT SEA

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The welfare of farmed Atlantic salmon during their marine grow-out phase has received considerable attention, yet the long-term implications of juvenile rearing conditions remain poorly understood. The industry's drive for year-round production, increased productivity and biosecurity has led to fundamental changes in how juvenile salmon are produced, with most commercial operations now raising smolts in intensive land-based Recirculating Aquaculture Systems (RAS). We conducted a comprehensive review examining how intensification of the hatchery phase impacts salmon welfare across their life cycle. Our study reveals that economic constraints of RAS create an inherent conflict between production requirements and biological needs. Minimum stocking densities required for economic viability not only prevent natural behaviors but create compounding water quality challenges. The combination of high densities and limited water exchange characteristic of RAS leads to rapid accumulation of metabolic wastes, CO_2, and suspended solids, increasing the likelihood of toxicity. Chronic stress from suboptimal environmental conditions is exacerbated by accelerated growth rates-achieved through genetic selection, high temperatures, continuous lighting, continuous swimming and intensive feeding practices-resulting in systemic physiological impairments such as compromised cardiac function, skeletal deformities, osmoregulatory and endocrine dysfunction, immune suppression, compromised skin and gill health, and a suite of production-related diseases. Moreover, the artificial stability of RAS does not supply the environmental variation necessary for developing the physiological resilience needed for successful adaptation to life at sea. These effects are particularly severe during smoltification, where current protocols fail to provide the environmental cues necessary for proper physiological transformation. The resulting "pseudosmolts", while technically seawater-tolerant, lack the physiological robustness needed for thriving in marine environments. The industry's response of producing larger smolts has proven counterproductive, with higher incidences of diseases like hemorrhagic smolt syndrome and nephrocalcinosis. Our findings suggest that without addressing these fundamental biological conflicts, the industry risks continuing to produce physiologically compromised fish ill-equipped for subsequent life stages, ultimately undermining both welfare and production efficiency. These failures mirror a defining global challenge in animal agriculture: the fish farming industry is repeating historical mistakes of terrestrial animal farming by prioritizing short-term efficiency at the expense of biological limits. Yet this recognition creates an opportunity: by treating biological requirements as non-negotiable parameters in system design and farming practices-such as ensuring adequate environmental cues for smoltification, introducing dark hours, and allowing periods of slower growth for skeletal and cardiac development-fish farming production can simultaneously achieve better welfare and reduce production risks.

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OPTIMIZING ENVIRONMENTAL ENRICHMENT FOR STRESS RESILIENCE IN LAYING HENS

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Environmental enrichment (EE) is a well-established strategy for enhancing animal welfare by promoting species-specific behaviors and mitigating stress. The negative effects of under-stimulation are well-documented, a low level of environmental enrichment limits choice, novelty and control. However, the potential for over-stimulation remains less explored. Some enrichment strategies may inadvertently increase stress sensitivity rather than fostering resilience. This study assessed the behavioural and physiological responses of laying hens (n = 60) to three EE treatments, focusing on the impact of enrichment complexity and novelty on stress resilience.

Hens were randomly assigned to one of three conditions. The Baseline group received the minimal level of enrichment allowed by DEFRA (a perch, a straw bale, a nest box, shavings, and a rope). The Complexity group had a stable yet diverse set of enrichment items (perches, ramps, tables, bedding materials, hanging/spinning/scattered/rolling food enrichments). The Novelty group was provided with the same enrichment as Complexity but rotated daily. Data were collected using video recording, accelerometers, infrared thermography, and eggshell scoring.

Preliminary results indicated differences in welfare indicators among the three groups. Novelty hens showed more soft-shelled or shell-only eggs than Complexity ($p = 0.007$) and tended to have more than Baseline ($p = 0.10$). Total egg abnormalities were also elevated in the Novelty group relative to Baseline ($p = 0.051$) and Complexity ($p < 0.001$), with the lowest incidence in the Complexity group ($p = 0.051$).

Novelty hens showed prolonged elevations in comb temperature during social isolation, whereas Complexity hens demonstrated more rapid thermal stress response recovery ($\chi^2 = 8.8$, $df = 2$, $p = 0.01$; Novelty vs. Complexity, $p = 0.004$). We aim to obtain further results from hens' behaviour, and automated tracking during novel arena/novel object and attention bias tests, as well as conduct an analysis of chicken behaviour throughout the treatment periods. These findings will be discussed in relation to the differential effects of enrichment treatments on hen welfare and the potential for welfare metrics to differ between under- and overstimulated environments.

Overall, these data highlight the importance of balancing novelty with predictability in EE programmes for laying hens. Our findings align with previous studies on zoo-housed animals, indicating the potential for both under and over stimulation from enrichment to result in diminished stress resilience. Providing a manageable and stable yet sufficiently varied environment for captive animals may optimize welfare outcomes by supporting resilience to stress.

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IN VIVO DIGITAL BIOMARKERS: A COLLABORATIVE BLUEPRINT FOR ADVANCING ANIMAL WELFARE AND TRANSLATIONAL RESEARCH

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New sensor technologies that enable continuous monitoring of animals in their home environment are set to transform preclinical studies. By capturing real-time data on behavior and physiology without the stress of traditional, intermittent measurements, these methods promise to boost both animal wellbeing and the reliability of scientific outcomes. Despite these clear benefits, barriers to widespread adoption remain, limiting the full potential of digital monitoring in research.

In response, the 3Rs Collaborative's Translational Digital Biomarkers initiative has brought together experts and stakeholders to share knowledge and drive progress. Our approach adapts the Digital Medicine Society's V3 Validation Framework to the preclinical arena, outlining a clear path for verifying digital biomarkers, ensuring analytical precision, and confirming their applicability in real-world settings. This structured method guarantees that the data collected is both dependable and relevant, fostering confidence in its use for translational purposes.

In this presentation, we outline practical strategies for integrating digital biomarker technology into animal research, highlighting key steps for successful validation and implementation. Through a spirit of interdisciplinary collaboration, our initiative aims to accelerate technological evolution in research practices, paving the way for more humane treatment of laboratory animals and more robust scientific discoveries.

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DISSECTING DISTRESS: SCIENTIFICALLY VALIDATING NEGATIVE AFFECTIVE STATES RELEVANT TO ANIMAL WELFARE (AND TRYING TO EXPLAIN IT TO STUDENTS)

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An animal's welfare state is often considered to be the integrated outcome of its mental experiences, both negative and positive. While various qualities of negative experience are acknowledged in theory, animal welfare research, policy and practice still focus strongly on the presence or absence of pain. Other unpleasant experiences are usually lumped together using catch-all terms like distress or suffering, risking a 'no pain, no problem' paradigm. In this presentation I will talk about my interest in, and explorations of, unpleasant experiences animals may have that are relevant to their welfare but that are not pain. This includes scientific investigations of breathlessness, nausea and, most recently, boredom. I'll also talk about my attempts to create a framework for scientifically validating indicators of these kinds of mental experiences, partly so that I can explain to my students what goes on in my brain all day. This validation is challenging, theoretically, practically and in terms of finding research funding. But it is critical to credibly applying, interpreting the outcomes of, and critiquing assessment frameworks like the Five Domains model that hinge on inference of affective experiences to understand welfare states. Finally, I'll touch on my growing interest in how to address animal welfare problems we understand really well from a science point of view but that persist nonetheless. I will give brief examples of current systems-based research and teaching on these kinds of animal welfare dilemmas such as brachycephalic dogs, managing wildlife disease and developing new tools to control invasive animal species.

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FROM WIRES TO WIRELESS: CAN VIRTUAL FENCING IMPROVE ANIMAL WELFARE?

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Virtual fencing (VF) is an innovative technology in livestock management. It utilizes GPS-enabled neck collars that deliver an audio warning and an electric pulse when an animal nears a virtual boundary. Studies have explored its impact on animal behaviour and welfare across various species, revealing nuanced effects depending on the animal, the technology, and the management context. Several studies have found no significant differences in behaviour or stress levels between animals using virtual fencing and those using traditional electric fencing (EF). For instance, a 31-day study on dairy-origin calves found comparable behaviour and stress levels between VF and EF groups, as measured by faecal cortisol metabolites (FCM). Similarly, research on Fleckvieh heifers found that virtual fencing did not negatively affect stress levels or productivity, with faecal cortisol metabolites remaining consistent. However, other studies indicate potential short-term stress during the initial training period. Dairy cows equipped with GPS-based neckbands showed increased stimuli delivery when fresh pasture access was restricted, suggesting that resource restriction can influence the animal's response to VF technology. Likewise, cows exposed to virtual fencing without visual cues exhibited reduced grazing and ruminating time, indicating stress (Table 1). A study on sheep found that while some individuals quickly associated the audio cue with the electric shock, others struggled, leading to varying levels of stress. The type of virtual fencing technology also plays a significant role. The Halter system, which uses sound, vibration, and a low-energy electrical pulse, has shown promising results in dairy cows, with cows quickly learning to respond to sound cues and move to the milking parlour without intervention. By the final week of management, many cows received no electrical pulses, suggesting a high degree of learning and adaptation. In contrast, a study using an earlier prototype of the Nofence system on ewes found that many animals received the maximum number of shocks, raising concerns about animal welfare. Furthermore, individual animal characteristics and social dynamics can influence the effectiveness and welfare implications of virtual fencing. Studies have noted significant inter-individual variation in learning rates, fence interaction frequency, and responses to stimuli. Social facilitation has also been observed, with animals responding to VF stimuli based on the reactions of their herd mates. This highlights the importance of considering individual animal needs and social contexts when implementing virtual fencing systems.

Table 1: A Cross-Species Comparative Analysis of Behavioural and Welfare Outcomes

Species	Technology	Study Duration (days)	Behavioural Effects	Welfare Effects	Reference
Dairy Cattle	eShepherd	10-44	Rapid learning of audio cues (≤4days) 90% containment within virtual boundaries	Comparable cortisol levels to electric fencing No long-term stress observed	Verdon et al. (2021)
Lactating Cows	eShepherd	10	Reduced grazing near boundaries during training	Temporary milk cortisol spike (day 5) No long-term effects	Langworthy et al. (2021)

Species	Technology	Study Duration (days)	Behavioural Effects	Welfare Effects	Reference
Beef Cattle	Nofence	12-139	Reduced electric pulses after initial learning Social facilitation in responses	No significant FCM differences vs controls Minimal behavioural disruption	Sonne et al. (2022)
Angus Heifers	Halter System	44	Moved autonomously to milking parlour 90% of cows spent ≤1.7 min/day outside boundaries	50% received 0 pulses/week in paddock Lower pulse rate than other system	Verdon et al. (2024)
Sheep	Modified eShepherd	4-28	66% containment with audio cues Variable individual learning rates	Stress from handling > fencing stimuli No hyperthermia observed	Marini et al. (2020)
Goats	Nofence	5-7	Naïve goats learned after 30 mins Accustomed goats generalized audio cues	Increased system predictability Potential stress reduction post-learning	Eftang et al. (2022)

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ALL FUN AND GAMES? THE CONNECTION BETWEEN RULE-BASED CHALLENGE AND ANIMAL AFFECT

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The link between animal play and welfare is complex; even though play is commonly used as a positive welfare indicator, animals with negative affective states sometimes play. And studies have focussed on spontaneous, creative play whereas externally constructed gameplay (skill development tasks, aligned to cognitive enrichment) has been overlooked. In this talk, I explore what we currently know about the link between gameplay and animal welfare. Do animals have more positive experiences when they understand the rules of a game? Do animals inherently 'enjoy' rule-following and respond negatively to rule-breaking? And how can we measure brief emotional responses to progression/winning and regression/losing? The answers to these questions are important because cognitive enrichment for captive animals is becoming increasingly popular. I will end by exploring how an animal's overall experience (affective balance) can justify games that are briefly frustrating, and how optimal experience (flow state) could be induced by games that perfectly balance skill level and challenge level.

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"FIVE DOMAINS WASHING": OPERATIONAL CHALLENGES OR A FORM OF WELFARE-WASHING?

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The Five Domains Model is an internationally recognised framework for assessing animal welfare, supported by numerous organisations. At least 56 NGOs, industry bodies, and companies worldwide have adopted the Model as the theoretical basis for welfare assessment. This surge in popularity also increases the risk of misuse, whether due to misunderstanding of the theory, challenges operationalising the Model, or deliberately to justify practices that lead to poor welfare outcomes. Common operational challenges for users of the Model include: aligning practical assessment with the affective state orientation; avoiding inferences that welfare state can be directly measured or observed; validating and integrating different types of indicators; aggregating across domains or over time for the same animal, across individuals within a group or over different groups of animals; identifying specific indicators for Domain 4 and for expression/restriction of animal agency; and avoiding quantitative scoring and the related assumptions about precision. Furthermore, growing concerns about "Five Domains Washing" using the Model exist. This form of welfare-washing strategically uses the well-recognised Model to present a public image that animal welfare is prioritised within an organisation or industry. Responsible usage is crucial to ensure that the Model retains its scientific integrity and credibility as a way of understanding animal welfare. In light of these issues, we will review some guidelines for properly operationalising the Model and the challenges that still need addressing. Most importantly, the Model serves as a framework, and the scientific integrity of the resulting welfare assessments hinges on the quality of the indicators used and the inferences made about mental states. We hope our guidelines will pave the way for more rigorous and validatory research using the Five Domains Model to assess animal welfare.

A Ten-step protocol for performing comprehensive animal welfare assessments using the Five Domains Model

1. Gather species-specific data for each of Domains 1 to 4 – nutrition, physical environment, health, and behavioural interactions.
2. Compile a species-specific list of potential welfare indicators aligned with each of Domains 1 to 4.
3. Propose a physical/functional impact (Domain 1 to 3 aligned indicators) or behavioural interaction (Domain 4 aligned indicators) that could be inferred for each indicator.
4. Propose a specific mental state (Domain 5) that could be inferred for each indicator.
5. Sort the indicators for each domain into animal-based, resource-based, or management-based.
6. Categorise each indicator based on the information it can tell us about Domain 5 (Mental State) - welfare status or welfare alerting.
7. Validate the link between each indicator and the proposed physical/functional impact (Domain 1 to 3 aligned indicators) or behavioural interaction (Domain 4 aligned indicators).
8. Validate the link between each physical/functional impact (Domains 1 to 3) or behavioural interaction (Domain 4) and the proposed mental experience (Domain 5).
9. Aggregate the mental states aligned to each of Domains 1 to 4 using scientifically informed reasoning (e.g., expert consensus). Overall animal welfare can be graded using separate approaches for welfare compromise and welfare enhancement (add citation to grading).
10. Assign a confidence score that reflects the degree of certainty about the inferences made using the data.

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INTEGRATIVE ANALYSIS OF HEAT STRESS EFFECTS AND MITIGATION IN DAIRY CATTLE: NOVEL INSIGHTS AND IMPLICATIONS

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Heat stress profoundly impacts dairy cattle, with physiological, metabolic, and production consequences that vary across breeds, environments, and mitigation strategies. Recent studies highlight the Temperature-Humidity Index (THI) as a critical determinant of heat stress severity, with thresholds ≥68 linked to reduced dry matter intake (DMI) and milk yield. A meta-analysis revealed that heat stress reduces DMI by 19.3% and energy-corrected milk (ECM) by 17.9%, with milk protein concentration declining by 3.9% (Table 1). Milk fat responses were inconsistent: seasonal studies reported an 8.3% decrease, while chamber studies observed a 2.3% increase, highlighting the role of environmental context in metabolic adaptations. Physiological markers such as respiration rate (RR), rectal temperature, and panting scores increase with THI, disrupting homeostasis. For instance, Holstein cows under severe heat stress (THI >90) exhibit RR exceeding 100 breaths/minute and body temperatures >40.6°C which compromises welfare and productivity. Innovative cooling technologies, including perforated air ducts (PADs) and evaporative systems, have been reported to mitigate these effects by enhancing convective and evaporative heat loss. Dynamic cooling strategies, such as sensor-driven sprinklers, reduce water use by 57% while maintaining efficacy. Nutritional interventions such as betaine supplementation lowered cortisol levels by 15–20% and increased milk yield by 1.5 kg/day (Table 1). Linseed oil improved rumination time and reduced core body temperature in grazing cows. Chromium yeast enhanced antioxidant capacity and milk protein synthesis via rumen microbiota modulation, though DMI remained unaffected (Shan et al., 2025). Such findings emphasize the potential of dietary additives to buffer metabolic stress. Genetic and breed-specific differences in heat tolerance are increasingly recognized. Jersey crossbreds exhibit higher THI thresholds (77 vs. 72 for Holsteins) before milk yield declines, attributed to Bos indicus ancestry. The SLICK1 allele, associated with heat resilience, reduces thermal discomfort and improves longevity, highlighting breeding programs as a long-term solution. Behavioural adaptations, such as increased shade-seeking and altered feeding patterns, reflect cows' attempts to self-mitigate stress. Precision technologies, including accelerometers and rumen boluses, enable real-time monitoring of these behaviours, thus facilitating early intervention. For example, automated systems adjusting cooling based on individual cow data improved lying time and reduced panting. In conclusion, mitigating heat stress requires integrated approaches combining environmental modifications, nutritional interventions, and genetic selection. Precision technologies and breed-specific strategies offer promising avenues to sustain productivity and welfare in warming climates, though contextual factors like study design (seasonal vs. chamber) must guide application. Future research should prioritize longitudinal studies to unravel chronic stress impacts and optimize adaptive frameworks.

1. Effects of heat stress on production, physiological and behavioural outcomes, and mitigation strategies

Category	Details	Findings/Effects	Source
Production & Milk Composition			
Dry Matter Intake (DMI)	Meta-analysis of 31 studies	↓19.3% under heat stress	Chen et al. (2024)
Milk Yield	Holstein cows	↓10–50% depending on cooling infrastructure	Rakib et al. (2024)
Protein/Casein	Holstein vs. Brown Swiss	Lower in Holsteins during heat waves	Ceciliani et al. (2024)
Physiological & Behavioural Changes			
Respiration Rate	Dairy cows	↑60–120 breaths/min (severe heat stress)	Habiba et al. (2025)
Rectal Temperature		↑40°C (heat stress) vs. 38.7°C (control)	Hossain et al. (2023)
Behavioural Changes		Reduced lying/rumination Increased shade-seeking and water intake	Rakib et al. (2024)
Reproductive Health		↓Conception rates, altered oestrus cycles Early embryonic mortality	Dovolou et al. (2023)
Immune Function		↑Somatic cell count, susceptibility to mastitis	Rakib et al. (2024)
Mitigation Strategies			
Cooling Systems	Sprinklers + fans	↓Respiration rate by 20% ↓Body temp by 0.3–0.7°C	Macavoray et al. (2023)
Shade + Ventilation	Natural or artificial shade	Improves welfare Cows spend 30% more-time grazing	Ximenes et al. (2024)
Dietary Interventions	Chromium yeast	↑Milk protein synthesis, regulates rumen microbiota	Shan et al. (2025)
Betaine	Supplementation (80g/day)	↓Cortisol, ↑antioxidants (Superoxide Dismutase) ↑Milk yield by 1.5 kg/day	Elhendawy et al. (2025)

1. Effects of heat stress on production, physiological and behavioural outcomes, and mitigation strategies

Category	Details	Findings/Effects	Source
Linseed Oil	Supplementation (400g/day)	↑Summer milk yield by 1.5 kg Alters fatty acid profile	Gheno et al. (2024)
Genetic & Management	SLICK1 allele	Enhances heat tolerance in tropical breeds	Erasmus & van Marle-Köster (2025)
THI Monitoring	Temperature-Humidity Index (THI)	Critical for early intervention; THI >75 reduces milk yield by 0.04 kg/unit	Gayari et al. (2024)

↑ stands for increase; ↓ stands for decrease; SOD stands for Superoxide Dismutase

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FROM CAGES TO CAGE-FREE: A QUALITATIVE EXPLORATION OF CHINESE EGG PRODUCERS' VIEWS ON THE OPPORTUNITIES AND CHALLENGES TO ADOPTING CAGE-FREE EGG PRODUCTION SYSTEMS IN CHINA

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Despite increasing consumer interest in cage-free eggs, the transition from conventional cage systems in China remains limited. This research investigates the perspectives of 15 large-scale Chinese egg producers operating conventional battery cages and/or cage-free systems (single-tier, multi-tier, and free-range) to explore the perceived challenges and opportunities of adopting cage-free production. Cage farms ranged from 110,000 to 30 million laying hens, while cage-free farms housed 12,000 to 300,000 laying hens.

Applying the Capacity-Opportunity-Motivation Behaviour (COM-B) model from the Behaviour Change Wheel, this study examines how producers' Capabilities, Opportunities, and Motivations influence their decision-making. Findings reveal that consumer demand and profitability are key drivers of cage-free adoption. Free-range producers expressed greater market confidence, while barn system producers faced uncertainty due to limited corporate buyer engagement. Producers emphasised the importance of reliable certification and labelling schemes in building consumer trust and ensuring market success. Access to land and financial resources was also critical for a successful transition.

While most studies propose education as a long-term strategy to promote the growth of the cage-free egg sector, our findings are the first to highlight that engaging corporate buyers and establishing trustworthy certification schemes are the most crucial short-term interventions required to drive the development of large-scale cage-free farms and support sustained improvements in animal welfare in China.

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ADVANCING FARMED FISH WELFARE IN AFRICA: LESSONS LEARNED FROM EGYPT AND KENYA

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Despite the abundant evidence of their sentience, and despite being farmed in such large numbers around the world, the welfare of farmed aquatic animals remains largely neglected within the global food system. This is particularly true within the African context, where the production and consumption of aquatic animals is rapidly rising. Farmed fish suffer from high stocking densities, poor water quality, barren rearing environments and a horrific end to life.

On its mission to improve the lives of farmed aquatic animals in Africa whilst upholding farmer livelihood, Ethical Seafood Research has embarked on a number of promising initiatives over the last few years within its key countries of operation in Africa. Lessons from the work being carried out in Egypt and in Kenya can now be shared for others to build on. Shared projects include rolling out FAI Farms' 'Tilapia Welfare App' to fish farmers around the continent, trialling the introduction of humane slaughter techniques and exploring the option of creating a farmer-led welfare certification scheme for Egyptian tilapia farmers.

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THE CAUSES OF DOG RELINQUISHMENT IN TAIWAN: THE PIVOTAL ROLE OF OWNER'S KNOWLEDGE AND MOTIVATION

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Dog relinquishment remains a persistent issue in Taiwan, exacerbated by high commercial pet sales and a ban on euthanasia, which has led to overcrowded shelters with limited resources. This situation places significant strain on shelters, contributing to overpopulation and declining animal welfare. Additionally, increasing pet demand and inadequate regulations have allowed unethical breeding practices to persist, raising concerns about the transparency of pet acquisition channels.

This study instead shifts attention to the underlying causes of relinquishment by examining the consumption pathway-acquisition motivation, channel of acquisition, training, problematic behaviours, and eventual relinquishment. Existing research suggests that relinquishment is linked to certain channels associated with unethical breeding and impulse purchases, as well as dog problematic behaviours and training methods. This study surveys 444 dog owners in Taiwan through an online survey to understand the causes of relinquishment. Notably, dogs obtained from kennels exhibited significantly fewer behavioral problems, supporting claims that kennels provide more responsible breeding and early care. Additionally, punitive training methods were associated with increased problematic behaviors, while ownership motivation also played a key role. Furthermore, knowledge and motivation were also major determinants of relinquishment. Owners with greater knowledge of dogs and those whose motivations aligned with companionship were significantly less likely to abandon their pets.

Given these findings, this study recommends stricter regulations on breeding and sales channels, with a particular emphasis on improving transparency in pet acquisition. A policy modeled after Lucy's Law in the UK, which mandates that pet sales occur only in licensed kennels where the mother and living conditions can be inspected, could help curb unethical breeding. Furthermore, since relinquishment ultimately traces back to the dog owner, there is a need for public education on responsible ownership. Encouraging prospective owners to acquire dogs from licensed kennels and promoting positive training methods could improve dog welfare and reduce relinquishment.

By addressing both regulatory and educational gaps, Taiwan can move toward a more sustainable and ethical pet ownership framework, reducing shelter burdens and enhancing animal welfare.

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ETHOLOGICAL AND PROCEDURAL ASSESSMENT OF BALLISTICS EUTHANASIA FOR STRANDED CETACEANS

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Euthanasia may be necessary at cetacean stranding events to end suffering. To ensure a humane death, verification of insensibility must be undertaken following application of the killing method. However, only limited information is reported on individual euthanasia events, including how insensibility and/or death is assessed. In this study, we describe current practices for euthanising stranded cetaceans in New Zealand by analysing video footage of fourteen ballistics events involving various species. Specifically, we detail the ballistics procedures applied and the behavioural responses of the animals. Additionally, we sought to understand how animal insensibility was evaluated following each event by surveying the personnel involved. Video recordings ranged in length from 25 to 480 s after the initial shot and involved 14 cetaceans: one Cuvier's beaked whale, one pygmy sperm whale, one bottlenose dolphin, four pilot whales and seven false killer whales. Insensibility criteria were typically not observed being verified in the videos analysed, despite markspersons stating that death occurred in <1 minute for most animals. Key behaviours indicative of insensibility included a continuously slack lower jaw and epaxial muscle relaxation. Based on behavioural observations, 66.7% of animals for which an estimate could be made (n=12) were likely unconscious within 30 s of the initial shot; half of these were likely unconscious within 10 s. The remaining animals appeared conscious for 30 s after the initial shot, and half of these were likely still conscious after one minute. Ten animals (71.4%) displayed post-shot behaviours suggestive of voluntary control, including tail lifting, beyond the point of presumed death reported by markspersons. The lack of verification of insensibility in most animals (12/14) hinders our ability to understand how these behaviours may correlate with awareness and thus welfare impacts of shooting. While the application of ballistics appeared to follow current national recommendations, the procedures mandated for verifying death were rarely observed.

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BRIDGING KNOWLEDGE GAPS: THE ROLE OF TRAINING IN IMPROVING EQUID WELFARE

Mathilde S Merridale-Punter[1], Abel L Wodajo[2], Belay Elias[2,3], Anna-Marie Bakos[1], Hanna Zewdu[2], Reta Tesfaye[2], Gizachew Hailegebreal[3], Teshale Sori[2], Charles M El-Hage[1], Anke K Wiethoelter[1] and Peta L Hitchens[4]

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Working equids support the livelihoods of millions of low-income households worldwide and face numerous welfare challenges. The well-being of these animals is a critical yet often overlooked issue in Ethiopia, where cart-pulling donkeys, horses, and mules play a vital role in transport, agriculture, and commerce.This research aimed to investigate harnessing practices and equipment design of working equids in Ethiopia, as well as the prevalence and risk factors for equipment-related wounds.

This study was conducted across three Ethiopian towns-Shashamene, Bishoftu, and Fiche-where data was gathered using structured surveys with working equid owners linked to a welfare assessments of 369 equids. The results indicate that 72.6% (268/369) of working equids suffered from equipment-related wounds, yet only 28.8% (106/368) of cart drivers actively took preventive measures. Additionally, important insights into the impact of human behaviour and management practices on equid welfare were found. Surprisingly, education level and socioeconomic status were not significant predictors of equipment related wounds, suggesting that technical knowledge gaps and long-standing traditions play a greater role than financial limitations. Additionally, improper harnessing techniques such as mispositioning of breast collars, inadequate padding, and reliance on equipment that is exclusively purchased rather than partially home-made were key contributors to injury prevalence. These findings reinforce the need for training-focused interventions that promote not only an adequate equipment design, but also proper equipment use, handling and management practices.

These findings shift the focus from material-based solutions to behavioural interventions, examining how owner knowledge, training, and daily handling practices influence the health and welfare of working animals. This study highlights that behavioural change is as critical in preventing injuries and enhancing animal welfare as modifications to harnessing materials and design. Addressing these issues requires evidence-based, community-driven interventions, including practical training programs for equid owners and cart drivers on proper harnessing techniques, collaboration with veterinarians and local authorities to promote welfare awareness, and the development of harnessing solutions that balance affordability with improved fit and comfort.

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BOAS IN THE BOSTON TERRIER - SIMILARITIES TO AND DIFFERENCES FROM THE BULLDOG BREEDS

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Certain extreme brachycephalic breeds, namely the Pug, English Bulldog and French Bulldog, soared in popularity in the decade preceding 2021. Disease related to this brachycephalic conformation has therefore become an increasing welfare concern. Brachycephalic obstructive airway syndrome (BOAS) is a condition that affects these dogs, compromising quality of life and in severe cases can be life-threatening. These breeds are also prone to skin fold dermatitis, ocular lesions, hemivertebrae, dental abnormalities and dystocia. Whilst these issues are well documented in the three popular breeds, lesser-known brachycephalic breeds such as the Boston Terrier have been studied less, and the extent to which they suffer from BOAS has not been elucidated.

From our study, we prospectively recruited 107 Boston Terriers from the UK pet dog population. All dogs underwent clinical assessment, respiratory function grading and conformational measurements. Whole-body barometric plethysmography (WBBP) was used in a subgroup of this cohort comparing the quantitative differences in respiratory parameters between both affected and unaffected Boston Terriers, and control mesocephalic dogs.

When compared to an equivalent study population of French Bulldogs and Bulldogs, Boston Terriers were found to have a significantly higher proportion of BOAS Grade 0 dogs at 37.5% compared to 10% and 15.2% respectively ($p<0.01$). The WBBP parameters measured found no significant difference between a small cohort of Grade 0 Boston Terriers and control dogs. There was still a substantial portion (27%) that suffered clinically significant BOAS (Grade 2 or 3), however only one dog was assigned Grade 3. Within the breed, more extreme brachycephalic conformation was found to be associated with an increased risk of BOAS: specifically, nostril stenosis, facial foreshortening, abnormal scleral show, and higher neck to chest girth ratio. Shorter tail length was nearing significance for association with BOAS ($p=0.05$).

The Boston Terrier, like the French Bulldog and Bulldog, is a screw-tailed breed. This study demonstrates that more extreme conformation in this breed is associated with greater BOAS risk. Whilst the Boston Terrier is less severely affected by BOAS than other bulldog breeds, it is still prevalent within the breed. Therefore, the findings of this study are useful to direct the selection of dogs which are less likely to be affected and support the use of a respiratory health scheme within the breed.

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PRELIMINARY STUDY ON THE CURRENT MANAGEMENT OF CALVES ON ITALIAN DAIRY FARMS: HEALTH AND WELFARE ISSUES

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Currently there is a growing interest on the welfare of calves. However, in Italy there is limited information on the practices applied in calf rearing and the repercussions of these on calf health and welfare. One of the objectives of this study was to describe current calf rearing procedures in Italian dairy farms, as well as to analyse potential factors impacting calf mortality and morbidity, namely occurrence of diarrhoea and respiratory diseases. Farmers were offered an online questionnaire about calf-rearing techniques and the current study presents preliminary findings (n=86), though the responses gathering is ongoing. The farms involved are characterised as follows: 44% have less than 100 lactating cows, about 79% have a daily production per cow of more than 30 litres, and 83% perform routine vaccinations. Regarding female calf mortality in the first four weeks of life, about 60% of the farms surveyed had a low female mortality rate (<5%). A binomial regression model was used to identify the long fibre allowance as a factor significantly ($p<0.05$) linked to a high female mortality rate (≥5%). The shown trend suggests that in farms that provide fibre to the calf from the fourth week the chance of high mortality is 4 times higher than in farms that provide fibre immediately or from the first week of life. Furthermore, the average prevalence of diarrhoea was reported to be below (or equal) 20% in about half of the herds (53%). Meanwhile, in most herds (72%), the average prevalence of respiratory diseases was low (≤20%). Using a binomial regression model, the factors significantly ($p<0.05$) associated with high prevalence of diarrhoea (>20%) were the elevated number of total births per year, the absence of a dedicated calving pen and the administration of colostrum 2 hours after birth. In particular, the results suggest that the likelihood of having a high prevalence of diarrhoea increases by around 18 times if there were more than 300 births per year and by 3 times if there was no exclusive calving enclosure. Additionally, the possibility of having a high prevalence of diarrhoea increases 4 times when the first colostrum feeding was given later than 2 hours after birth. Although the number of farms surveyed does not constitute a representative sample of Italian farms, the results suggest that calf management has a strong impact on the health and welfare of dairy calves and needs to be more carefully addressed in Italy.

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ANIMAL ADVOCACY IN CHANGING POLITICAL AND ECONOMIC TIMES: OPPORTUNITIES AND CHALLENGES IN THE AFRICAN CONTEXT

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In the African context, animal advocacy faces a unique set of challenges and opportunities due to shifting political, economic, and social landscapes. Rapid urbanization, changing agricultural practices, and the growing influence of international trade policies all present both threats and avenues for progress in animal welfare. One of the primary challenges stems from the prioritization of economic development, which often places animal rights in competition with human welfare, especially in regions heavily reliant on agriculture and livestock industries. In countries where poverty remains widespread, animal welfare may be seen as secondary to immediate human needs such as food security and employment. This creates tension between advancing animal advocacy and maintaining socio-economic stability.

Political instability and changing government priorities also play a crucial role. Shifting political administrations may either strengthen or weaken laws related to animal welfare, leaving advocacy organizations in a constant state of adaptation. Additionally, the expansion of industries such as mining and infrastructure development further encroach on wildlife habitats, leading to increasing human-wildlife conflicts that complicate advocacy efforts.

However, there are significant opportunities to drive change. The rise of youth activism, greater connectivity through social media, and a growing global focus on sustainable practices open doors for advocacy groups to build larger, more diverse coalitions. By tapping into international networks, African activists can draw attention to local issues and generate support for animal welfare initiatives. Furthermore, with increasing awareness of climate change and biodiversity loss, there is growing recognition of the interconnectedness of human and animal health, creating a platform for advancing animal advocacy within broader environmental and public health discourses.

For activists and organizations, it is crucial to focus on multi-stakeholder engagement, building alliances with government bodies, businesses, and local communities. This collaborative approach can help frame animal welfare within broader socio-economic contexts, ensuring that both human and animal needs are considered in policy-making processes. Empowering local communities, especially those who directly interact with wildlife and livestock, will be key in fostering sustainable and effective advocacy.

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SPACE THE FINAL FRONTIER IN CAPTIVE ANIMAL WELFARE?

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Various studies suggest that the space available to captive animals predictably impacts their welfare. However, differentiating the effects of space from factors that covary with it remains a challenge. Recent analyses indicate that purposeful travel may be universally important for captive animal welfare. While this might seem to support the idea that habitat size directly determines welfare outcomes, research on nomadism and captive travel suggests that the opportunities and contingencies associated with travel in the wild are more significant than the sheer volume of space or the distance covered in captivity. We subsequently recognise "meaningful locomotion" as a critical welfare priority and explore targeted management and design solutions currently being deployed for one of the most stereotypic of zoo animals- the tiger. This project aims to serve as a proof of concept, addressing the widespread but previously overlooked issue of purpose driven travel in a way that could transform our understanding and approach to captive animal welfare.

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VALIDATION OF A SMART CAMERA SYSTEM FOR ANIMAL WELFARE SURVEILLANCE IN THE SLAUGHTERHOUSE

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Conventional animal welfare surveillance in the slaughterhouse is challenging. Inspectors commonly have to oversee a large slaughterhouse facility. They also have multiple responsibilities, including animal welfare and food safety surveillance. Conventional camera systems (CCTV) have the advantage that they can collect video data when the inspectors are not present, but the footage still has to be reviewed by a person, resulting in similar time constraints. Smart camera systems can be used to automatically recognize, record and store situations that are deviating from normal, such as an animal staying behind, or a slaughterhouse worker hitting an animal. An operator or inspector can then review the recorded deviations and can take action in case of a true positive. This study focused on the AI4Animals smart camera system, installed in a commercial pig slaughterhouse in The Netherlands. We evaluated the accuracy of the system in recording the use of the (low voltage) electrical prod, used to stimulate the pigs to enter the electrical stunner. We compared detection by the smart camera system with detection by a trained observer from video observations. Accuracy, sensitivity, specificity and precision were calculated. Twenty 10 minute videos were analysed and 461 events were detected by the human observer. The accuracy was 83%, the sensitivity 82%, the specificity 84% and the precision 82%. Approximately 8.4% of the events registered by the system were false positives: these would normally be filtered out by the operator. Further, 8.7% of the events were not registered by the system (false negatives). These would be missed by the system, but given that the smart camera system monitors the slaughter process continuously, the system will still result in the detection of a much larger percentage of events compared to a human inspector, with or without support of a CCTV system. Accuracy, sensitivity, specificity and precision were all above 80%. There are only few validation studies to compare to, as only 20% of the sensors used in slaughterhouses has been externally validated. The findings are well above chance level, which would be 52% based on the current dataset. For the validated indicator, the AI4Animals system provided a valid solution for automatic monitoring. Additional benefits are observed from the mandatory evaluation of the system footage by slaughterhouse personnel, urging the slaughterhouse to take action in case certain welfare risks are observed frequently.

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3. **Facilitating dairy cow posture transitions with permissive lying cubicle design**
   Stijn Brouwers, Michael Simmler and Pascal Savary *(Federal Food Safety and Veterinary Office (FSVO) and Digital Production, Agroscope, Switzerland)*

4. **Fur marker pens: an alternative to ear notching for identification**
   Robbie McLaren-Jones *(Astrazeneca UK Ltd, UK)*

5. **From Rudolph to reality: Assessing the welfare of captive reindeer in festive events**
   Tayla Hammond *(Animal Insights Research and Consulting and OneKind, Edinburgh, UK)*

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1. **Perspectives of Western Canadian cow-calf producers on cattle welfare, handling, and training in livestock handling**
   Nathanael Lutevele, Karin Orsel, Meagan King, Ed Pajor and Maria Ceballos *(University of Calgary and University of Manitoba, Canada)*

2. **What behaviour is important behaviour? A systematic review of how wild and zoo-housed animals differ in their time-activity budgets**
   Robert Kelly, Marianne Freeman and Paul Rose *(University of Exeter, Exeter, University Centre Sparsholt, Hampshire and WWT (Wildlife and Wetlands Trust), Slimbridge Wetland Centre, UK)*

3. **Investigating gradual decompression as an alternative to carbon dioxide for killing laboratory rats**
   Sophia Bullock, Jasmine Clarkson and Matthew Leach *(Newcastle University, Newcastle Upon Tyne and University of Glasgow, Glasgow, UK)*

4. **The fair-fish database: Review and assess welfare of aquatic species in aquaculture and fisheries**
   Jenny Volstorf, Caroline Marques Maia, María Cabrera-Álvarez and Paolo Panizzon *(fair-fish, Weiherweg, Switzerland; FishEthoGroup, Incubadora de Empresas da Universidade do Algarve, Faro, Portugal)*

5. **A substantial volume of animal welfare policy is informed by systematic review methodology**
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   Wan-Jhu Huang and Gordon Li *(National Taipei University of Technology, Taipei, Taiwan)*

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   Mathilde Merridale-Punter, Abel Wodajo, Belay Elias, Anna-Marie Bakos, Hanna Zewdu, Reta Tesfaye, Gizachew Hailegebreal, Teshale Sori, Charles El-Hage, Anke Wiethoelter and Peta Hitchens (*University of Melbourne, Victoria, Australia; Addis Ababa University, Bishoftu and Hawassa University, Hawassa, Ethiopia)*

4. **BOAS in the Boston Terrier - Similarities to and differences from the bulldog breeds**
   Francesca Tomlinson, Ella O'Neill, Nai-Chieh Liu, David Sargan and Jane Ladlow *(University of Cambridge, Cambridge University Hospitals NHS Foundation Trust, Cambridge and Granta Veterinary Specialists Referrals, UK; National Taiwan University, Taiwan)*

5. **Preliminary study on the current management of calves on Italian dairy farms: health and welfare issues**
   Valeria Bocchi, Angela Costa, Giulio Visentin, Martina Zappaterra, Marilena Bolcato, Leonardo Nanni Costa and Barbara Padalino *(University of Bologna, Bologna and Ozzano dell'Emilia, Italy; Southern Cross University, East Lismore, Australia)*

LOCOMOTORY, RESTING, AND AGGRESSIVE BEHAVIOURS IN NIGERIAN LOCAL AND HYBRID CONVERTER TURKEYS: A COMPARATIVE STUDY

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Turkey welfare is a critical aspect of sustainable poultry production, as it directly affects productivity, health, and overall economic viability. Behavioural patterns serve as key indicators of welfare status, reflecting the adaptability of the birds to their environment. Understanding breed-specific differences in behaviour can inform management strategies that enhance well-being and performance. This study examined behavioural variations in locomotory (walking), resting, and aggressive behaviours between Nigerian Local Turkeys (NLT) and Hybrid Converter Turkeys (HCT). Ethological studies were conducted to quantify locomotory, resting, and aggressive behaviours in 30 HCT and 30 NLT at 11th, 15th, and 17th weeks of life utilizing scan-sampling measurements. Statistical analysis using Mann Whitney U tests in SPSS was performed to determine breed differences in locomotory, resting, and aggressive behaviours between turkeys. The results indicated significant ($p<0.05$) differences in locomotory and resting behaviours at 11th, 15th, and 17th weeks of life with HCT exhibiting higher ($p<0.05$) resting behaviour, while NLT displayed increased ($p<0.05$) locomotion for all the weeks. There was significant ($p<0.05$) effect of breed on aggressive behaviour at 17th week of life with NLT displaying higher ($p<0.05$) level of aggression compared to HCT. There were no significant differences in aggression between the two breeds at 11th and 15th weeks of life. These findings suggested that HCT experience better welfare conditions, whereas the heightened aggression and activity levels observed in NLT may indicate increased stress and social instability. Such stress-related behaviours can negatively affect feed efficiency, growth rates, and overall productivity. Crossing NLT and HCT is recommended to improve the welfare and productivity of NLT.

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SYSTEMIC CHALLENGES IN PSYCHEDELIC ANIMAL RESEARCH: ADDRESSING SEX BIAS, METHODOLOGICAL RIGOR, AND DOSE RELEVANCE TO IMPROVE TRANSLATION

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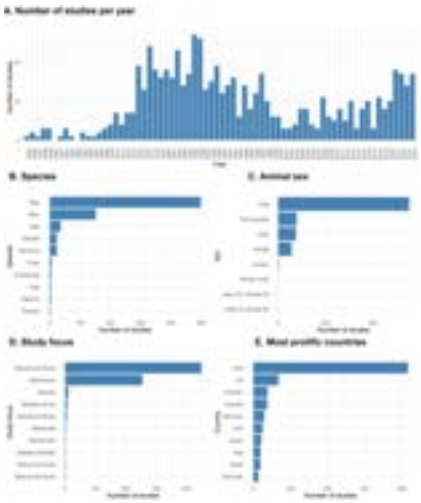
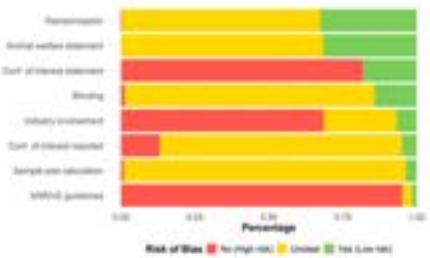
Objective: Psychedelic research is an active field of animal experimentation, yet the generalizability of findings to humans remains unclear. This study aimed to analyze animal research on psychedelic substances, focusing on species, sex distribution, substances, doses, and methodological rigor to identify potential 3R targets.

Methods: A systematic search of PubMed, Embase, and PsycInfo was conducted. Screening and data extraction were performed in duplicate. Animal doses were converted to human-equivalent doses (HED) using species-specific Km factors.

Results: From 7,288 screened publications, 1,243 underwent full-text review, and 769 studies were included in this preliminary analysis. Rats were the most frequently used species (66%, 499/755 studies), followed by mice (20%, 152/755 studies, Figure 1). Other species included monkeys, cats, dogs, guinea pigs, and birds. Male animals were used in 81% (553/682) of studies, females in 8% (56/682), and both sexes in 11% (75/682). The remaining studies did not report the sex of the animals. Behavioral outcomes were the primary focus of 61% (449/738) of studies, followed by mechanistic investigations such as histopathology (35%, 255/738). The USA was the leading country publishing such studies (61%, 417/686), followed by the UK (10%, 68 studies) and Sweden (6%, 38 studies). Regarding critical appraisal, a third of studies reported randomization (33%) or an animal welfare statement (32%). Blinding was mentioned in 14% of studies. Conflict-of-interest statements appeared in 18%, with 5% disclosing conflicts and the rest declaring none (Figure 2). Importantly, 43% of studies applied HEDs exceeding typical clinical doses, particularly for LSD, where 72% of studies used higher doses, with a six times higher HED median compared to clinical doses (median HED: 1.14 mg vs. 0.15 mg in humans, Table 1 and Figure 3).

Interpretation: We identify systemic problems in psychedelic animal research, including a strong sex bias, low methodological rigor (e.g., lack of randomization and blinding), and frequent use of unrealistically high HEDs. These issues undermine the generalizability and relevance of findings to human health, particularly given the extensive safety and efficacy data from human psychedelic use over the past 50 years. Refining animal experiments is essential to enhance translational value and reduce unnecessary mechanistic investigations in animals.





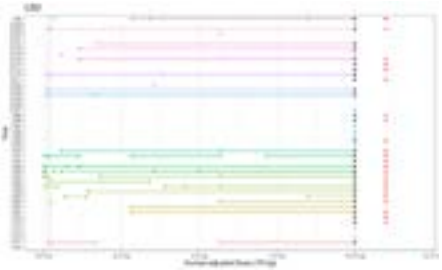


Figure 1: Study characteristics

Figure 2: Critical appraisal of studies

Figure 3: Applied LSD doses per year.

Each dumbbell represents the minimum and maximum applied dose. Studies outside the x-axis range are marked with an asterisk, while partially displayed dumbbells are indicated with a triangle. Common clinical doses (0.1–0.2 mg) are shown between the two dotted vertical lines.

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A SCOPING REVIEW OF COGNITIVE ENRICHMENT FOR YOUNG CATTLE AND ITS IMPLICATIONS FOR WELFARE AND AGRICULTURAL PRACTICES

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Cognitive enrichment satisfies the behavioral needs of animals by engaging their natural instincts, providing mental stimulation, and enhancing cognitive skills. It distinguishes itself from other types of enrichment by introducing cognitively challenging tasks to the environment and promoting cognitive stimulation. For young cattle, this form of enrichment is necessary for supporting healthy development, adaptability and overall well-being. This scoping review seeks to critically assess the current state of literature on the effects of cognitive enrichment on young domestic bovine within an agricultural environment. This is substantial for understanding benefits to individual animals in addition to possible implications for the efficiency and sustainability of farming practices. The scoping review specifically focuses on identifying gaps in knowledge related to methodology, terminology, practical implementation, and future directions of cognitive enrichment practices. A comprehensive search of databases Scopus and Web of Science was conducted using PRISMA guidelines to identify records published between 1970 and 2024. Studies were included if they met the criteria examining cognitive enrichment or related interventions for calves and heifers. After a multi-step screening process, a total of 32 studies reduced from 13,195 were included in the final analysis. Results of the analysis showed inconsistent definitions of age classification of bovine developmental stages and missing fundamental cognitive enrichment terminology. These results highlight the difficulties in tracking and defining the emergence of cognitive enrichment for young bovines due to lack of standardization. Consequently, non-standardized methodologies impose limitations on cross-study comparisons and hinder the development of evidence-based recommendations for practical implementation. Secondly, methodological elements such as measures and practicality of tests were categorically organized to investigate the potential welfare implications of cognitive enrichment and were found to hold meaningful contributions towards the topic. As a whole, cognitive enrichment holds significant promise as a tool for enhancing the welfare and cognitive development of young bovine.

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PROHIBITION ON KEEPING ANIMALS - CHALLENGES IN IMPLEMENTATION

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Legislation restricting animal ownership following convictions for animal cruelty is a key preventive measure in animal welfare laws worldwide. In Israel, the Animal Welfare Act (1994) amended in 2015, grants courts the authority to prohibit convicted individuals from owning animals, or restrict ownership for a certain period. This measure is considered progressive, as it restricts the fundamental rights of ownership under Israeli law, to protect vulnerable animals.

While similar laws exist in various countries, their scope varies significantly. Some jurisdictions restrict ownership only for the species involved in the offence, while others extend the ban to all animals within the offender's residence. Some, even prohibit offenders from profiting from animal-related businesses. Despite the adoption of such laws, enforcement remains a challenge, limiting their effectiveness.

Over the past decade, Israeli courts have imposed ownership bans in multiple cases with restrictions ranging from months to years. However, several barriers hinder their implementation, highlighting the need for legislative refinements:

1. A centralized offender database - accessible to individuals and organizations involved in animal sales, adoptions, and transfers, this system would prevent banned individuals from acquiring animals. If residence-based prohibitions are enacted, known addresses should also be included.
2. Enforcement through home inspections - many animals are transferred privately and remain unregistered, making violations difficult to detect. Legislation should explicitly authorize law enforcements to conduct periodic inspections.
3. Extending bans to shared residences - If an offender resides with an animal, even without formal ownership, the risk of cruelty remains. Laws should prohibit all animal presence in shared living spaces.
4. Stronger penalties for violations - currently, possession of an animal despite a ban results in contempt of court charges, requiring additional legal proceedings. A more direct penalty system would improve deterrence and enforcement.
5. Prohibitions independent of prosecution - ownership bans should be applicable even when offenders cannot be prosecuted, such as cases involving mental fitness to stand trial.

By reviewing international legislation and Israel's decade-long experience, critical gaps in enforcement can be identified and solutions to enhance the effectiveness of ownership bans found. Strengthening legal frameworks and enforcement mechanisms will help ensure better protection for animals and prevent repeat offenses.

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TO WHAT EXTENT DO SEASONAL CLIMATE VARIATIONS AFFECT HEALTH AND WELFARE IN HORSES KEPT IN MARGINAL AREAS?

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Horses kept in marginal areas might promote sustainable animal husbandry practices, yielding favorable outcomes for the environment and animal welfare. Fluctuating atmospheric conditions necessitate the development of adaptive management strategies to mitigate their impact on equine health and welfare. The aim of this study was to evaluate through animal-based measures (ABMs) how seasonal changes in climatic conditions influence the health and welfare of horses kept in marginal areas, defined in the experimental design as land with limited agricultural potential, characterised by economic infeasibility or physical constraints (e.g., poor soil fertility, steep slopes, rocky terrain) that preclude conventional crop cultivation. Data were collected from 80 leisure horses (14.02±0.26 years old) recruited from six stables located in marginal areas of Italy. Horses were kept outdoors all year in social groups with access to pasture, their primary feed consisting of a forage-based diet. Artificial or natural shelters were supplied, and water was provided ad libitum. The ABMs included in the AWIN welfare assessment protocol were assessed by two trained observers to gain information about welfare during summer and winter seasons. Each horse was monitored for two consecutive years (2023 2025). For each ABM, the proportion of each score was calculated, and generalized linear models with a binomial distribution were used to analyze the seasonal effects, and pairwise comparisons were conducted with Bonferroni correction to adjust for multiple comparisons. During the winter, horses with a suboptimal Body Condition Score were slightly higher in both years, with 64.1% and 66.1%, respectively, compared to summer (first: 57.5%, second: 58.8%). The human-horse relationship showed minimal fluctuations as well across both seasons, with over 90% of horses showing positive signs when approached by humans. During the summer season, integumentary alterations, including alopecia (first: 61.3%, second: 35%) and skin lesions (first: 60%, second: 40%), were significantly more frequent compared to winter, with respectively, 33.3% and 20.5% in the first year and 28.8% and 37.3% in the second. Furthermore, both alopecia and skin lesions were significantly more prevalent in summer 2023 compared to summer of 2024 with $p=0.001$ and $p=0.006$, respectively. Bite injury occurrence was also significantly higher during the first summer (42.5%) compared to the second (21.6%) ($p=0.017$). In addition to the higher temperature average in the first summer season (24.7°C) compared to the second (23.4°C), higher prevalence of integumentary alterations and bite injuries might be due to the greater insect activity and more sun exposure, which might have led to skin irritations and potentially aggressive behaviour. Consequently, managing horses' seasonal needs can enhance horse welfare, particularly in marginal areas where horses are exposed continuously to fluctuations in atmospheric conditions.

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EFFECTS OF THE STRUCTURAL ENVIRONMENTAL ENRICHMENT IN CAPTIVED-BRED NURSEHOUND *(SCYLIORHINUS STELLARIS)* JUVENILES FOR RESTOCKING

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Sharks have a pivotal role in the stability of the ecological balance of the seas. But the general loss of biodiversity is affecting this group in particular. In the Balearic Islands, a restocking program is seeking to breed *Scyliorhinus stellaris* in captivity for release into the sea. Improving the welfare of the sharks during their time in captivity is crucial for the success of the restocking program. For the first time, the effects of different structural environmental enrichments (EE) (seaweed or tiles) on the growth and welfare of this species were studied in a group of 45 nursehounds. The EE treatments had no negative effects on growth. Through space-use analysis, we demonstrate that EE promotes positive welfare-related behaviors, such as exploration and aggregation. Notably, the seaweed treatment shortened the habituation period by three months. The control group took more than four months from the start of the experiment to habituate, as indicated by the point when differences in core areas (measured using Kernel Utilization Distribution) were no longer significant between the SW and C groups. Additionally, nursehounds in the tile treatment exhibited a greater preference for this enrichment than those in the other groups.

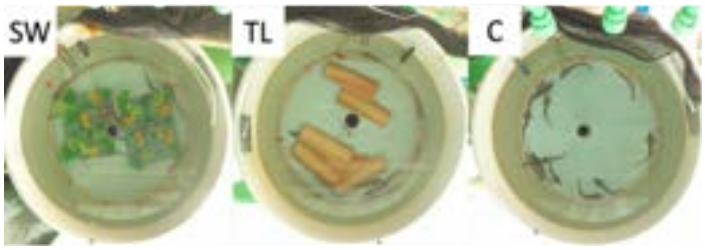

Figure 6. Setting of the EE during the space-use test. SW. Represents seaweed treatment. TL. It is the tiles treatment. C. The control group.

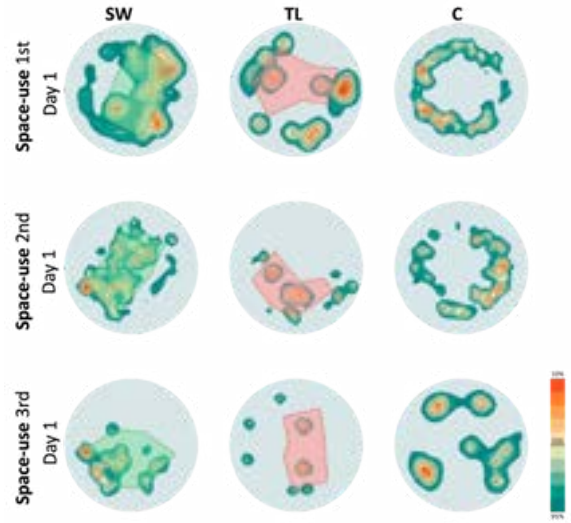

Figure 9. Heat map showing the cumulative spatial distribution of nursehounds within the tank during the three space use tests during the first day of each test. Divided into the three treatments (SW, TL and C). The density of presence, estimated as probability of shark presence calculated by KUD is expressed on a scale ranging from 95% probability (blue) to 10% (red). The black lines delimit the 50% area. Grey area delimits the tank, green polygons are the algae EE, and red polygons are the tiles EE.

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GIVING THE CONVENTION OF BIOLOGICAL DIVERSITY TEETH BY IMPLEMENTING AN INVASIVE SPECIES FRAMEWORK THAT BALANCES ECOSYSTEM HEALTH WITH ANIMAL DIGNITY

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The Convention for Biological Diversity (CBD) is "an international agreement that aims to conserve biological diversity, sustainably use natural resources, and fairly share the benefits of genetic resources". Yet the convention fails to be enforced or have an adequate review system for assessing state's goals for implementation. To transform the CBD, the article suggests implementing an assessable framework that is enforceable through trade restrictions. The framework would have an improved likelihood of passing at the CBD's Conference of the Parties because each country would be able to propose their own guidelines and set percentages to be applied for sections of the framework. Further invasive species is an increasingly urgent issue that requires cross boarder coordination. Implementing this framework would be the first step to creating enforcement mechanisms for the CBD treaty.

The CBD states that "[e]ach contracting Party shall, as far as possible and as appropriate, prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species". This article will suggest a new framework for working with invasive species that prioritizes prevention and provides flexibility for climate change. When removal is required, it seeks to balance the dignity of individual animals while taking a whole health approach to protecting ecosystems. The framework will be a step-by-step guide of handling invasive species. Often ecosystem health is pitted against the wellbeing of individual invasive wildlife, it does not have to be the case. Preventing and reducing invasive species would help the CBD achieve its conservation goals.

There is underutilized new technology that could prevent suffering such as AI. The framework seeks to balance where funding is allocated and what mitigation methods are used. At the moment, most invasive species funding is spent on eradication when prevention is far more effective. It also emphasizes non-lethal and humane methods over ecosystem harming methods such as poison.

The paper is laid out as follows. The first section is a background on the CBD treaty and its lack of enforceability. The second section will detail examples of invasive species and the resulting detrimental effects on ecosystems. The final section will layout the framework, which will prioritize prevention, then non-lethal methods of removal, and finally humane lethal methods of removal. The steps will all be accompanied by a case study from either international regulations or Country specific examples. The framework will endeavor to reduce wildlife suffering while improving outcomes for ecosystems.

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A PILOT STUDY ON YOUNG ADULTS' PHYSIOLOGICAL REACTIONS TO VISUAL STIMULI OF BRACHYCEPHALIC DOGS AND BABY SCHEMA

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Small brachycephalic companion dogs dominate popularity rankings despite their severe health issues and shorter life spans. One reason for their great popularity is probably their baby schema features. While it is known that people prefer baby schema traits in dogs, the physiological basis for this preference remains unclear. Examining physiological responses is important, as social expectations can influence self-reported answers. Physiological measurement techniques offer insights into the subconscious mechanisms driving consumer, in this case, dog owners' behaviour, revealing true emotions and preferences related to dog breed choices.

The study aimed to investigate whether the baby-like appearance of dogs elicits physiological reactions in people. Exploring people's implicit physiological reactions may help uncover instinctive reasons behind the popularity of brachycephalic dog breeds. We measured heart rate variability (HRV) and electrodermal activity (EDA) of young adults (N=44 university and high school students) during a presentation of visual stimuli depicting brachycephalic (BC) and non-brachycephalic (NBC) adult dogs and puppies, along with human babies. The physiological responses to these five types of stimuli were compared. We considered the participants' gender and prior experience with dogs. Attention and high-arousal emotions (such as fear or excitement) increase sympathetic activity, indicated by an increase in the low-frequency to high-frequency (LF/HF) ratio in HRV, EDA, and skin conductance response, along with a decrease in the root mean square of successive differences (RMSSD) of HRV.

Dog owners' sympathetic activity was higher in response to NBC puppies than to NBC adult dogs. In male dog owners, sympathetic activity was also higher in response to BC than to NBC adult dogs. Similarly, in male dog owners, sympathetic activity was higher in response to BC than to NBC puppies. Additionally, in male dog owners, sympathetic activity was higher in response to BC puppies than to human infants. In female dog owners, sympathetic activity was higher in response to NBC puppies than to human infants. Among female non-dog owners, sympathetic activity was higher in response to NBC adult dogs than to human infants. For this group, sympathetic activity was also higher in response to BC adult dogs and BC puppies than NBC puppies.

Our results partly supported the assumption that baby schema in dogs elicits a heightened sympathetic reaction from young adults and that BC dogs evoke higher sympathetic activity than NBC dogs. Our pilot study showed that physiological measurement techniques can be useful supplements to self-reported preference surveys.

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STRUCTURAL ENCLOSURE ENHANCEMENTS PROMOTE BEHAVIORAL DIVERSITY IN GREEN ANACONDAS *(EUNECTES MURINUS)*

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Green anacondas *(Eunectes murinus)* remain largely understudied, particularly regarding their behavior and welfare in captivity. To address this gap, this study assessed the impact of permanent enclosure design modifications on green anacondas' behavioral patterns. The aim was to evaluate immediate shifts in behavior after enclosure modifications and investigate the potential habituation over time, thereby determining the impact and lasting effectiveness of the terrarium modifications. Two captive-bred adult green anacondas, one male and one female, were observed to develop a comprehensive ethogram. A total of 22 distinct behaviors were identified. Systematic behavioral observations were performed in three phases: before enclosure modifications (Phase 1; 9 days), immediately after modifications (Phase 2; 9 days), and after a three-week interval post-Phase 2 (Phase 3; 9 days). The terrarium was virtually divided into five zones, and throughout all observation phases, data on behavior, location, and vertical space use during inactive periods were recorded at 30-second intervals. Enclosure modifications were intended to encourage greater use of the areas less frequented by the anacondas, as identified during Phase 1. The terrarium floor was covered with pine bark and rocks, and both terrestrial and aquatic zones were furnished with trunks and artificial plants. Results revealed a reduction in inactivity and a peak in social interactions during Phase 2. In Phase 3, the anacondas displayed increased locomotion, exploration, and interaction with novel enclosure features. Notably, the three-week interval between phases resulted in a more balanced use of the enclosure space, as anacondas began occupying previously underutilized areas, including at various heights. This was contrary to expectations, as a decrease in engagement would be anticipated due to habituation. While temperature and humidity fluctuations may have contributed to behavioral differences between Phases 1 and 2, the consistent thermal conditions between Phases 2 and 3 indicate that the behavioral changes observed in the final phase resulted primarily from enclosure modifications. Additional factors, such as ecdysis, may have also contributed to behavioral variation, particularly during Phase 2, when the female anaconda was undergoing this process. Observations of the female shedding against the added trunk feature suggest that the enclosure modifications may have better supported the expression of natural behaviors. This study's findings indicate that enclosure modifications can significantly affect the behavior of green anacondas and potentially improve their welfare, offering valuable insights that add to the limited existing research on this understudied species.

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EXPLORING SPACE: HABITAT USE BY A GREEN SEA TURTLE IN A PUBLIC AQUARIUM

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Use of space and environmental features by animals under human care is a crucial indicator for assessing their welfare since its understanding makes it possible to design environments that correspond to their biological needs and optimize their welfare. Observations based on knowledge of the behavior and use of space in an environment under human care can provide important information about the animals' needs and preferences. An artificial environment that is inadequate can be a source of discomfort and stress that can have negative consequences on a physiological, behavioral and welfare level. On the contrary, an artificial environment that is enriched and of an appropriate size for the species that live there can be highly beneficial. Therefore, in this study, we assessed the space occupation over time of a green sea turtle *(Chelonia mydas)* present in SEA LIFE Porto's main tank. Understanding how the turtle uses different areas of the tank can provide information about its behavioral needs and lead to enrichment strategies to promote its well-being. For the space analysis, the tank was divided into 13 irregular zones, different in size but with ecological relevance. The tank was divided into depths (surface – A1 to A3, middle – A4 to A6 and bottom – A7 to A13) and each level had functional areas (e.g. feeding, grooming, hiding, resting, etc.). Systematic observations were made four times daily (9 AM, 12 PM, 3:30 PM and 4:40 PM) to understand the spatial distribution of the animal in the different areas. Our results show that area significantly affects space use, but time of day does not. However, we found a significant interaction between area and time. The distribution of spatial occupation over time revealed that time was predominantly spent in Areas 1 and 2, with minimal to no use of the remaining areas. However, at 9 AM, the distribution became more uniform across all areas. Areas A1 and A2 showed a significant increasing trend in occupancy over the day and had the highest overall occupancy, while no significant differences were found in the remaining areas (A3–A13). A1 and A2 are in the upper third of the water column, where occupancy was highest. This preference for upper areas may be driven by multiple factors. In the wild, marine turtles frequently float or rest near the surface, particularly in shallow coastal waters, where the surface serves both as a vantage point and as a means of behavioral regulation. In captivity, such preferences may persist even in the absence of predators or environmental cues, as these are likely highly conserved behaviors. Additionally, the upper zones provide easier access to air for breathing and may offer greater exposure to light, warmer microclimates, or increased environmental stimulation, such as feeding events or water inflow. These findings suggest site-specific temporal preferences, highlighting the importance of considering spatial and temporal factors when designing environmental enrichment structures to maximize effectiveness and engagement.

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STUDENTS' ANIMAL WELFARE PERCEPTIONS AFTER COMPLETING A NOVEL "ANIMAL WELFARE AND BEHAVIOR" FIRST-SEMESTER REQUIRED COURSE AT A NEW VETERINARY UNIVERSITY

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Animal welfare knowledge, including the ability to assess and implement welfare principles, is a day-one core competency for graduating veterinary students. Furthermore, growing societal concern surrounding welfare topics necessitates that veterinarians are knowledgeable advocates for animal welfare. However, animal welfare has not traditionally been incorporated into veterinary school curricula, and some studies have found that animal welfare courses have not achieved their intended outcomes. The objectives of this study were to explore and evaluate incoming veterinary students' perceptions regarding animal welfare before and after completing a newly developed first-semester course in animal welfare and behavior. The course's structure and content were created by the author. The first part of the course addressed: general welfare and assessment frameworks, learning and behavior concepts, and frustrations, stress, and coping concepts. Subsequent weeks focused on understanding different key species' needs and normal behaviors to evaluate their welfare. Student perceptions were assessed through an anonymous, online, voluntary questionnaire containing 40 individual statements gauging students' concern for animal welfare; a "total welfare concern" (TWC) score, indicative of predilection toward animal welfare, was calculated for each student based on responses collected before (PRE), after (POST), and 2.5 years after (LAST) course completion. A total of 105 out of 107 (98.1%) students completed the PRE questionnaire, 81 (75.7%) completed the POST, and 59 (56.1%) completed the LAST. The Wilcoxon rank sum test was used to compare median TWC scores between PRE, POST, and LAST among all respondents. Because only some of the students correctly recalled their IDs between surveys, the Wilcoxon signed rank test for matched pairs was used to compare median TWC scores between matched PRE, POST, and LAST respondents, and the Wilcoxon rank sum test was used to compare median TWC scores between matched and unmatched PREs. Median TWC score increased from PRE (n=105) as compared to POST (n=81, $p<0.001$) and LAST (n=59, $p<0.001$), with no significant difference between POST and LAST ($p=0.20$). Among matched IDs, the median TWC score increased from PRE as compared to POST (n=69, $p< .001$) and LAST (n=32; $p<.001$), with no significant difference between POST and LAST (n=32; $p=.64$). The TWC PRE scores did not differ ($p=.81$) for the 69 matching PRE scores as compared to the 36 non-matching PRE scores. These findings suggest that students' attitudes toward animal welfare and empathy toward animals significantly increased after completing this course, and their increased awareness remained elevated throughout their education. Although those with more favorable views toward the course and animal welfare might have been more likely to complete the POST and LAST questionnaires biasing results toward higher TWC scores, there were no differences found in the PRE students' TWC scores when comparing those who completed or did not complete the POST, so this suggests that at least the initial views of the different groups of students were similar, and overall attitudes changed after completion of the course. This novel first-semester course might have provided students with a foundation and evaluative framework for continued attentiveness to animal welfare.

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WHERE DO DOGS PREFER TO PLAY? THE INFLUENCE OF SURFACE AND TEMPERATURE ON DOG BEHAVIOR

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Many pet dogs live in urban areas with limited access to open outdoor spaces. As a result, local agencies build community parks where dogs can play and socialize. Different surface materials can be used in these spaces, but the influence of these surfaces on dogs' behavior and their preferences remains unclear. The aim of this study was to evaluate dogs' preference for natural or artificial grass surfaces in a play yard. A 12.2 x 12.2 m2 play yard was constructed and divided into 12 plots (3.5 x 3.5 m2). Each plot was randomly assigned to one of three surface treatments: Bermuda grass (Control), Bermuda grass over a soil-stabilizing grid (Honeycomb) to prevent soil compaction and provide cushioning, and artificial turf. Ten dogs received 10 play sessions, each consisting of three periods: a 5-minute acclimation period, 5 minutes of active play, and a 5-minute cool-down period. Prior to each session, environmental temperature and the temperature of each plot were recorded. Sessions were video recorded, and dogs' behavior and location were coded using 10-second scan samples. Behaviors were grouped as active, passive, or elimination. The proportion of time spent on each surface was calculated relative to the total observation period. A generalized linear mixed model with a binary distribution was used to evaluate the effect of surface, session period, and their interaction on dog behavior. The main effect of treatment, period, and their interaction were statistically significant ($p<0.001$) for both active and passive behaviors but not for elimination. Dogs spent more time performing active behaviors during the acclimation period than the cool-down period (0.28 ± 0.008 vs 0.13 ± 0.005), and more passive behaviors in the cool-down period than the acclimation period (0.11 ± 0.10 vs 0.01 ± 0.01). Regardless of behavior, dogs spent significantly more time on Honeycomb plots (0.46 ± 0.007) compared to Control plots (0.34 ± 0.006) or Turf plots (0.18 ± 0.005). When environmental temperatures were above 20°C, the surface temperature of the turf exceeded the temperature of the natural grass by more than 10°C. These findings indicate that dogs have a strong preference for natural grass over artificial turf. Additionally, the high surface temperature of artificial turf in warm environments raises potential welfare concerns, as it may pose a risk of heat-related injury to dogs.

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EXPLORING INDIVIDUAL DIFFERENCES IN COMMONLY USED MEASURES OF RAT AFFECTIVE STATE

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Assessment of rat affective state has typically relied on tests conducted at a single timepoint that are summarised at the group level. However, this approach disregards potential individual differences in trait affect or affective personality. The ability to reliably measure both state and trait affect is key to assessing an animal's welfare, as measuring individual differences in affective personality is required to fully interpret measures of affective state.

To explore whether there are individual differences in commonly used measures of affective state, 40 male rats were tested once every two weeks for a total of four sessions under consistent conditions on three behavioural tests (elevated plus maze (EPM), sucrose preference test (SPT), and novelty supressed feeding test (NSFT)) as well as a non-invasive physiological measure (faecal corticosterone metabolite (FCM) levels). The six affective state measures were: percentage time spent in the closed arms of the EPM, sucrose preference score from the SPT, amount of sucrose consumed in the NSFT, latency to first approach the sucrose bowl in the NSFT, number of faecal pellets produced in the SPT, and FCM levels.

For each measure, log likelihood ratio tests were used to determine whether a general linear mixed model containing rat ID as a random effect provided a better fit than a model which did not contain this factor. Significant individual differences in personality were found where the model containing rat ID as a random effect provided the significantly better fit. Using this approach, we found evidence for significant individual differences in four out of the six measures: percentage time spent in the closed arms of the EPM, amount of sucrose consumed in the NSFT, number of faecal pellets produced in the SPT, and FCM levels.

Additionally, there were no significant correlations between the mean values for each measure with Spearman's correlation coefficients of less than 0.31 in all cases. The lack of significant correlations suggests that these measures could be capturing different components of affect, for example more time spent in the closed arms of the EPM may reflect a more negatively valenced high arousal anxiety-like trait whereas more sucrose pellets consumed in the NSFT may reflect a more positively valenced high arousal excited-like trait.

This study highlights the importance of considering individual differences in trait affect when measuring affective states. Future work should explore how these measures change in response to manipulations of affect using a reaction norm approach.

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IT IS ETHICAL FOR A COUNTRY TO INCLUDE ALL ANIMALS IN A NATIONAL PLAN TO RESPOND TO A CRISIS THAT IS CAUSED BY THE CLIMATE CHANGE

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In 2023 Greece faced a crisis that affected enormously the area called Thessalia. Tones of water, after raining for days, resulted in the most catastrophic floods that destroyed hundreds of homes, farms and land. Livestock and companion animals faced death. For the first time in the history of the Greek government a station was set up in order to assist the animals in the affected areas. Hundreds of farm animals and companion animals, especially dogs and cats were saved as a result of the cooperation between stakeholders. They received first aid, all of them were chipped, had been fully vaccinated to prevent infectious diseases, had treatments and all the adult dogs were neutered. Many of them were pets that their owners lost everything in the floods. None of the dogs or cats who were saved that days, returned to the streets. Many found families or foster homes. 175 dogs and cats were saved and none went back to the streets and became a stray again.

The inclusion of animals in a national crisis management plan is a significant ethical issue related to the protection of life, welfare, and the dignity of all living beings. The aim of this study is to explore the ethical framework and legal basis for integrating animals into national crisis management policies, such as those addressing natural disasters and emergency situations. The consequences of neglecting animals in critical circumstances are analyzed, revealing that these do not merely threaten their survival but also disrupt social cohesion, burden public health, and have negative effects on human mental well-being. Additionally, the best practice example is presented, highlighting the ethical and practical need for a holistic approach that respects the interconnectedness of humans, animals, and the environment.

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LEAD-ING' THE WAY: A QUALITATIVE EXPLORATION OF OWNER EXPERIENCES WITH TAKING THEIR CATS ON OUTDOOR WALKS

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The popularity of keeping cats indoor-only or outdoor-indoor varies according to geographic location, and both have welfare risks and benefits. Walking cats may enable mitigation of roaming risks while providing outdoor access, but the practice of walking cats (e.g. on lead) has not yet been explored in the literature. Therefore, semi-structured online interviews (n=21 participants across 7 countries) were conducted to examine cat walking perceptions and experiences in owners who currently practise it. Interview recordings were transcribed and analysed using reflexive thematic analysis. Five main themes were generated: (1) Benefits of walking, (2) Challenges around walking, (3) Safety for walking, (4) Cat individuality and walking, and (5) Attitudes about walking across geographic contexts. Themes highlighted that benefits of walking were seen for both cat and owner, while challenges were largely based around dogs and their owners in addition to judgment from others in the community. The main priorities of walking were seen to be ensuring safety and attending to the individual needs of each cat. Reactions to cat walking appeared to vary according to participants' local norms and attitudes about cats and owner-cat relationships. These findings emphasise the subjective nature of both the concept and practice of cat walking. Whilst owners who walk their cats perceived it to be beneficial to their welfare, further applied work involving animal-based measures is needed to assess the extent to which cats' welfare is impacted by walking.

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EVALUATION OF IN UTERO HEAT STRESS AND GENOMIC SELECTION ON PIGLET BEHAVIOR AND HAIR CORTISOL POST WEANING AND TRANSPORT

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In utero heat stress (IUHS) is caused by an environmentally-induced increase in maternal body temperature, and results in poorer postnatal welfare in IUHS when compared to in utero thermoneutral (IUTN) piglets following weaning and transport. Therefore, reducing the heat stress (HS) response of gestating sows through genomic selection for improved HS tolerance (TOL) may alleviate these negative effects on resultant offspring. We hypothesized that IUHS piglets derived from TOL dams would have reduced behavioral and physiological stress responses relative to those derived from HS sensitive (SEN) dams when subjected to commercially relevant weaning and transport protocols. Pregnant gilts from TOL (n = 15) or SEN (n = 13) genetic lines were assigned to either thermoneutral (TN; 17-20ºC; n = 7 TOL, 6 SEN) or cycling HS (26-36ºC; n = 8 TOL, 7 SEN) conditions from d 6-70 of gestation, after which all gilts were maintained under TN conditions until farrowing. At weaning, male and female piglets were selected to establish four experimental groups: TOL + IUHS (n = 60), TOL + IUTN (n = 60), SEN + IUHS (n = 59), and SEN + IUTN (n = 58). Following a 12 h transportation event, piglets were housed in 40 mixed-sex nursery pens (5-6 piglets/pen) for 5-weeks. Piglet behavior was video-recorded 24 h/d for 11 d post-weaning and transport, and then evaluated using an ethogram to assess posture (standing, sitting, laying), consumption (feeding and drinking), and huddling behaviors on d 3, 5, 7, 9, and 11 post-weaning and transport. Hair samples were collected on d 1 and 35 to assess cortisol. Poisson regression models were used to analyze behavioral data, and linear mixed models were used to analyze hair cortisol in R. Standing behavior was reduced ($P < 0.05$; 13.1%) and huddling behavior was increased ($P < 0.01$; 6.1%) on d 3 for IUHS versus IUTN piglets. Huddling behavior was greater on d 3 ($P = < 0.05$; 5.1%) and standing behavior was greater on d 9 ($P = < 0.01$; 21.4%) in TOL versus SEN piglets. Hair cortisol tended to be greater ($P = 0.07$; 6.7%) for IUHS versus IUTN piglets on d 35 post-weaning and transport. In conclusion, IUHS piglets exhibited increased huddling and reduced activity on day 3 post-weaning and transport, indicating poorer welfare. Increased huddling and no cortisol differences, indicate TOL selection did not mitigate IUHS effects. Additional generations are required to thoroughly assess genomic selection effects.

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DIETARY FIBRE SUPPLEMENTATION IN BROILER DIETS: ENHANCING GUT HEALTH AND WELFARE THROUGH NATURAL FORAGING BEHAVIOUR

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Present broiler production systems generally prioritize low-fibre and high-energy diets in order to maximize growth rates and feed efficiency. But these nutritional strategies frequently fail to address the birds' innate physiological and behavioral needs, resulting in welfare issues such as stress, feather pecking, and digestive dysfunction. This review investigates the potential of dietary fibre (DF) to meet productivity goals with broiler welfare by encouraging natural foraging behaviors and enhancing gut health. Dietary fibre has traditionally been dismissed as anti-nutritional, emerging evidence suggests that moderate inclusion of fermentable fibre such as cereal by-products, soybean hulls, and lucerne can improve nutrient utilization, modulate gut microbiota, and reduce stress-related behaviors, providing a dual benefit for health and welfare. Broilers' gastrointestinal tract (GIT) is physiologically adapted to process fibrous materials via natural foraging and pecking behaviors. However, traditional low-fibre diets do not stimulate gizzard development, impairing digestion and increasing susceptibility to disorders such as necrotic enteritis. Recent research shows that fermentable DF sources, such as oat hulls or sugar beetroot pulp, increase beneficial microbial populations (e.g., Lactobacillus spp.) while decreasing pathogenic Clostridium colonization. This microbial shift increases short-chain fatty acid (SCFA) production, thereby improving gut barrier function and nutrient absorption. In addition, insoluble fibre such as lignocellulose improve gizzard motility, feed retention time, and enzymatic digestion efficiency, all of which indirectly support growth performance. Beyond physiological benefits, DF supplementation addresses the behavioral deficits that are inherent in intensive systems. Broilers fed fibre-rich diets have longer foraging periods, which reduces inactivity and stress-related behaviors like aggression and feather pecking. Fiber's potential to induce satiety through slower digestion and increased gut fill may alleviate frustration with feed restriction practices commonly used in commercial settings. For example, lignin-rich substrates such as soybean hulls promote pecking behavior, satisfying natural instincts while diverting attention away from potentially harmful conspecific interactions. These results emphasize DF's role as an environmental enrichment tool that aligns feeding strategies with ecological requirements. Dietary fibre is a multifaceted tool for improving broiler welfare and gut health while maintaining productivity. Fibre addresses both physiological and behavioral needs, which are frequently overlooked in intensive systems. However, realizing its full potential needs deeper understanding of fibre-microbiota interactions, tailored inclusion strategies, and synergistic integration with other welfare-focused practices. Further studies should prioritize these areas in order to develop commercially viable, ethically sound feeding systems that meet the broiler's biological needs.

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CARDIAC RESPONSE OF EUROPEAN SEABASS TO DIFFERENT STUNNING AND SLAUGHTER METHODS

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The slaughter process of farmed fish for human consumption is a crucial step in the production cycle, significantly impacting their welfare. In European seabass aquaculture, immersion in ice-water is the most commonly used method, although alternative techniques are being explored to minimize stress and suffering. This study aims to evaluate the cardiac response of seabass, as a physiological indicator of welfare, when exposed to different stunning and slaughter methods. Heart rate and internal temperature were monitored using biologgers (DST milli HRT, Star-Oddi®, Iceland) surgically implanted in adult seabass. Nine experimental groups were assessed, combining different stunning and slaughter techniques, including electrical stunning, ice-water immersion, anesthesia overdose, and the Ikejime method. The results revealed significant differences in the duration of detectable cardiac signals across treatments. Electrical stunning prior to slaughter reduced the time during which heart activity was detected, whereas ice slurry immersion resulted in a prolonged detection period. Specifically, fish slaughtered without prior stunning exhibited distinct cardiac responses depending on the slaughter method, with heartbeats persisting the longest in those exposed to ice slurry (41 ± 3.69 min) and the shortest in those subjected to Ikejime (26.66 ± 4.37 min) or anesthesia overdose (25.33 ± 5.45 min). In groups stunned with ice slurry, cardiac signals disappeared fastest in Ikejime-slaughtered fish (5.25 ± 0.66 min), followed by anesthesia (12.16 ± 0.60 min), and ice slurry (37.9 ± 9.47 min). Similarly, in electrically stunned fish, cardiac signals ceased first in those slaughtered using Ikejime (5.5 ± 0.83 min) and anesthesia (5.2 ± 1.06 min), while ice slurry immersion resulted in prolonged cardiac activity (24.7 ± 4.06 min). Statistical comparisons showed that in ice slurry slaughtering, electrical stunning significantly reduced the duration of detectable cardiac activity compared to ice slurry stunning (p-value < 0.01). These findings highlight the need to refine slaughter protocols in seabass aquaculture, emphasizing that electrical stunning effectively reduces cardiac signal duration, while immersion in ice slurry prolongs detectable heart activity regardless of prior stunning. This study provides critical insights for developing alternative slaughter techniques that enhance fish welfare during the final stages of aquaculture production.

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FIN HEALTH CHALLENGES IN BELUGA STURGEON (*HUSO HUSO*) AQUACULTURE: CLINICAL OBSERVATION

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Fish rely on their fins for efficient locomotion, playing a vital role in swimming, stability, and overall physiological function, making fin health a critical welfare indicator, particularly in aquaculture systems. In species such as the Beluga sturgeon *(Huso huso)*, known as the Great sturgeon, and reared for extended periods in aquaculture, fin conditions can reflect welfare and environmental quality. The partially cartilaginous structure of sturgeon fin rays makes them vulnerable to damage in aquaculture environments. The abstract aims to gather farm observations on the issues that impact the beluga sturgeon's fins.

- Trauma: Prolonged confinement and the large body size of the beluga sturgeon fish can cause mechanical injuries, especially during transportation, handling, tagging and sorting. Mechanical damages might lead to wounds, ulcer or swelling of the fin.
- Fin Curl: Curling of fins, observed at different ages and ranging from mild to severe, compromises swimming performance. In severe cases, fish lose the ability to utilize pectoral fins effectively, leading to poor body positioning, and early fatigue.
- Fin Rot and Erosion: Fin rot and fin erosion typically originate from primary factors, including stress, overcrowding, poor water quality, nutritional deficiencies, or physical contact with rough surfaces which often deteriorate further due to secondary (opportunistic) bacterial and fungal infections. Fin rot is characterized by necrosis and irregular, ragged fin edges, whereas fin erosion involves the gradual degradation of fin tissue.
- Fin Tumors: Masses of different sizes and shapes can be seen on various parts of the sturgeon fin (Base, margin, body). Tumor like masses in fish can result from a variety of infectious and non-infectious causes that might occur as a secondary event due to stressful rearing environment. These lumps and swellings on sturgeon fins need further histopathology investigations concerning effects on health and welfare.
- Fin Malformation: Anomalies in fin development, including the absence of fins or abnormal fin sizes, can affect the fish's swimming, growth performance and welfare.

The growing global importance of sturgeon farming and trade has heightened addressing the welfare and sustainability of species such as the Beluga sturgeon *(Huso huso)* that attain a larger size and greater longevity in farms and are highly valued for meat and caviar.

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THE IMPACT OF OVARIOHYSTERECTOMY ON BRAIN ACTIVITY, PHYSIOLOGICAL AND BEHAVIOURAL PARAMETERS IN DOMESTIC CATS *(FELIS CATUS)*

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Ovariohysterectomy (OVH), or spaying, is a normal surgical procedure performed for female cats (Felis catus). While the advantages of spaying are well-established, the possible effects of OVH on physiology and behaviour are still need investigation to ensure the best outcome of stress and pain management in cats. To date, there is little evidence in cats relating to using objective measurement tools, namely, electroencephalogram (EEG), in assessing pain and stress in post-OVH cats. Therefore, this study aims to determine the correlation between EEG, physiological and behavioural parameters of OVH cats. Six healthy female cats were recruited and evaluated for stress and pain prior to surgery (baseline) followed by post-operative assessments at T5HR, T8HR, T24HR, and T48HR using EEG, physiological parameters (e.g. heart and respiratory rate), stress and pain scales. Findings indicated that stress scores decreased from pre-operative to post-operative assessments. Pain score was higher at T5HR and T8HR. While baseline physiological parameters remained same and stable, blood cortisol and blood glucose levels were increased at T5HR compared to baseline (mean cortisol: 77.5 ± 61.65 nmol/L) (mean glucose: 4.98 ± 0.71mmol/L). EEG reading was markedly elevated at T5HR, indicating heightened neurophysiological responses which might associate with pain post-OVH. Results showed a positive correlation between pain and stress behaviour, physiological parameters (i.e., cortisol and rectal temperature) with EEG measurements in cats undergoing OVH. The current study suggests the value of incorporating behavioral stress and pain scales in the assessment of pain and stress in cats. By doing so, the study emphasizes the potential to enhance feline welfare and improve management practices during and after surgical procedures like OVH.

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APPLICATION OF MOBILE FLOW CYTOMETER FOR HYGIENE MONITORING ON PIG FARROWING UNITS

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Monitoring environmental hygiene is essential for maintaining livestock health and welfare. Pig farrowing units require strict biosecurity, including cleaning and disinfection. The standard monitoring method is plate culture, although its main disadvantage is the time required. An alternative could be rapid detection methods, such as luminometers measuring ATP, which provide an image of organic contamination but do not allow direct quantification of microorganisms. This study aimed to assess the potential of a mobile flow cytometer for environmental hygiene monitoring on pig farrowing units, compared with cultivation. A mobile flow cytometer (CytoQuant, Romer Labs) was used, which employs impedance and alternating current at various frequencies, allowing for the detection and direct quantification of intact cells and other particles. The study was conducted on two farms, during cleaning and disinfection procedures, at three locations (heating pads, pen walls, and corridor floors). Samples were taken via swabbing method (100 cm² area). Measurements with the mobile flow cytometer followed the manufacturer's protocol. Cultivation was conducted to assess TMC at 22°C (PCA agar) and 36°C (blood agar). A correlation analysis was performed using the Spearman (rSp) correlation coefficient. A significant correlation ($p < 0.05$) was confirmed between direct quantification of bacteria using the flow cytometer and the number of mesophilic bacteria (blood agar). The highest correlation was confirmed in the corridor (A: rSp = 0.725; B: rSp = 0.807), while the correlation was moderate on the heating pads (A: rSp = 0.648; B: rSp = 0.626). A significant correlation ($p < 0.05$) was found on the pen wall only on farm A (rSp = 0.564). When comparing with psychrophilic bacteria (PCA agar), significance ($p < 0.05$) was confirmed only on farm A (heating pad: rSp = 0.777; corridor: rSp =0.786). It was found that the mobile flow cytometer detected 3.77-4.30 log CFU higher counts of microorganisms compared to cultivation. This difference is due to the cytometer quantifying all present cells, while culture methods only count colonies capable of growth on specific media. Although this device is primarily designed for food production environments, this study confirms the potential use of a mobile flow cytometer for environmental hygiene monitoring on pig farms. Unlike luminometers, its results are not influenced by disinfectants, making it useful for quickly identifying deficiencies during cleaning and disinfection. This can contribute to reducing the risk of infection spread between batches and improve the health and welfare of the animals.

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GLOBAL ANALYSIS OF COMMUNITY ANIMAL HEALTH WORKER PROGRAMS: STRATEGIES FOR SUSTAINABLE COMMUNITY HEALTH ENHANCEMENT

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Limited access to veterinary care in remote and underserved areas has implications for community health and animal welfare. The aim of our research was to collaborate with Veterinarians Without Borders (VWB) to explore the roles of Community Animal Health Workers (CAHWs) globally. We address critical gaps in animal welfare and wellbeing within remote and underserved communities through the development of an evidence-based framework for Community Animal Health Worker (CAHW) programs. This mixed-methods study incorporated 28 stakeholder surveys and 11 in-depth interviews to examine CAHW programs globally, with particular emphasis on Northern Canadian communities. The resulting 12-section framework provides comprehensive guidance for establishing effective CAHW initiatives that significantly improve animal health outcomes while respecting cultural contexts. At its core, this work focuses on enhancing animal welfare by equipping CAHWs with essential training and resources to deliver compassionate veterinary care, including wound treatment, vaccinations, and humane population management. The framework specifically targets preventable suffering in vulnerable animal populations by addressing systemic barriers to veterinary access, particularly in Northern communities where there are currently limited treatment options for injured or ill animals.

The framework's components - ranging from community engagement strategies to monitoring systems - are all designed for welfare improvements as their primary objective, including pain reduction, decreased suffering, and enhanced quality of life for both companion animals and livestock. Beyond this purposes, the framework integrates One Health principles to create sustainable systems that support long-term animal wellbeing while addressing broader community health priorities. The adaptable nature of this model allows for scaling to other underserved regions through VWB networks, offering a practical solution to global animal welfare challenges. By combining empirical research with considerations for community-specific adaptations, this work provides both an immediate pathway to reduce animal suffering and a foundation for ongoing development of welfare and community focused veterinary care systems in remote areas worldwide.

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A CASE STUDY: SCIENTIFIC BEHAVIOURAL OBSERVATION BASED HABITAT MODIFICATION RESULTS IN MANTA RAY WELFARE IMPROVEMENT

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The application of activity and habitat monitoring has proven to be a powerful tool, providing valuable insights into behavioural patterns. This knowledge empowers the animal care team to refine their management plans, leading to positive changes in the enclosures, training, and feeding plans, all aimed at enhancing animal welfare. This study focused on a male Reef Manta Ray *(Mobula alfredi)* named Noriko. Noriko was housed in the main tank of the Grand Aquarium of Ocean Park Hong Kong. In 2019, Noriko was found to have a surface wound on the ventral side of his left pectoral fin. Under a preliminary investigation, the manta ray was suspected of engaging in a wall-rubbing behaviour that caused the scarring. Behavioural observations were carried out focusing on the frequency, timing and pattern of the rubbing events to investigate the potential underlying cause; and make recommendations for solutions. Baseline observations were conducted between November 2019 and January 2020 that focused on his daily activity (from 9 am to 4 pm) and his habitat use. The data showed that the rubbing activity peaked during the morning hours, around the time of Noriko's feeding sessions and in the afternoon when other fish in the tank were being fed. Furthermore, most rubbing events occurred in the area adjacent to where Noriko was fed from the surface. As a result, changes were recommended for his habitat and for his feeding strategies. In July 2020, the care team started to feed Noriko underwater around 3 times weekly and in Nov 2020, a new floating walkway was set up for poolside feeding. To investigate the impact of the implemented changes, the behavioural observation was repeated in 2021 and in 2023. During each period, 32 observations were conducted.

The wound was completely healed in May 2021. Although there was no significant difference in the number of rubbing events overall, we detected a declining trend along with a more even temporal and spatial distribution of the rubbing events. Additionally, Noriko spent significantly more time in the deeper waters compared to the baseline observations.

These findings underscore the importance of monitoring and the connection between behaviour and welfare science in zoological facilities. They also highlight the cooperation and shared understanding among researchers, veterinarians, curatorial team, and care team members.

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FARMERS, VETS, AND THE MANAGEMENT OF LAME SHEEP, EVIDENCE OF CONTEXTUALISED CARE IN PRACTICE?

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Lameness is endemic in the UK sheep population. It is a significant welfare issue and has labour, time, and financial costs associated with its management and treatment. Lameness is a complex, multifactorial condition. This makes it challenging for farmers and vets to control. Here we report on findings from six focus groups with UK sheep keepers and veterinarians exploring the management of the condition. We use these findings to -
1) Explore contextualised care in farm animal veterinary practice.
2) Present evidence that it is being used to manage sheep lameness.
3) Identify challenges which may limit its effectiveness in practice.

The concept of contextualised care originated in human health research. Recently, it has been discussed in relation to veterinary medicine, especially companion animal care, in part as a critical response to the idea of a 'gold standard' of veterinary practice. Nevertheless, the concept has been critiqued, and it is important to consider whose context is being taken into account in a system where animals have the legal status of commodities and decisions around farm animal care are influenced by their productive and economic value. As of yet there has been little research into contextual care in farm animal veterinary practice. Here we present evidence of contextualised care 'in practice,' used by vets and farmers to manage and control sheep lameness.

Our findings indicate that vets are considering both the farm and the farmers' contexts before giving advice. Vets tailor advice to what can be achieved within the physical constraints of the farm and the abilities and motivations of individual farmers. To achieve this vet and farmers are working to build long-term, trusting relationships based on two-way communication. Vets employ strategies to take advantage of ad hoc opportunities as well as using more formalised moments, such as flock health planning, to encourage lameness management. However, challenges exist, particularly around the ways sheep are valued by farmers, for example, the high cost of veterinary care versus the potentially low value of an individual sheep.

In conclusion, much of what is discussed as contextualised care is already practiced by vets, as part of day-to-day 'good practice' and in response to the on-going changes and challenges to the veterinary industry. However, the greater acknowledgement of the need to be responsive to the emotional and embodied experiences of both farmers and the animals they keep adds a potentially novel register to the work vets do.

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A PRACTICAL AND RAPID METHOD FOR ASSESSING HORSE TEMPERAMENT: ADVANCING EQUINE WELFARE AND ENHANCING HORSE-HUMAN INTERACTIONS

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The accurate assessment of equine temperament is critical for advancing horse welfare and fostering safe, effective horse-human interactions. This study presents a novel, simplified framework for classifying horse temperament into four types: energetic/reliable, energetic/unreliable, passive/reliable, and passive/unreliable.

A comprehensive literature search was conducted across multiple databases, including Web of Science, Scopus, and PubMed, to identify behavioral traits commonly used to describe horse temperament and/or personality. Based on this review, 24 key behavioral traits were identified. A structured questionnaire was developed and distributed to 1,300 respondents, including veterinary students, equine veterinarians, and horse handlers from 78 equestrian facilities. Respondents were asked to match the identified traits with one of the proposed temperament categories. Data from 1,260 validated responses were analyzed, focusing on the consistency and reliability of the proposed typology across diverse equine professionals.

The analysis revealed a high level of agreement among respondents in categorizing behavioral traits, confirming the practical applicability of the proposed four-type temperament model. The majority of respondents consistently associated specific behavioral traits-such as calmness, energy, and reliability-with the respective temperament types. The results demonstrate that horse temperament can be effectively simplified into these four categories, offering a coherent framework for field application.

This approach offers practical benefits in applied ethology, as it provides a clear and user-friendly typology that can be readily applied in everyday equine management, training, and welfare practices. By bridging the gap between complex scientific findings and field applications, this study facilitates the development of more personalized handling strategies, reducing stress and improving horses' well-being.

From a veterinary science perspective, recognizing temperament types enables better management of first-time human-horse encounters which are critical moments in veterinary practice. Understanding whether a horse is more prone to anxiety or displays a calm demeanor can guide veterinarians in approaching and handling the animal, thus minimizing fear responses and potential welfare risks.

In addition to enhancing safety and welfare, the study underscores the importance of temperament in equestrian sports, breeding, and equine-assisted therapy. Horses classified as passive/reliable may be ideal for therapeutic settings, while those identified as energetic/reliable can be better suited for competitive environments. This nuanced understanding contributes to more ethical breeding programs, ensuring horses are matched to roles that align with their inherent temperament.

In conclusion, this study provides a simplified yet effective tool for advancing equine welfare, improving safety in human-horse interactions, and contributing to ongoing research in applied ethology and veterinary science.

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RISK ANALYSIS IN LIVESTOCK SLAUGHTER HOUSE UNIT- GAM

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The Great Amman Municipality Slaughterhouse plays an essential role in ensuring food safety, public health, and proper livestock handling in Amman, Jordan. Established in 1972, the facility operates under rigorous hygiene standards and is regulated by the Jordanian FDA, Jordan Standards and Metrology Organization, and local agricultural laws. The slaughterhouse follows practices aligned with ISO standards to ensure food safety, efficiency, and halal regulatory compliance.

The facility's main functions include humane livestock handling, slaughtering, meat inspection, quality control, and environmental waste management. Each stage of the slaughtering process is designed to prevent contamination and uphold the highest hygiene standards. Livestock, including sheep, goats, and cattle, undergo thorough ante-mortem and post-mortem inspections by veterinarians to ensure that only healthy animals enter the food supply chain. Inspections

cover abnormalities in respiratory patterns, behavior, structure, and coloration, contributing to food safety and public health by identifying potential zoonotic diseases.

Modernization efforts have increased production capacity, enabling the facility to meet the city's growing demand for safe, high-quality meat. The production lines are designed to optimize processing speed and minimize potential hazards. A detailed risk analysis identifies physical, chemical, and biological hazards at each step in the process, from lairage to cold storage, with critical control points in place to mitigate these risks. Additionally, responsible waste management practices reduce environmental impact, aligning with sustainability goals. The facility is involved in livestock handling, humane slaughtering, meat inspection, quality control, and waste management. It strives to reduce contamination risks and uphold food safety through efficient processes and continuous modernization.

The slaughterhouse's traceability protocols and quality stamps further ensure transparency and consumer trust. Overall, the Great Amman Municipality Slaughterhouse supports Jordan's national food safety standards, contributing to public health, environmental protection, and economic stability by delivering safe and hygienic meat products to the market.

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OVERCOMING LANGUAGE BARRIERS IN ANIMAL WELFARE: IDENTIFYING COMMUNICATION NEEDS BETWEEN ENGLISH-SPEAKING ANIMAL PROFESSIONALS AND SPANISH-SPEAKING CARETAKERS, AND DEVELOPING SPANISH FOR SPECIFIC PURPOSES COURSES AND INTERNSHIP PROGRAMS FOR VETERINARY AND ANIMAL SCIENCE STUDENTS IN SPANISH-SPEAKING FARM SETTINGS

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The United States is experiencing an increase in Spanish-speaking immigrants, constituting 18.5% of the population, with over 60 million Hispanics. Within this demographic, 43% are mono-lingual Spanish speakers, projected to represent 30% of the U.S. population by 2050. Language barriers between Spanish-speaking farmworkers and English-speaking veterinarians are a significant obstacle to effective communication, impacting animal welfare and farm productivity. This study addresses these challenges by integrating Spanish for Specific Purposes in Agriculture (SSPA) courses for veterinary and animal science students to improve their communication skills and animal welfare knowledge in Spanish-speaking farm environments. This program was a collaborative effort involving two additional institutions. A survey identified communication gaps among non-Spanish and bilingual animal professionals. Data underwent analysis using descriptive and inferential statistics, including ordinal regression to assess demographic influences. Three SSPA courses were developed and delivered, followed by six-week on-farm internships, where students presented twelve training topics to farmworkers in Spanish. Student performance was evaluated through course scores, while farm workers' knowledge was assessed using pre- and post-intervention surveys and feedback collected through close-ended surveys. Data were analyzed to compare differences between pre-and post-intervention assessments across farms and topics. Challenges faced by English-speaking professionals in communication, both written and oral, were evident, with distinctions compared to bilingual counterparts ($p < 0.05$). Gender-based differences, especially in necessary Spanish skills and likely topics for communication, were observed ($p < 0.05$), with varied responses from female professionals. The study highlighted oral communication difficulties as major barriers faced by animal professionals in engaging with the Hispanic/Spanish-speaking workforce. The course completion rate was high (53.62%) compared to similar studies, despite challenges like the absence of course credits and academic workload. By the end of the intervention, 60% of Spanish-speaking farm workers demonstrated an improved understanding of topics such as Animal Health, Transport, and Behavior. This study highlights that SSPA courses, combined with hands-on internships, and training provided in Spanish can effectively address language barriers on farms. Furthermore, they offer a scalable solution to enhance communication between veterinary professionals and Spanish-speaking farm workers, leading to improve farm productivity and welfare. This project aims to serve as a model for addressing language barriers in various industries, particularly focusing on animal welfare, livestock productivity, and sustainability. Aligned with the trend of incorporating intercultural competence in language education, the study recognizes the cultural dimension as crucial to linguistic proficiency.

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THE ROLE OF DOMESTIC DOGS IN MAASAI CULTURE AND THE IMPACT OF VETERINARY INTERVENTIONS IN THE MARA NORTH CONSERVANCY, KENYA

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Domestic dogs are essential in Maasai communities, primarily guarding livestock from predators. At night, dogs protect livestock housed in bomas near family homes. Despite playing a critical role in the household, limited food resources and lack of veterinary care contribute to poor dog welfare and increase dog-to-dog aggression due to competition. Uncontrolled reproduction has led to more free-ranging dogs, some forming packs that encroach into protected areas, threatening native wildlife. Additionally, unvaccinated dogs pose significant zoonotic risks, including rabies, a major public health concern in Kenya. Despite their importance, dog owners often have limited knowledge of canine health, behavior, and welfare, supporting veterinary services are scarce, and local veterinary personnel have had minimal training. Since 2018, the Mara North Conservancy Dog Project (MNCDP) has provided free vaccinations, neutering, and educational outreach to address these issues. This study explored the role of dogs in the Maasai community, perceptions of dog ownership, and the potential impact of MNCDP interventions. Semi-structured interviews with 13 dog owners revealed that guarding remains the primary reason for keeping dogs, with many also expressing affection for them. However, this fondness was closely tied to their function as guard dogs. Some respondents noted concerns about unvaccinated or rabid dogs within the community. All participants had previous contact with MNCDP, and veterinary engagement has influenced aspects of dog care. Most had vaccinated at least some of their dogs. However, younger puppies were often unvaccinated, either due to their age or because their owners had not yet done so. Some owners still relied on self-medication when their dogs fell ill, as for some, contacting a veterinarian was not considered necessary. Following neutering surgeries, 10 of 13 respondents observed positive changes, including reduced roaming, fewer fights, and improved body condition. While most saw no decline in guarding ability, concerns emerged about potential long-term population decline due to widespread neutering. Communities viewed engagement with vet services as positive, and owners reported improvements in dog welfare, with no reported issues regarding dog welfare.Expanding educational outreach may increase awareness of responsible dog care, encouraging owners to vaccinate their puppies and reduce reliance on self-medication. Concerns about long-term population decline need to be further understood if the MNCDP activities continue, as this could affect future willingness to engage. With ongoing collaboration between veterinarians, conservationists, and the Maasai community, MNCDP can work towards a balanced approach that benefits dogs, people, and the broader ecosystem.

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THE RELATIONSHIP BETWEEN MOTIVATION, ANTICIPATION, AND FRUSTRATION IN ANIMALS: A SCOPING REVIEW

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Motivation, anticipation, and frustration, are important concepts for understanding animal emotion. Denying or delaying an outcome that an animal is motivated for, expects, and performs specific behavior in preparation of, can cause frustration, impacting the emotional welfare of the animal. However, diversity in the definitions and methodology related to these concepts can lead to confusing or conflicting results, and may complicate replication of previous work. A scoping review (conducted according to PRISMA guidelines) was completed where a multi-step screening process identified 112 final primary research papers. The objectives of the review were to determine the ways in which the three concepts have been studied in previous literature, the relationship between the main concepts, and the gaps in knowledge regarding these concepts. Advantages and drawbacks of tests and variables used in the selected papers were explored, along with the repeatability, the applicability within and between individuals or species, and the interpretation of results. There were no universally accepted definitions of motivation, anticipation, or frustration, and the methods used to find or show evidence of the concepts varied, even within a species using the same test. However, a clear connection between concepts was confirmed, where it was suggested that authors develop a framework to measure the concepts together to understand the full scope of how different decisions or practices may impact animal emotion.

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TURMERIC *(CURCUMA LONGA)* AS A PHYTOGENIC FEED SUPPLEMENT: A REVIEW OF ITS ROLE IN ENHANCING FISH WELFARE, GROWTH, AND SUSTAINABILITY IN AQUACULTURE

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This review throws light on the potential of *Curcuma longa* (turmeric) as a plant-based feed supplement in aquaculture, focusing on its impacts on growth, health, and welfare of fish. The active principle of turmeric is curcumin; it exhibits antioxidants, anti-inflammatory, and immunomodulatory activities hence promotes growth, improves feed conversion ratios, and provides resistance against diseases in fish. These advantages reduce the use of antibiotics and other synthetic additives. Also, turmeric maintains gut health by modulating the gut microbiota and improves nutrient absorption that again contributes to higher productivity of fish.

This underlines the overall profitability and all benefits of turmeric against other phytogenic additives, such as garlic and ginger. Still, notwithstanding all these advantages, the low bioavailability and species-specific response of curcumin are indicating disadvantages this ingredient is still faced with, and thus, it has to be supported with innovative solutions, such as nanotechnology or encapsulation.

Turmeric can further allow sustainable aquaculture through the reduction in chemical inputs and mitigation of environmental impacts. Application of turmeric also falls within the global dimensions toward sustainable aquaculture by enhancing the welfare of fish and ecosystem health. This review explores in detail the many roles of turmeric and underlines its value in improving ethical, sustainable, and productive aquaculture systems.

The obtained results evidenced the application of turmeric in aquafeeds for fish growth and welfare, hence exerting a positive effect on environmental care. This review hence emphasized that continuous research is warranted in optimizing application and hence giving full potential in aquaculture.

Phytogenic Additive	Active Compounds	Primary Effects in Aquaculture	Shortcomings	References
Tumeric *(Curcuma longa)*	Curcumin	Enhances growth performance, improves immune responses, and provides antioxidant properties	Low bioavailability; may require advanced delivery methods	Kocaadam, B., & Şanlier, N. (2017). https://doi.org/10.1080/10408398.2015.1077195
Moringa *(Moringa oleifera)*	Flavonoids, phenolic acids	Improves growth rates, enhances immune function, and offers antimicrobial effects	Potential anti-nutritional factors; optimal dosage needs further research	Elgendy, et al (2021) Aquaculture Research
Garlic *(Allium sativum)*	Allicin	Acts as an antimicrobial agent enhances immune responses, and promotes growth	Strong odor may affect feed palatability; variability in active compound concentration.	Valenzuela-Gutiérrez, et al (2021). Springer Nature Link

Phytogenic Additive	Active Compounds	Primary Effects in Aquaculture	Shortcomings	References
Ginger *(Zingiber officinale)*	Gingerol shogaol	Enhances growth performance, boosts immune system, and provides antioxidant effects	Limited studies on long-term effects; variability in efficacy based on preparation methods	Ghasem, et al (2020) ScienceDirect
Thyme *(Thymus vulgaris)*	Thymol, carvacrol	Exhibits antimicrobial properties, enhances growth, and improves feed efficiency	Potential toxicity at high doses; variability in active compound concentration	Hammoudi, et al (2022) MDPI

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OCCURRENCE AND COMPARISON OF HAEMATOLOGICAL AND SERUM BIOCHEMICAL PARAMETERS OF PESTE DES PETITS RUMINANTS' VIRUS (PPRV) INFECTED AND NON-INFECTED NIGERIAN BREEDS OF GOATS

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Peste des Petits Ruminants (PPR) virus infection in goats is an important animal welfare issue, causing high morbidity and mortality, and affecting livelihoods, food security, and the economy in general, especially in regions where small ruminants are crucial for sustenance, like Nigeria. It is recognized among the top ten diseases threatening small ruminants' production and productivity globally, most especially in the tropics.

This study investigates the occurrence of PPRV and establishes and compares hematobiochemical parameters of PPRV-infected and non-infected Nigerian goats to establish the extent of deviations of these parameters

A total of 58 goats, including 32 apparently healthy and 26 PPRV-infected goats manifesting clinical symptoms and confirmed with Shenzhen Finder Biotech Co., Ltd PPRV Antibody Rapid test kit, were sampled. Blood and serum samples were collected aseptically during June to August of 2024 at the Akinyele Livestock Market and the University of Ibadan Teaching and Research Farm, Ibadan, Oyo State, Nigeria. Breeds and sex were morphologically identified, and age was determined using the rostral dentition technique. Hematobiochemical analyses were done by the adoption of standard procedures.

Findings revealed that crossbred goats were the breed with the highest incidence (57.1%), while the lowest incidence was observed in West African dwarfs (30.0%). Also, higher incidence was observed in bucks (58.3%) compared to does (35.3%). There were no significant differences ($p < 0.05$) observed in all hematological and biochemical parameters, but lymphocytes and neutrophils had p-values of 0.08, respectively, when the values were compared. There was lymphocytosis, neutrophilia, hypoproteinemia, hyperglobulinemia, hypoglycemia, generalized increased liver and kidney enzymes, and an increase in the concentration of sodium and potassium ions in PPRV-infected goats compared to non-infected goats.

The distinct variation observed in haematological and biochemical parameters in PPRV-infected and non-infected Nigerian goats confirmed the importance of blood indices in assessing the general health status of animals. This agrees with prior findings of (Tambuwal et al., 2002), who also identified that because the life of all flesh is in the blood, therefore, its role in the assessment of the health status, chemical evaluation for the survey, physiological and pathological conditions, and diagnostic and prognostic disease evaluation in animals is indisputable.

This study is very crucial for the successful treatment and management of PPR infection in goats, thereby improving the welfare of both the infected animals and their owners. These findings will enhance animal welfare by promoting early recovery and survival, as their adoption by veterinarians will facilitate early diagnosis, allow for appropriate treatment, and assist in evaluating disease progression. Therefore, the study recommends considering these parameters when making prognostic, therapeutic, and diagnostic decisions regarding PPRV infection in goats.

References
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INVESTIGATING AVIAN NEGLECT AND WELFARE VIOLATIONS: CASE STUDIES IN SOUTH KOREA

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This paper investigates three significant cases of avian welfare violations in South Korea, emphasizing the detrimental effects of neglect and inadequate management practices. The first case concerns the mass mortality of birds in a Seoul park due to methomyl poisoning. The second case focuses on a botulism outbreak occurring in a quail farm. The third case examines sustained mortality resulting from nutritional deficiencies and environmental stress in an ostrich farm. These cases highlight the urgent need for improved animal welfare practices and stricter regulatory measures to ensure the protection and well-being of avian species.

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EVALUATING THE IMPACT OF GROUP SIZE AND COMPOSITION ON BROILER BREEDER HENS' WELFARE

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Flock social dynamics can be influenced by the size and composition of the group, which can affect the welfare of the birds. This study aims to determine the impact of group size and male presence on hen welfare. A total of 472 broiler breeders, 408 females (F) (Ross 308AP) and 64 males (M) (Ross 344) were housed and randomly distributed into five treatments (4 pens/treatment); large pen (L 15'x6) with spiking (LS), L without spiking (LN), small pen (S 4'x6') with spiking (SS), S without spiking (SN) and S with no male present (AI). LS, LN, SS, and SN treatments had a 1M: 9F. At 45 weeks of age (woa) one male was replaced with a new male in the spiking treatments. Fear response was assessed via two fear tests; novel object (NO) and human approach (HA), at 21 and 55 woa. From 21 to 61 woa, feather condition (CN) and coverage (CV) of 7 regions (Back, breast, cloaca, neck, tail, thighs, and wings) were scored on 4-point scale every 5 weeks. Data from NO and HA were analyzed via two-way ANOVA for main effects of age and treatment (PROC GLIMMIX with Beta Distribution). Data from CN and CV were analyzed as repeated measures ANOVA for the effect of age and treatment (PROC GLIMMIX with poisson distribution). With means separation via Tukey-Kramer. On NO, latency to approach the object was shorter at 21 woa (0.2 s) compared to 55woa (8.55 s). Whilst, latency to interact with NO was shorter at 55 woa (24.9 s) then at 21 woa (107.9 s). For HA, the latency to human interaction was shorter at 21 woa (20.9 s) than at 55 woa (163.5). For NO and HA, more birds interacted with the object and human at the younger age (<0.05). Less birds interacted with the novel object and the human in L pens than in S pens (<0.05). CV and CN scores increased with age, and were highest at 61 woa (P<.0001). Among treatments, birds in L pens had higher CV scores. Overall findings indicate bird engagement with the object and the human reduced with age, although latency to interaction increased with age. Birds in L pens interacted with HA and NO less. CV was better in S pens most likely due to smaller group sizes or a reduction in competition. Highlighting group size as a factor to be considered for hen welfare.

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ANIMAL WELFARE EDUCATION IN ENGLISH PRIMARY AND SECONDARY SCHOOLS: BARRIERS AND ENABLERS

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There is currently no requirement for schools in England to deliver animal welfare education, this is despite calls from animal welfare organisations arguing for its importance. In English mainstream schools the national curriculum sets out the programme of study for all key stages, which makes incorporating additional content difficult. Furthermore, the pressurised culture created by the Office for Standards in Education, Children's Services and Skills (OFSTED) means that schools may feel forced to focus on academic performance in a narrow range of subjects. As a result of this, animal welfare organisations have developed a range of educational materials that can be delivered in schools, either by teachers, or directly by the organisation. Whilst these opportunities are welcomed, the resource/sessions offered are limited and predominantly focus on knowledge improvement. Furthermore, for schools to use these resources it requires knowledge of what is available, an appreciation of the need for these materials in addition to the standard curriculum and time within their daily lessons to fit additional materials.

There is also a dearth of research focusing on what schools are currently delivering in this field. What we do know is that the education system in England has been accused of promoting speciesism and of proliferating inaccurate representations of animals and animal related activities through curriculum materials, related texts and wider school processes. Considering this, this work seeks to explore the perceptions of school staff (teachers, teaching assistants and members of senior leadership) on the barriers and enablers to implementing animal welfare education in their schools.

I argue that if we want to be successful in implementing such change, we need to move beyond focusing on deficits in knowledge, and instead focus on systemic change, which would require whole school buy in. Whilst ambitious, recent policy and strategy changes in environmental and sustainability education in response to increased public and specialist concern provides an opportunity for learning and demonstrates evidence of promise.

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ENHANCING EQUINE WELFARE: THE IMPACT OF MEDICAL TRAINING ON COMPLIANCE AND STRESS IN VETERINARY CARE

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Veterinary procedures often induce stress in horses, leading to fear-related behaviours that increase the risk of injury for both animals and handlers. Medical training, based on positive reinforcement, has been proposed as a method to enhance compliance and reduce stress. However, its application in equine practice remains limited. This study aimed to evaluate the effects of medical training on horses' compliance and potentially dangerous behaviours.

Twenty mares were randomly assigned to a trained group (MT, n = 10) or a control group (CON, n = 10). All horses underwent an initial veterinary examination (T1) replicating common procedures (e.g., auscultation, temperature measurement, ear manipulation, eye drop administration, oral medication delivery, spray and clipper exposure, positioning for radiographs, simulated intravenous injection). The trained group then received 15 training sessions over three weeks, while the control group remained untrained. An identical veterinary examination was conducted at the end of the training period (T2). The time required to complete procedures and horses' behaviours were recorded and analysed. The two experimenters ("veterinary" and "handler", both blind to treatment) reported their perceived safety using a visual analogue scale (0 - unsafe to 20 - very safe).

Preliminary analyses included univariate comparisons using Wilcoxon tests to assess differences in test duration and perceived safety between groups, as well as paired Wilcoxon tests to evaluate changes within groups before and after training. By the time of the conference, linear mixed models will refine the evaluation of test duration and perceived safety. Additionally, a principal component analysis was conducted to classify behavioural responses and assess their association with training status.

Initial results indicate that medical training significantly improved the perceived safety of the "veterinary" (CON: 12.5 ± 2.5, MT: 18.0 ± 1.6; $p < 0.01$), while no significant change was observed for the "handler" (CON: 13.5 ± 4.0, MT: 16.9 ± 2.7; $p = 0.1$). The time required to complete veterinary procedures decreased in both groups during the second test (T1: 10.4 min, T2: 7.7 min; $p < 0.01$) but was significantly shorter in the trained group (MT: 6.8 min; CON: 8.6 min; $p < 0.01$). Behavioural analysis revealed fewer avoidances and defensive reactions in trained horses, whereas these behaviours remained stable or increased in controls.

These findings underscore the benefits of medical training in improving equine welfare and safety during veterinary care. Integrating medical training into routine equine management could significantly enhance veterinary care experiences for both horses and practitioners.

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EVALUATING MENTAL HEALTH SUPPORT STRATEGIES OF UK ORGANISATIONS FOR RURAL AND RESEARCH-BASED ANIMAL CAREGIVERS

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The One Welfare concept outlines a reciprocal relationship between human and animal well-being; however, to date, there has been more focus on how animal welfare impacts human well-being than the reverse. There is growing recognition in research that these concepts are deeply intertwined, with improvements in one often reinforcing the other. Animal caregivers in livestock farming and research settings face distinct challenges, balancing multiple demanding duties while ensuring animal welfare and adhering to ethical and regulatory standards. Such challenges may increase the likelihood of mental health concerns, including burnout, stress, anxiety, depression, and compassion fatigue. Research has shown that workplace stress can negatively impact the well-being of animal caregivers, reduce job performance, and, in turn, compromise animal welfare. In the UK, organisations exist to support the mental health of these caregivers, but there is a limited understanding of their operations, support strategies, and barriers to providing support.

Qualitative research was undertaken with members of UK organisations specialising in the mental well-being of animal caregivers in research and rural (farm) settings. Nine online semi-structured interviews were conducted (six rural-focused, three research-focused organisations). Topics covered included methods of accessing support, workplace stressors and their impact, available training and resources, and challenges and opportunities in providing effective support. Interviews were audio recorded, transcribed and analysed thematically.

Key barriers to support for animal caregivers were identified, including feelings of embarrassment and fear of judgment, particularly in research settings where external support often lacks an understanding of the job. Stressors such as isolation and loneliness, high workloads, animal health concerns, and interpersonal dynamics significantly contribute to mental strain. Compounding challenges were highlighted in farming, including adverse weather conditions, financial constraints, and statutory changes. Culling animals emerged as a major stressor in both settings, although more prevalent in research settings. Training and knowledge exchange were more established in rural settings yet an increased need for support and knowledge exchange was identified in research settings given the limited capacity for reflection and emotional expression within roles. Participants identified challenges in providing support, including limited-service reach, delayed engagement from users, workplace restrictions on seeking external help due to reputational concerns and a preference for managing well-being internally, and resource constraints such as a shortage of volunteers and funds.

Overall findings highlight the need for more targeted training tailored to the contextual needs of animal caregivers, with better co-ordination of training efforts within each sector. These findings have been used to inform a quantitative exploration of the potential impact of compassion fatigue on those who care for animals on farms and research settings, the potential impact on animal welfare and identify animal caregivers' preferences for resources and support.

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AN OVERVIEW OF BEHAVIOR ANALYSIS IN RHESUS MACAQUE MEDICAL RESEARCH CARE

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Behavioral analysis, most commonly employed with learners diagnosed with Autism Spectrum Disorder, allows us to understand the functions of behavior and support the behaviors a learner deems significant. Despite extensive literature on productive applications of behavioral analysis in humans, standard practices within animal research utilize water or food restriction to motivate behavioral task performance. Applied behavioral analysis (ABA) strategies such as errorless learning, token systems, picture exchange communication systems (PECS), and antecedent arrangements may elicit the necessary motivation required to produce similar quality data results while improving the experience of the animal in a research setting. In a brain-computer interface (BCI) study, motivating the performance of rhesus macaques (Macaca mulatta) in a cursor controlled grid task was evaluated using token systems compared to no token system. Separately, icons on an augmentative and alternative communication (AAC) device were introduced to macaques in a similar way to PECS. We hypothesized that animals would obtain similar or higher net targets per minute (NTPM) while expressing less abnormal behaviors and increased engaged behaviors than if they did not use these tools. NTPM is based on the number of correctly clicked targets per minute, minus any incorrect clicks, and the grid size. Animals were reinforced with a diversified diet, including a monkey biscuit-based smoothie and rotating produce. All required daily calories in a typical diet for their age, size, and sex were provided each day, regardless of performance. Water was provided ad libitum. Metrics evaluated included NTPM, level of engagement (gameplay duration and frequency of animal lead breaks), and the presence of abnormal behaviors (frequency of bar licking and mock grooming). Preliminary results in three male rhesus macaques serving as their own control suggest that a token system (delayed reinforcement by exchanging tokens for a higher-value reward) allowed animals to engage for extended periods (mean = 41.99 min vs. 64.98 min, +55% increase) on their own volition, reduced animal led breaks (mean = 57.40 sec vs. 22.88 sec, -60% decrease), and increased the NTPM (mean = 46.3 vs. 50.77, +9%).

Additionally, two observers scored abnormal behaviors a week prior to and after the implementation of available reinforcement choices indicated by icons on an AAC device, using instantaneous point scan sampling in two male rhesus macaques serving as their own control. Macaques could make daily choices and communicate their preferred activities, reducing abnormal behaviors by 35%. Behavioral analysis is a novel alternative to industry standards to support researchers and animal care teams in achieving practices in alignment with the refinement principle of the 3Rs, significantly improving the animal's experience in research.

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REFINING HUMAN-ANIMAL INTERACTIONS AND HOUSING OF NONHUMAN PRIMATES IN RESEARCH: A PRACTICAL APPROACH

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One key aspect of forward progress in scientific research is the implementation of the 3Rs (refinement, reduction, and replacement). These are a key part of conducting humane animal research and quality science. The 3Rs Collaborative is a non-profit organization dedicated to helping research professionals make change by providing thought leadership and practical resources. Our collaborative provides a unique perspective to these topics by facilitating collaboration between all relevant stakeholders including academics, pharmaceutical companies, technology providers, regulatory agents and other non-profit organizations. In this session, a member of the 3RC nonhuman primate (NHP) refinement initiative will present a discussion on the need to refine human-animal interactions and housing conditions for NHPs in research, focusing on practical implementation.

Starting with refining human-animal interactions, we delve into the multidimensional aspects of improving interactions between researchers and NHPs, exploring better welfare, better science, and better operations. This underscores the ethical, scientific, and operational motivations and benefits for continuous evolution in housing and husbandry practices change. Then moving on to the case to refine housing, we dissect the critical impact of housing conditions on NHPs. This section underscores the need for advancements in housing practices to enhance the physiological and psychological well-being of NHPs, aligning with ethical, scientific, and operational imperatives. We focus on practical recommendations and provide actionable strategies for both refinements that foster positive interactions with NHPs and improve physiological and psychological well-being. Recommendations to be covered include positive reinforcement training programs, animal restraint techniques, and housing refinements, including social housing, cage sizes, novelty, and creativity. Additionally, we cover veterinary care, compassion fatigue, and empathy, offering a comprehensive guide to implementing positive changes in NHP research practices. We will conclude by exploring the diverse roles of stakeholders in NHP research and provides practical recommendations for key stakeholders. This includes key tips for: (1) IACUCs with a focus on institutional oversight; and (2) technicians, offering practical insights for those directly involved in animal care. This collaborative approach aims to create a unified front among stakeholders, promoting the collective responsibility of refining human-animal interactions and housing conditions for NHPs.

This interdisciplinary exploration with practical guidance intends to inspire positive change in NHP research, bridging the gap between theory and application for the betterment of both scientific endeavours and the welfare of non-human primates.

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DEFINING BEST PRACTICES FOR WORKING WITH RABBITS: RABBIT WELFARE WORKING GROUP

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Rabbits are a common species worked with in biomedical research, and as work with primates and dogs becomes more restricted, their role as a primary non-rodent second species will expand. In recognizing the need for more formalized recommendations on rabbit care and management, and in honor of the 2023 Lunar Year of the Rabbit, the Rabbit Welfare Working Group was formed. The group consisted of personnel with extensive rabbit experience discussing topics such as procedural refinements, behavioral management, welfare assessment, pain recognition, handling and restraint, housing, humane interventions, and euthanasia procedures. The group met in 2023 and 2024, and appraised peer reviewed literature where available, filling in the gap with personal experience and expertise, to develop 12 recommendations for best practices when working with rabbits in a research setting. A Rabbit 3Rs Workshop was held in 2024 to present on the main topics discussed in the working group, and to introduce the recommendations. The recommendations were then circulated within the company for feedback and consensus building, then presented to corporate leadership for final buy in and distribution. The recommendations from the Rabbit Welfare Working Group will be incorporated into site audits and a rabbit welfare assessment tool and will be utilized across Europe, North America, and the United Kingdom.

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RISK FACTORS FOR OWNERS CURRENTLY THINKING ABOUT GIVING THEIR COMPANION RABBIT *(ORYCTOLAGUS CUNICULUS)* AWAY OR LETTING THE RABBIT LOOSE OUTSIDE: AN INTERNATIONAL, CROSS-SECTIONAL STUDY

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Domestic rabbits are common companion animals numbering in the millions globally. Despite their popularity with some owners, many are relinquished or let loose outside. Limited research assesses rabbit owner care and commitment, so we explored potential risk factors for owners contemplating getting rid of their (focal) rabbit. Data (n = 2093 companion rabbit owners) were from a broadly recruited, online, cross-sectional survey. Descriptive statistics were used to depict owner characteristics and perceptions; rabbit demographics, husbandry, and behaviour; and yes/no responses to owners thinking about giving the rabbit away and to letting the rabbit loose outside at survey completion time. Multiple univariable logistic regression models were used to explore associations between owner and rabbit factors, and participants' responses to contemplating giving their rabbit away and letting their rabbit loose outside, respectively. Our results suggest numerous risk factors ($P < 0.05$). Factors associated with increased odds of both outcomes included having <1 year of rabbit care experience; financial difficulty buying day-to-day rabbit supplies; financial difficulty buying day-to-day supplies for self; having training in animal behaviour, welfare, husbandry, or medicine; having veterinary care insurance; owner gender; number of human householders; rabbits having lop ears; lack of litter training for rabbits with house access; rabbits housed indoors and outdoors (vs. only indoors or only outdoors); rabbits with recent health problems; owners who have never seen a rabbit with the zoomies; owners who do not see their own rabbit flop on their back or side at least weekly; and rabbits who display moderate/severe problems with urine spraying/inappropriate elimination, socialness/cuddliness, and aggression. Decreased odds were seen for both outcomes with increasing rabbit emotionality ratings. Increased odds were seen for thinking about giving the rabbit away for owners with financial difficulty buying all needed vet care, rabbits <1-year-old, rabbits with the owner for <1 year, and owners who have never seen a rabbit flop onto their back or side. Increased odds were seen for thinking about letting the rabbit loose outside for younger owners; having three or more rabbits; the presence of other animals (excluding rabbits) in the household; and for house rabbits, always being kept in an enclosure or always free roaming (vs. having some free roam time) and the presence of potential predators in the household. Identifying risk factors for owners contemplating getting rid of their rabbits can inform communication, support, and future research (e.g., interventions) aimed at new adopters and owners seeking to relinquish rabbits.

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QUANTIFYING CHANGES IN FACIAL EXPRESSION FOLLOWING HOT-IRON DISBUDDING UNDER PROCAINE HYDROCHLORIDE AND MELOXICAM TREATMENT IN HOLSTEIN DAIRY CALVES

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The analysis of facial expression for cattle pain assessment has been under explored compared to other animal species, despite reports highlighting its usefulness. Therefore, this study aimed to assess changes in facial expression following hot-iron disbudding, a routine painful procedure, in dairy calves. Seventeen female calves (4.59 ±0.27 weeks old) were divided into two groups: A (n=11), to be disbudded and B (n=6), the control. Video recordings (two mins each) were obtained immediately prior to disbudding in both groups and following disbudding in group A only. Still images were extracted from each video at thirty secs intervals resulting in four images/calf in group B and eight images/calf in group A. Images were randomly arranged and used to create an online survey which assessed participants' ability to recognise and score facial expression based on six action units (AUs): backward ear-BE, nose bulge-NB, eye closure-EC, cheek tense, tongue show, and open mouth and/or upper lip raise. The survey was first piloted before recruiting 196 participants using mixed sampling methods. Participants were provided with the survey link containing participant information sheet, consent form, pictorial guide of the AUs associated with disbudding and calf facial images to be scored on a three-point scale (0 =not present, 1 = moderately present, 2 = obviously present. If the participants were unable to score an AU clearly, they were asked to use the 'don't know' option. The total sum of AU (TSAU) scores/calf and mean score of each AU/calf were compared within and across groups using paired and independent sample t-test, respectively. Post-disbudding, the TSAU score was significantly higher than the pre-disbudding mean (P = 0.001) and the control (P = 0.001). Mean scores of BE (P = 0.037) and EC (P = 0.010) were significantly higher than pre-disbudding. Compared with the control, BE (P = 0.048) and NB (P = 0.021) were significantly higher post-disbudding. These findings suggest that changes in facial expression occur following disbudding, and quantification of these changes may be useful for optimising pain management in disbudded calves. For this, it needs to be ascertained that similar changes are not seen in calves just handled (sham disbudded).

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IMPACT OF TRANSPORT IN SUMMER AND WINTER CLIMATIC CONDITIONS ON WELFARE AND MEAT QUALITY IN ORGANIC OR CONVENTIONAL FINISHING PIGS

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Transport is known as an important source of stress, climatic conditions being a relevant factor impacting pig welfare. Transport can also influence perimortem muscle metabolism and, therefore, meat quality. Most of the studies in that area have been conducted under conventional production systems, whereas little is known about the impact of transport on organic pig production. The aim of this study was to investigate the impact of transport under summer (SU) vs. winter (WI) conditions in organic pigs (ORG), compared to conventional production systems (CON). Four batches of 70 pigs considering seasonality and production system (2 SU and 2 WI) were loaded from 15:00-16:00h, transported for 5 hours in two different trucks and unloaded at 22:30-24:00h in the abattoir. A datalogger (Hobo MX2300 temp/RH) recorded temperature and relative humidity for five hours before loading at farm, during transportation and at lairage in the abattoir. Tail, body and ear lesions were scored using a 3 point-scale (0 = no lesion vs. 2 = severe lesions) before transport and at the slaughter line. Saliva samples from 15 males and 15 females per system and batch (120 samples in total) were obtained before loading and at lairage to analyze cortisol, haptoglobin, chromogranin A and IgA. Meat quality parameters were obtained from the Longissimus thoracis muscle (pH, drip loss, electrical conductivity) and were also evaluated in the same subsample of 120 pigs. The effects evaluated in the statistical model were transport, season, production system and their interactions. A significant difference during transport ($P<0.05$) was found for the temperature (WI: 15.12±0.206°C vs. SU: 26.47±0.205°C) and relative humidity and relative humidity (WI: 56.20±0.736% vs. SU: 69.55±0.655%). In cortisol, a significant interaction between transport and season was found, the levels for both ORG and CON pigs being significantly higher after transport in summer as compared to winter (8942.3±1073.7pg/ml vs. 2559.4±366.4pg/ml, respectively, $P<0.05$). Haptoglobin levels were significantly higher in both systems after transport (400.4±43.5ng/ml vs. 988.3±138.7ng/ml, $P<0.001$), and a significant increase in body lesions was also found after transport, especially in SU conditions. Lower pH values ($P<0.05$), higher electrical conductivity ($P<0.05$) indicating lower water holding capacity of muscle fibers, and greater drip losses ($P<0.05$) were observed in SU in both production systems as compared to WI. Overall, the results indicate that transport in summer conditions had more negative consequences on the welfare and meat quality than production system, pointing out the need in both production systems to implement prevention strategies.

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EVALUATING THE EFFECT OF BREEDING-AGE GILTS' PREFERRED TOY ON AGGRESSIVE BEHAVIORS POST MIXING

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Mixing unfamiliar breeding-age gilts is a common procedure in swine production; however, it can lead to high incidence of aggression that can negatively impact gilts' welfare and reproductive performance. Thus, the development of enrichment strategies that reduce aggression in breeding-age gilts is necessary to ensure their welfare, longevity, and optimal reproductive performance. The objectives of this work were 1) assess breeding-age gilts' preference for different enrichments and 2) determine if the provision of their preferred enrichment would decrease aggressive behaviors when breeding-age gilts are mixed. In Experiment 1, thirty-two breeding-age gilts were tested with 3 different toys (i.e., 20cm Jolly Ball, 13cm Kong, 14cm ring ball), either hanging at eye-level or on the floor, and with no food or filled with applesauce or peanut butter to evaluate their preference. Each combination of toy, location, and food was tested individually, and gilts' behavior was recorded for 5 h to evaluate the amount of time they interacted with the enrichment. Preliminary results from Experiment 1 showed a statistically significant 3-way interaction between location, toy, and food ($p<0.0001$). Gilts interacted with the Jolly Ball filled with food and placed on the floor the most (95% CI for peanut butter was 0.08, 0.11 and 95% CI for applesauce was 0.07, 0.09). In Experiment 2, we will evaluate if breeding-age gilts' preferred toy reduces the incidence and intensity of aggression when breading-age gilts are mixed. Our work will provide insight as to which enrichment types can be utilized to potentially reduce aggression in breeding-age gilts and thus improve gilt welfare, longevity of breeding stock, and the economics of the swine industry.

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ELEVATED PLATFORM USE BY HOSPITALIZED GOATS' POST-SURGERY

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Properly chosen environmental enrichment has the potential to improve animal welfare. We know that goats like to climb up onto elevated places. The purpose of this study was to evaluate whether goats would use an elevated platform to perform species typical behaviors, which can be indicative of positive welfare. We designed a quasi-randomized, controlled trial with eight adult, male castrated goats that had been diagnosed with spontaneously occurring urinary blockage and received a tube cystostomy. Animals were assigned to either a platform or non-platform treatment group. The platform was always placed in the same location within the pen. Video recording started approximately 48 hours after surgery and continued for 3 days. We used scan sampling at 5-minute intervals to code for location in the stall, posture (standing or lying) and behavioral activity (eating, drinking, investigating, observing, ruminating, resting, sleeping, and walking). We analyzed whether goats were more likely to use the platform area with a logistic mixed-effects model. The model included treatment group, observation day, and their interaction as fixed effects, and animal was included as a random effect. All goats in the platform group used the platform, but usage varied by goat ranging from 7.6% to 54.5%. The behaviors most frequently performed on the platforms were observing, resting and ruminating. A significant interaction was found ($p<0.001$) between the presence of the platform and observation day: on average, the goats used the platform about 50% more every day post-surgery. Our study showed that goats in a new and potentially stressful environment will use an elevated platform, and that usage increases as the animals recover post-surgery. These findings suggest the potential for improved patient welfare via a safe, easy-to-provide enrichment item at little additional cost or effort.

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REFLECTIVE PRACTICE: AIDING ANIMAL WORKERS TO BE SAFE, SUPPORTED AND RESILIENT TO AID BEST OUTCOMES FOR ANIMALS

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Reflective practice is routinely used within the world of human health care. As a regular, formal process it allows practitioners to be supported by a trained colleague to consider their work and their responses to it, including emotional impacts. A safe and confidential space allows workers to gain support and to learn from work experiences. It compliments, but differs from and does not replace, line management or counselling or wellbeing support.

Reflective practice has only recently been applied to those working in animal health care, specifically for veterinary surgeons, Schwartz Rounds for veterinary teams and more recently by the equine charity World Horse Welfare. World Horse Welfare's recent reflective practice project, groundbreaking in the animal welfare field, includes externally facilitated reflective practice groups running over the past four years and early in 2024, twelve members of staff were trained to deliver reflective practice one-to-one to their colleagues.

Early feedback from World Horse Welfare showed that reflectees felt better able to meet the challenges of their roles, that the organisation was supportive and reflectees were experiencing safe spaces to talk about work, and that the weight of their work experiences was lifted by being able to verbalise experiences out loud.

Reflective practice allows examination of workers' actions, non-actions, and use of interventions and skills. What went right on this occasion and what could have been done differently including in future situations, enabling welfare workers to recognise areas for improvement, the horse being the ultimate beneficiary.

There is also space to consider the emotional impact of the work as no matter how experienced, boundaried and professional workers are, it is inevitable that there will be some impact from the work. Reflections on the wider professional experience may include organisational issues, working practices, legal aspects, team dynamics and relationships with work colleagues, including other agencies.

Those who work in the field of animal medicine and research are presented with ethical dilemmas which can lead to moral distress or moral injury. This is an emerging area of research both in human healthcare and veterinary medicine, and having a safe space to reflect has been identified as a protective factor from moral distress and to improve safety and outcomes for animals.

This presentation will outline the case for reflective practice to be offered to workers in animal health, medicine, welfare and science and describe the successful pilot undertaken by World Horse Welfare, an equine welfare charity following a research-led and evidence-based approach to help guide their work.

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OUTLINING AN EXPLORATORY ASSESSMENT OF AMERICAN ALLIGATOR (ALLIGATOR MISSISSIPPIENSIS) WELFARE ACROSS SETTINGS IN THE UNITED STATES

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Alligator mississippiensis is a critical species within the United States, significant for its cultural, economic, and ecological value across the country, as are many crocodilian species around the world. However, even with this considerable importance, this species continues to lack focus within animal welfare science. Considering it is a popular species found in a variety of human-care settings, it is imperative that we work to gain a better understanding of these animals' needs to enable welfare-oriented management practices.

The aim of this project is to evaluate behavioral and physiological indicators in *A. mississippiensis* housed in a zoological facility, commercial farming system, and managed native range area to determine baseline ranges for this species in intensively managed professional settings in comparison with populations in the wild. The information generated will allow for informed interpretation of these animals' welfare.

This presentation will highlight preliminary findings, including descriptive analyses of baseline parameters for each focal population with respect to behavioral time budgets and physiological indicators to demonstrate how this work may be used in the care and management of *A. mississippiensis* by employing science based welfare-oriented decisions.

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HOUSING BY DESIGN: AN EXAMPLE OF DESIGNING AN ENVIRONMENT FOR DONKEYS TO MEET THEIR BEHAVIOURAL NEEDS

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Despite their differences, donkeys are often managed and treated like horses or ponies. This compromises their behavioural and physical requirements and can have a negative impact on their welfare. Here we report a project aimed at improving the housing and environment of a herd of miniature donkeys to allow them greater agency and behavioural flexibility. A One Welfare approach was taken whereby opportunities to improve biodiversity and ecosystem health, alongside visitor experience and ease of management were also explored. Comprehensive data on all aspects of the project site (0.7 ha area) and its usage were collected to provide a baseline and inform the project design, including behavioural observations, Qualitative Behavioural Assessments (QBAs), and ecological surveys (soil health and botanical surveys). Pre-intervention observations revealed the area to be overgrazed except for latrines with poor in-field shelter and shade provision, and no natural browse. The positioning of some of the available shade created by the housing caused potential conflict between the donkeys' desire for shade and their exposure to visitor interaction. Resource guarding, agitation and aggression were observed due to feeder placement. Behavioural observations were supported by the QBA scores which differed significantly depending on whether there was overcrowding around the feeders ($P<0.001$). Donkey were significantly less happy, less relaxed, pushier, and more anxious when there was overcrowding around the feeders. The mood of donkeys was significantly worse ($P=0.01$) and the energy state of the donkeys greater ($P<0.001$) when overcrowding was present. There was also a significant difference in the QBA scores of donkeys depending on the type of access they had to a paddock ($P<0.001$). Donkeys were more curious, less happy, less relaxed, less at ease, more bored, more agitated, pushier, more aggressive, more anxious, more playful and more fearful when they had no access to a paddock. The mood of donkeys was significantly more positive ($P<0.001$) and their energy state was significantly calmer ($P<0.001$) when they had paddock access. From the baseline data, the priorities for the housing design were increased opportunities for shelter, shade, paddock access and privacy from the public, greater environmental variation and improved feeder placement. This included increased plant diversity and structure, year-round access to outdoor infrastructure to encourage movement and exercise, a grazing system which allows a longer grazing season, and improved grassland health and resilience. Monitoring has been ongoing from the outset and will continue into the future, with some positive outcomes already being recorded.

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REFINING MOUSE HANDLING: EVIDENCE-BASED AND PRACTICAL RECOMMENDATIONS

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One key aspect of forward progress in scientific research is the implementation of the 3Rs (refinement, reduction, and replacement). These are a key part of conducting humane animal research and quality science. The 3Rs Collaborative is a non-profit organization dedicated to helping research professionals make change by providing thought leadership and practical resources. Our collaborative provides a unique perspective to these topics by facilitating collaboration between all relevant stakeholders including academics, pharmaceutical companies, technology providers, regulatory agents and other non-profit organizations.

One of the key ways we enact 3Rs change is through our Refinement Initiative. This initiative has a specific focus on refined mouse handling. Traditionally, research mice are picked up by the tail to move them for examination, cage changes, and a variety of standard laboratory procedures. However, strong multimodal evidence from multiple labs indicates that it is instead advantageous to pick mice up with tunnels or cupped hands (e.g., “refined mouse handling" (RMH)) prior to these procedures. The growing body of scientific literature supports the claim that refined mouse handling improves animal welfare, scientific quality, and ease of handling. Furthermore, it is fully compatible with procedures such as cage change, injection, oral gavage, and anaesthesia.

Since its creation, the 3RC Refinement Initiative has created an extensive resource hub, with over 11 resource pages, introducing individuals to evidence and guides supporting the use of refined handling, an e-Learning course and mentorship program for new users, and common barriers and misconceptions to implementation. Additionally, the 3RC refined mouse handling initiative has published data from a mixed methods longitudinal benchmarking survey of refined handling that is grounded in the validated theory of planned behavior. Our benchmarking data showed that individuals attitudes, social/professional norms, and perceived control beliefs are strongly associated with the intent to implement refined handlings (p's < 0.001). Results also detail commonly listed barriers to the practice, including jumpy mice, perceived incompatibility with restraint, lack of time, and other personnel, which can be targets for future education. Finally, a systematic review and meta-analysis is currently underway to assess the effectiveness and potential benefits of refined handling compared to traditional methods, which will be discussed.

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