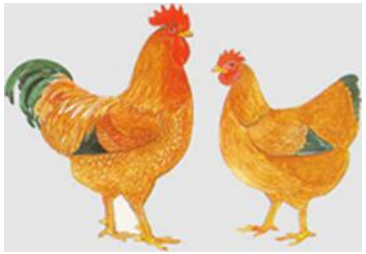
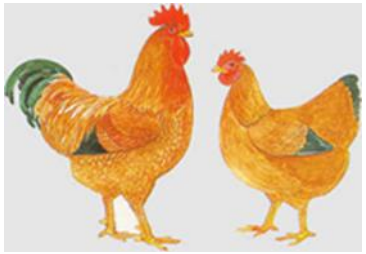


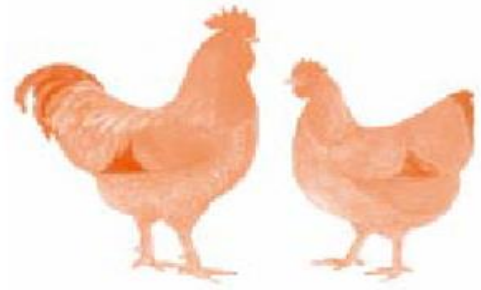
Poultry Industry Education Trust

Investing in People for the Poultry Industry



Poultry Industry Education Trust

INVESTING IN PEOPLE FOR THE POULTRY INDUSTRY



Northern Ireland Poultry Industry Conference

"Meeting The Challenges"

CAFRE LOUGHRY CAMPUS
COOKSTOWN
76 Dungannon Road, Cookstown BT80 9AA
Loughry Campus is located approximately 9 miles from Dungannon
And 1 mile from Cookstown on the A29

Tuesday 31st October 2023

PROGRAMME

Conference Chairman – Eric Reid

9.30am Morning Coffee & Registration.

10.10am **Conference Welcome & Opening Address** – **Eric Reid**

MORNING SESSION

Chairman – David Brown. President Ulster Farmers Union

10.30am **Tim Burnside** - Aviagen
"Meeting The Challenges of Poultry Meat Production"

11.00am **Marcus Kenny** – Hy-Line
"Meeting The Challenges of Commercial Egg Production"

11.30am **Jason Winstanley** – Moy Park
"Meeting The Challenges of Customer Insight & Marketing??"

12.00pm **Discussion**

12.30 – 2.00pm **Lunch & Trade Stands**

AFTERNOON SESSION

Chairman – Nigel Sweetnam Regional Chairman Irish Farmers Association.

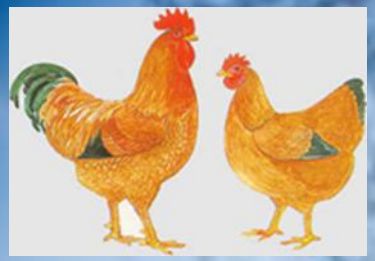
2.15pm **Dr. Elizabeth Magowan** - AFBI.
"Meeting The Challenges of Environmental Sustainability"

2.45pm **Professor Ian Brown** — APHA
"Meeting the Challenges of Notifiable Poultry Diseases"

3.15pm **Discussion.**

3.45pm **Closing Remarks. Eric Reid & Conference Close.**


Poultry Industry Education Trust
Developing People for the Poultry Industry
2023 NORTHERN IRELAND POULTRY CONFERENCE
CONFERENCE CHAIRMAN & OPENING ADDRESS
ERIC REID



Poultry Industry Education Trust

Developing People for the Poultry Industry

2023 NORTHERN IRELAND POULTRY CONFERENCE

MORNING SESSION CHAIRMAN DAVID BROWN DEPUTY PRESIDENT UFU

ULSTER FARMERS' UNION

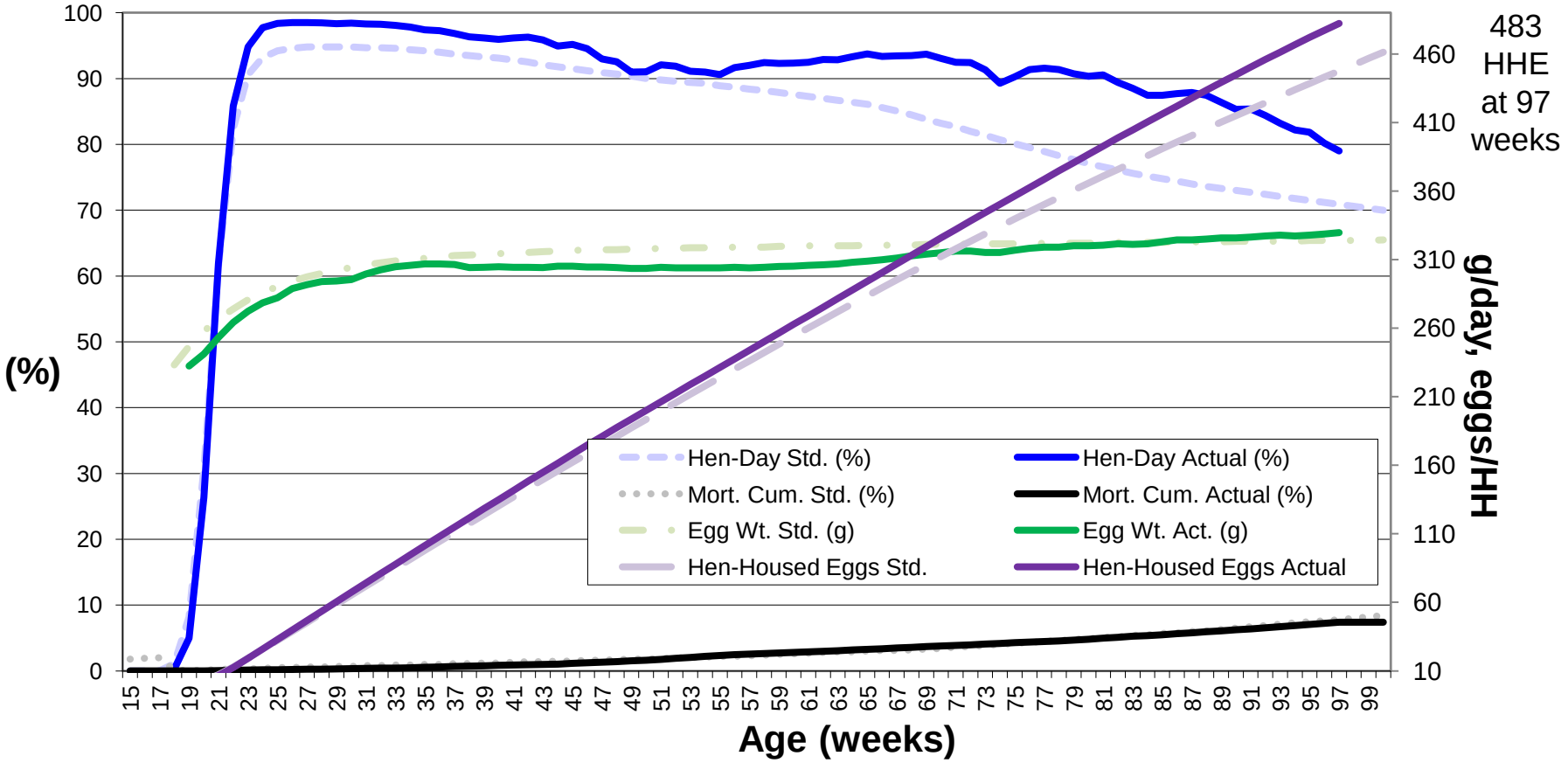
Tim Burnside Aviagen

- Online Presentation from USA
- https://www.dropbox.com/scl/fi/0wtxoxy5opc0so5niitwq/NI-Conference-Oct-23.pdf?rlkey=qov5fhmki4ht12a3g311h0yrk&dl=0

Meeting The Challenges Of Commercial Egg Production

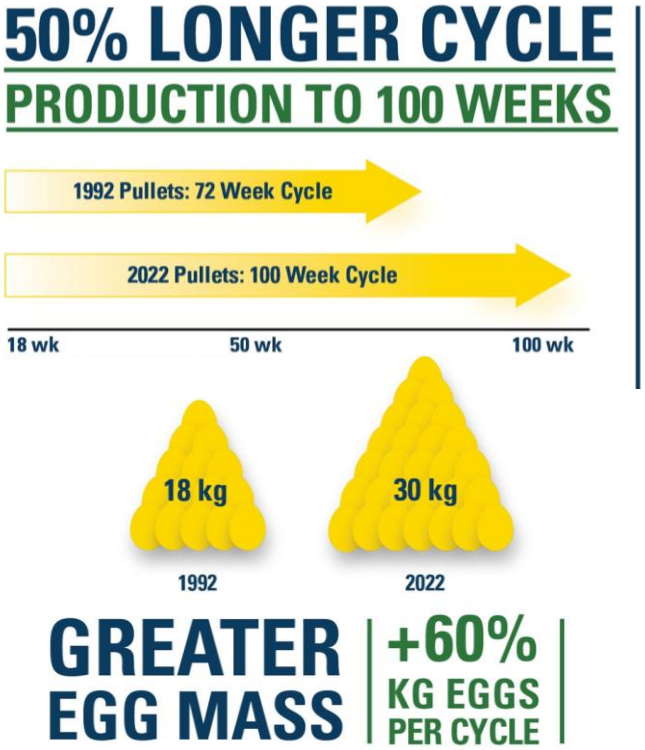
M Kenny Global Nutritionist

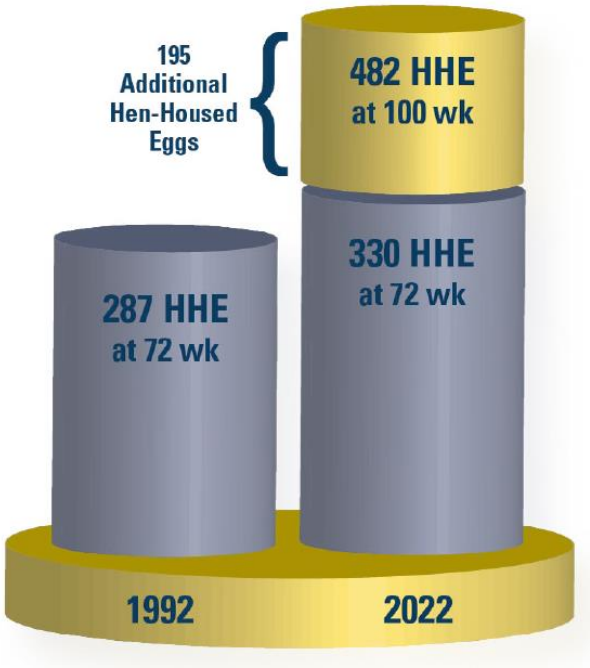
Achieving Extended Laying Cycles



Hy-Line Brown Extended Production Cycles

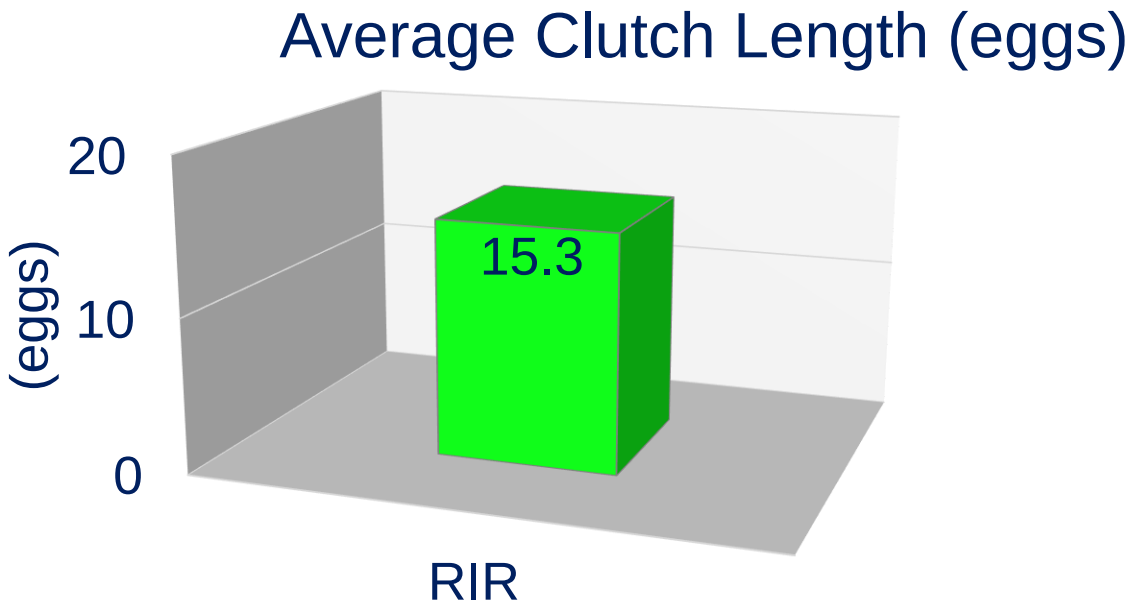
1992 Commercial Layer vs. 2022 Commercial Layer



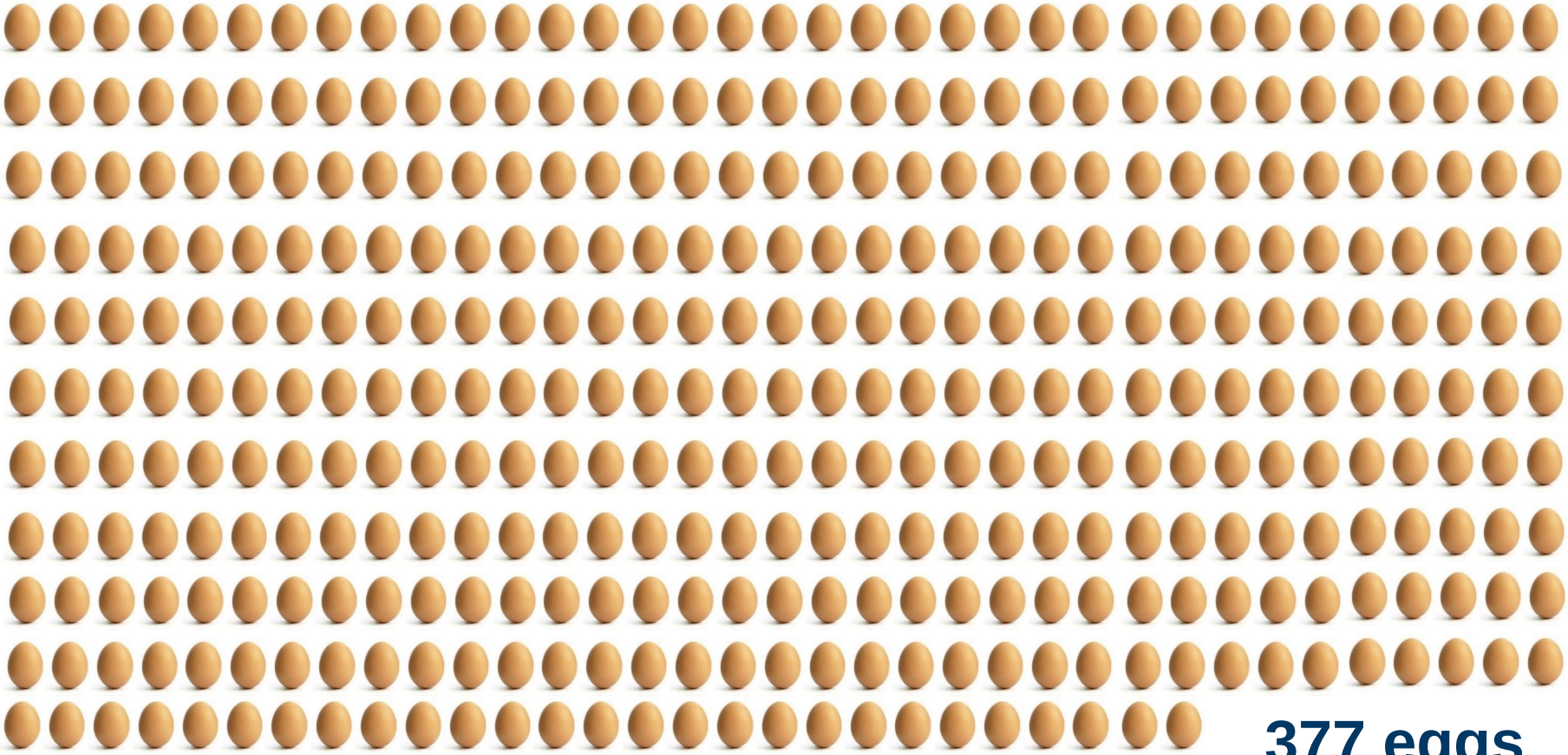


Persistent egg production: Clutch length

Clutch length: number of eggs laid in sequence
Assessed in 23,809 Rhode Island Red daily for each bird



Longest Clutch Recorded (eggs)

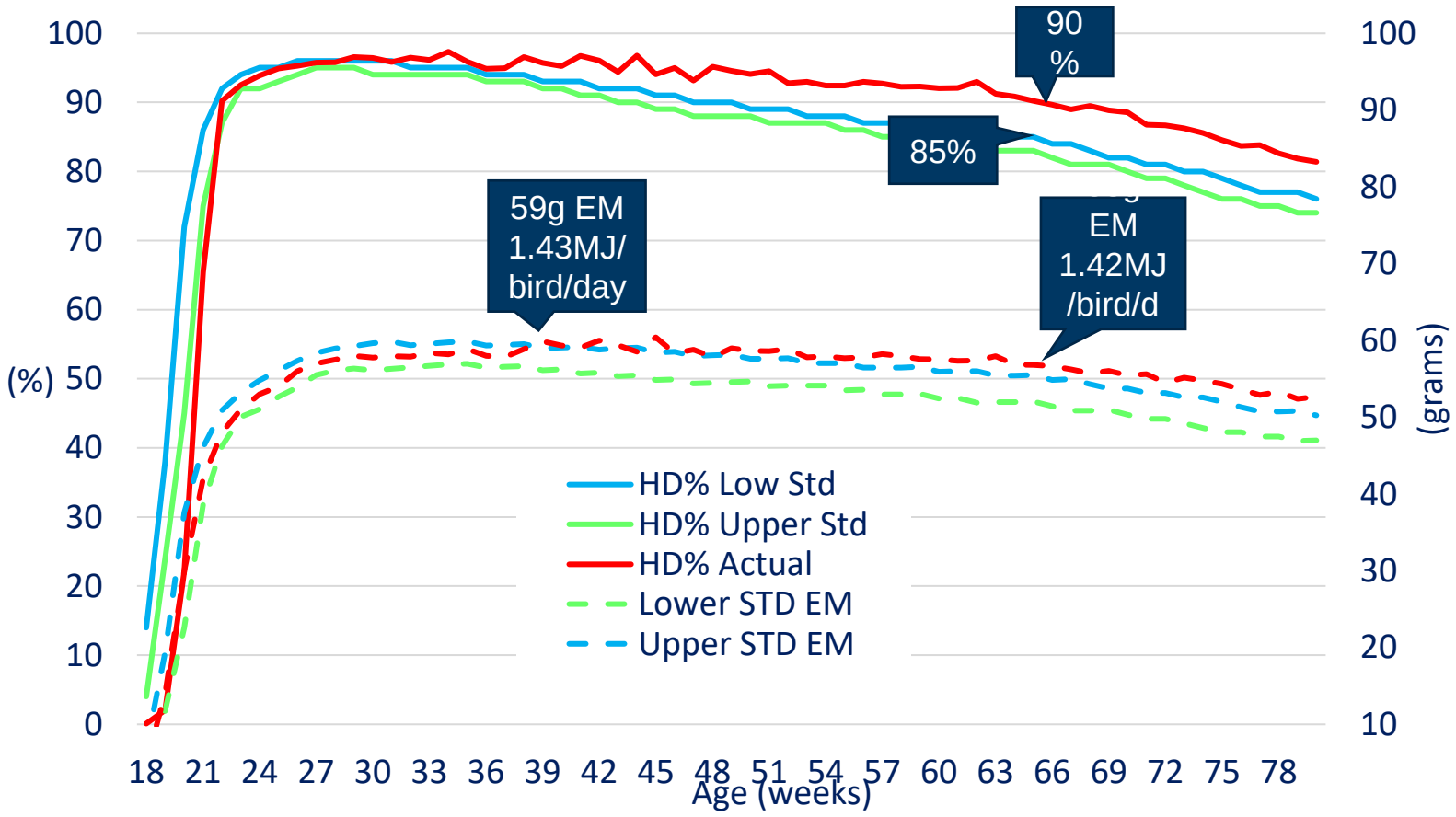


377 eggs

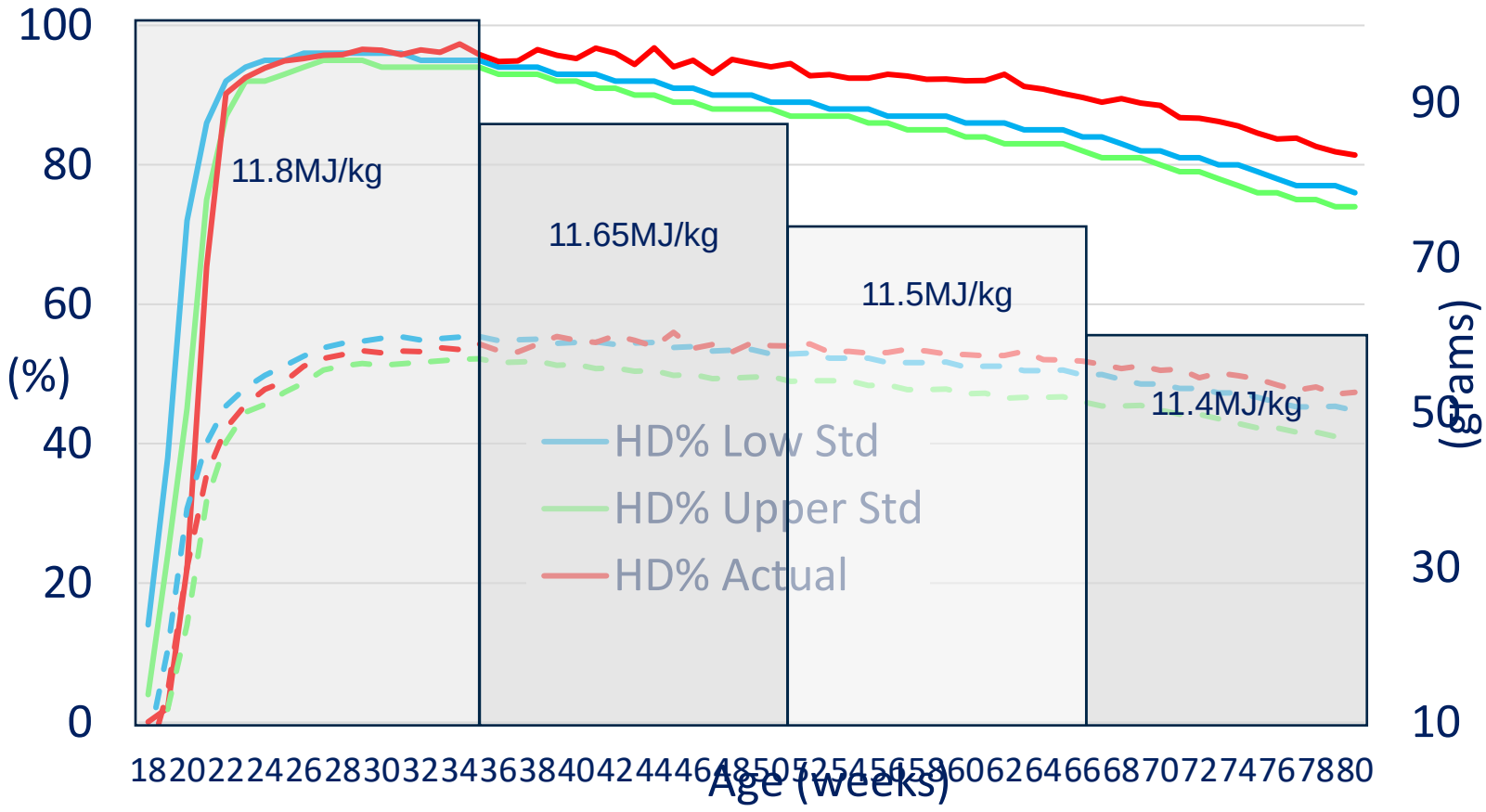
Extended Cycles

Critical to support with consistent nutrient supply

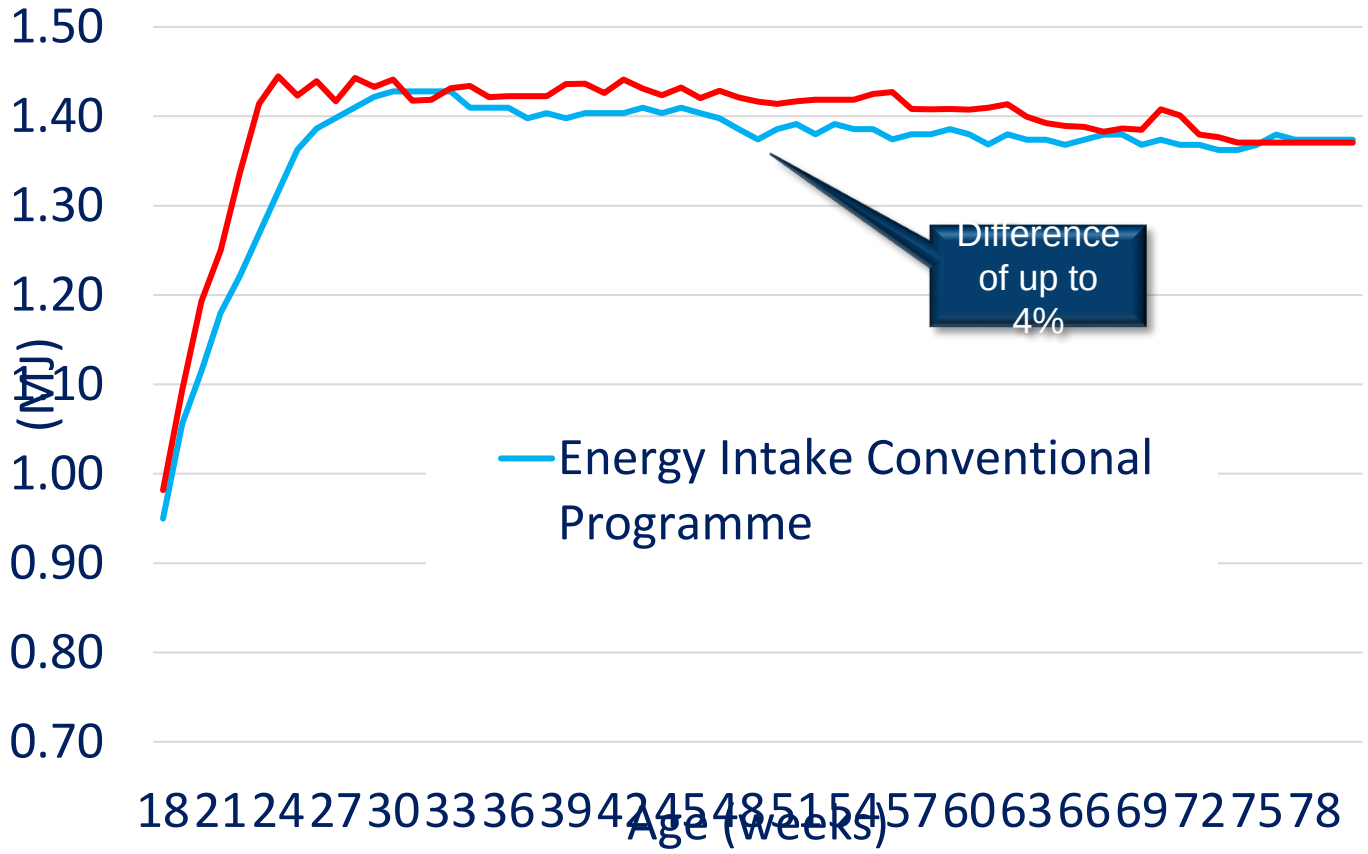
Hen Day Production (%) and Egg Mass (g/bird)



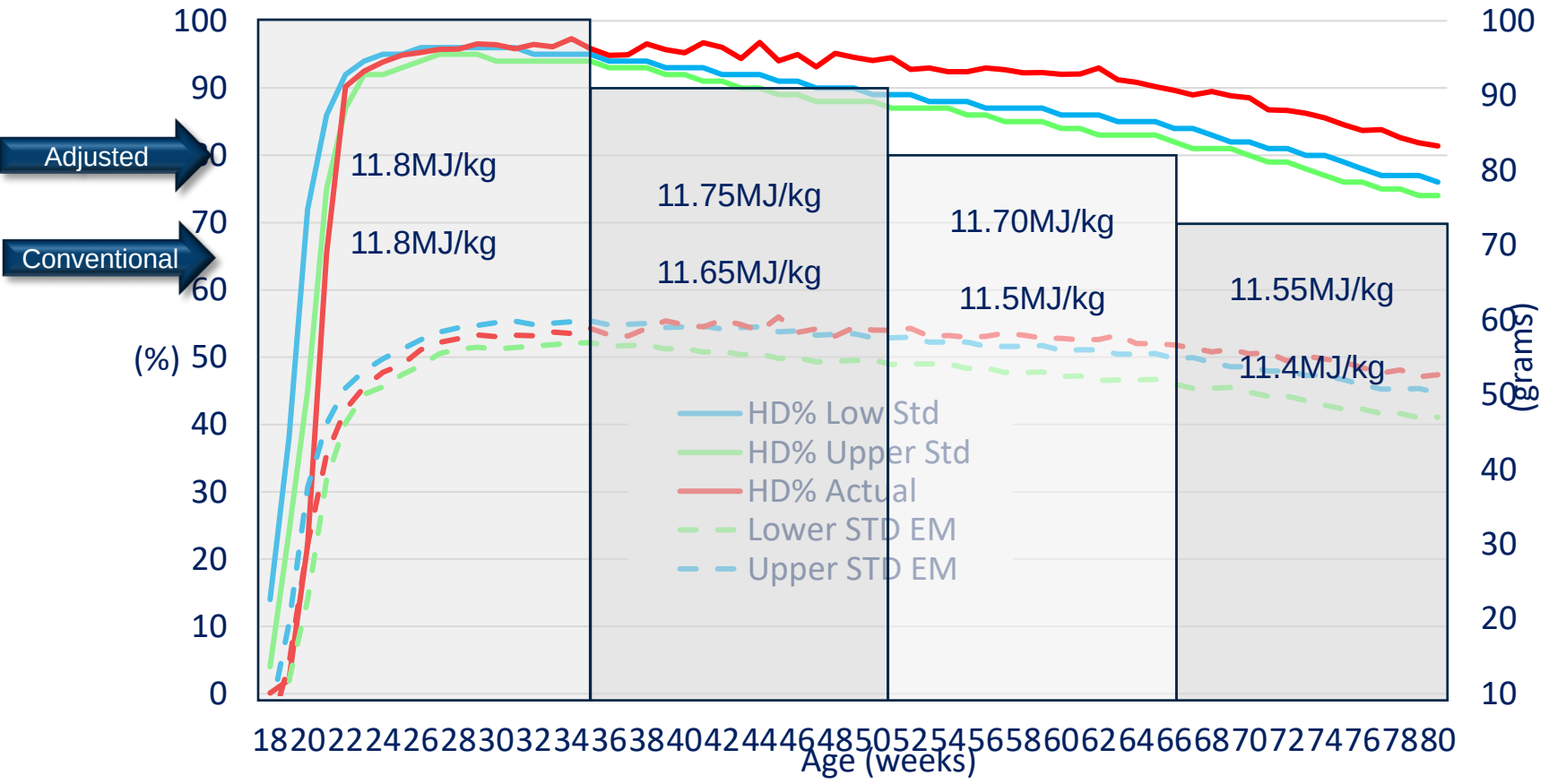
Hen Day Production (%) and Egg Mass (g/bird)



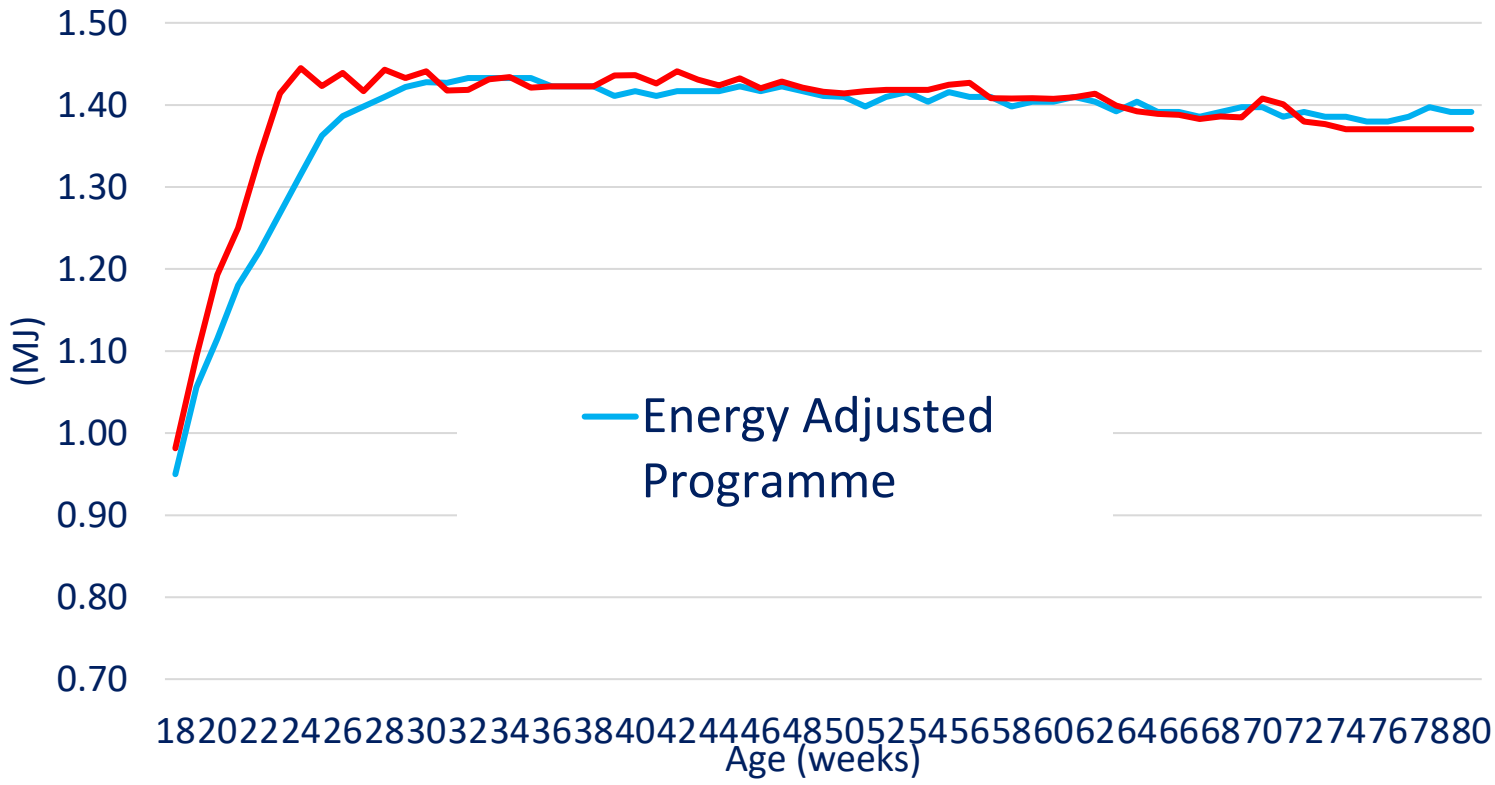
Actual Energy Intake and Estimated Energy Requirement (MJ/bird/day)



Hen Day Production (%) and Egg Mass (g/bird)

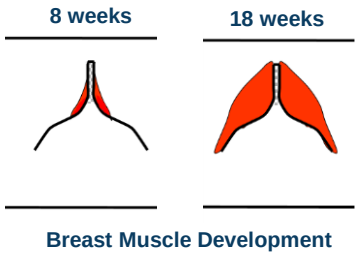


Actual Energy Intake and Estimated Energy Requirement (kcals/bird/day)



Rearing

Bodyweight And Body Condition



Nutrient Intake

Not just feed intake.

Birds eat quantities of nutrients not percentages!

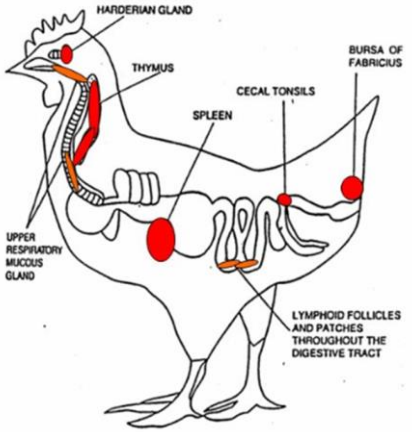
Minimal Stress

Vaccination pressure

Environment

Social pressure

Health/Immune system



Extended laying periods

- Modern layers are genetically bred to persist in lay.
- Realise better performance through better rearing practices.
- Support persistency with optimal nutrient intake in lay.
- Control egg weight.

Annual Genetic Improvement In Hy-Line Brown Performance

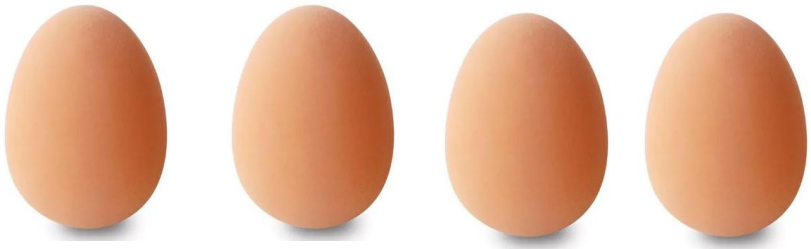
Trait	Improvement
Egg Number 60 wk	2.0
Egg Number 90 wk	4.0
Egg Weight (40 wk), g	0.2 g
Breaking Strength, 40 wk	102
grams feed/doz	5g

Annual Genetic Progress in Hy-Line Layers

+4 hen-housed eggs (85 weeks of age) and -5g/dozen FCR improvement:

Value Created For a Commercial Layer

+4 eggs x £0.12/egg* =	+£0.49/bird
-5g/dozen x 33 dozen = -0.165kg x £0.31/kg* =	+£0.05/bird
	+£0.54/bird

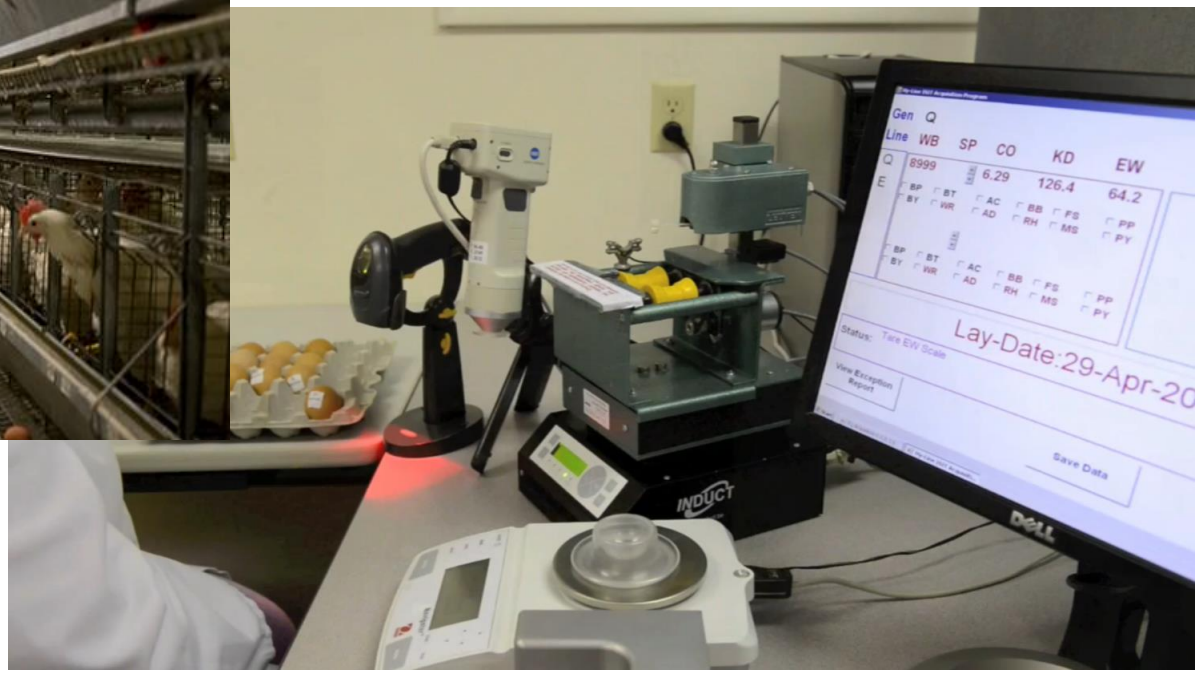


**Ranger October 2023*

HL Brown Egg Shell Quality

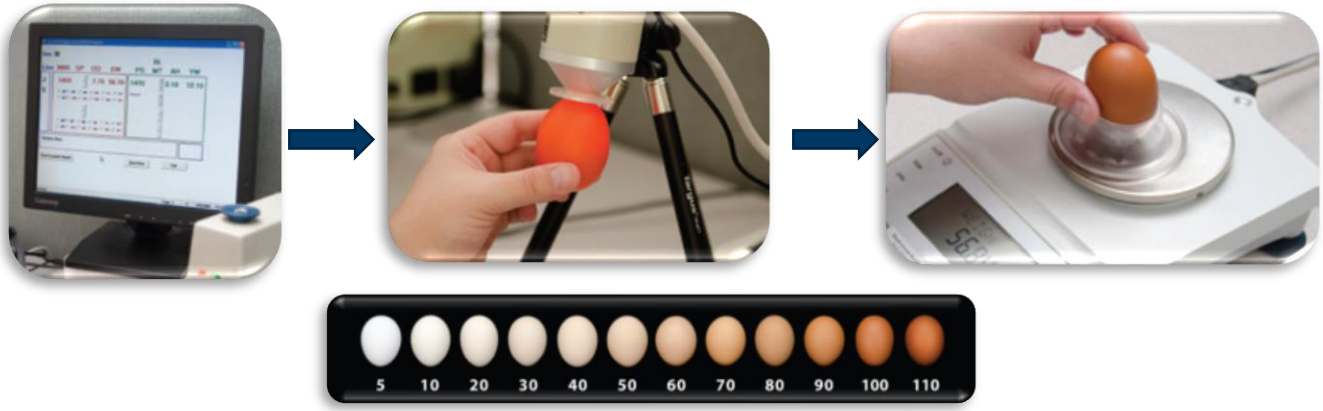
Pedigree Farm

Pedigree Egg Breakout Process



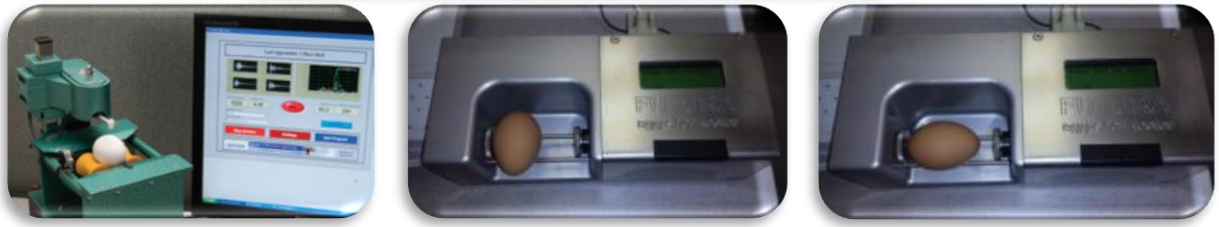
Period of monitoring extended from 90 to 105 weeks.

Pedigree Egg Breakout Process >1M eggs/annum



SQC

Acoustic Egg Test

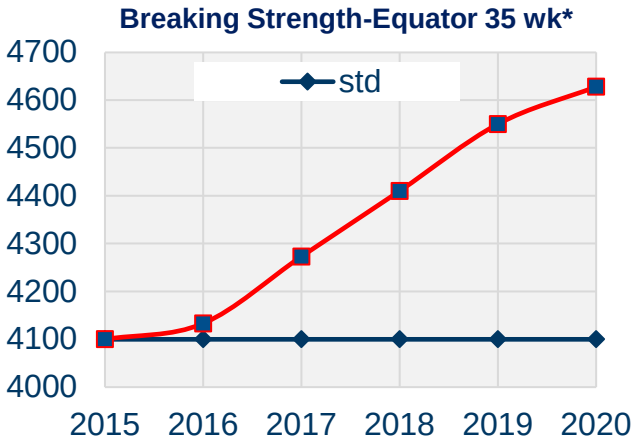


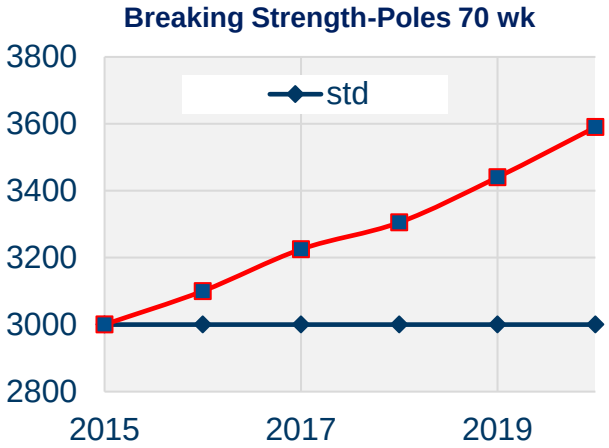
Internal Egg Test

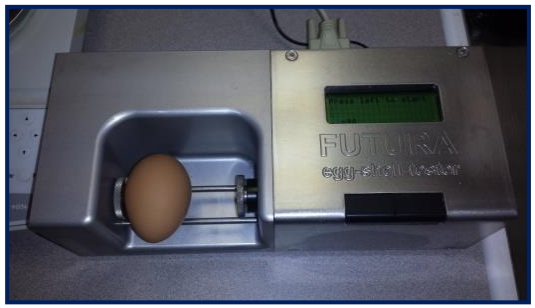
Egg Defects:

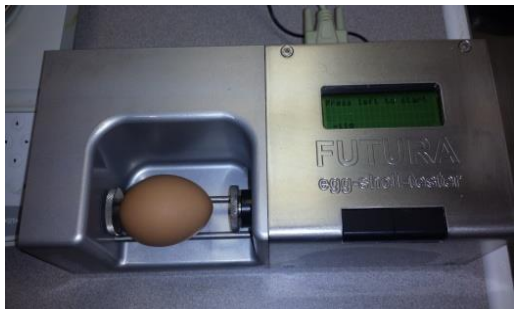
Quantitative: Speckles; internal inclusions.
Qualitative: Addled; Equatorial Band; Broken in Processing; Broken in Transit; Broken Yolk; Flat Sided; Misshapen; Purple; Rough; Wrinkles

HL Brown Egg Shell Quality







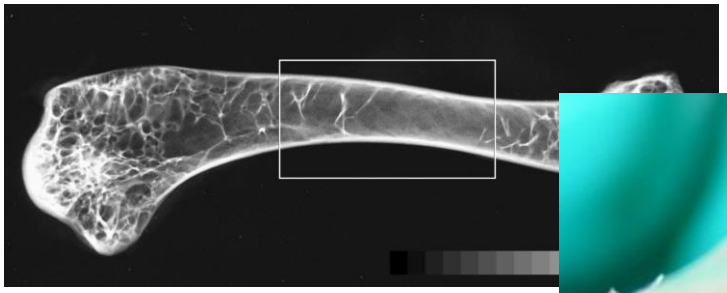


*Year indicates hatch of GGP generation.

Bone Condition

Cortical bone

- outer structural component



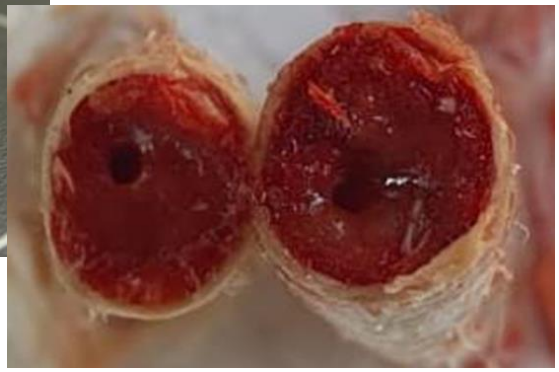
Trabecular bone

- inner structural component

Photo courtesy of Bob Fleming

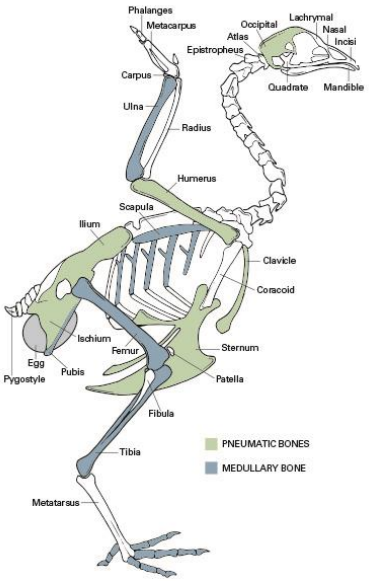
Medullary Bone

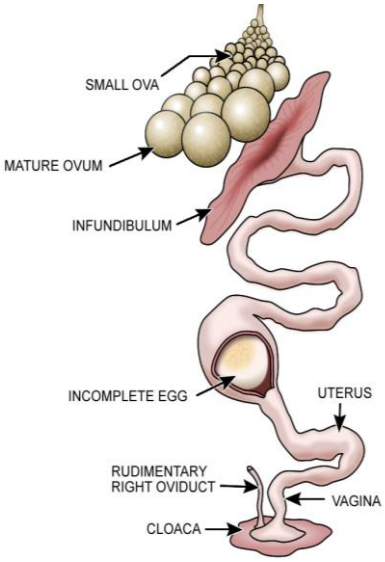
- readily mobilized/deposited

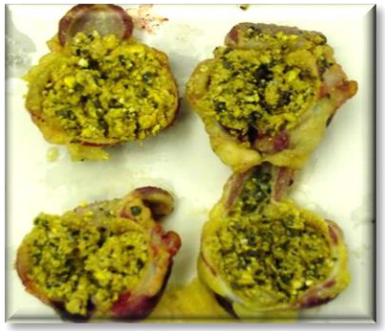


Pre-Lay Diets

Skeletal and Reproductive System







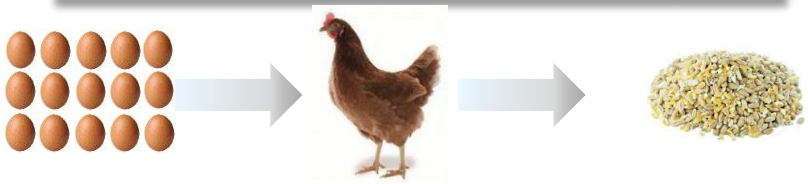
Supplies more calcium for mineralisation of the medullary bone for the laying period and first egg

Expression Of Feed Efficiency

Feed Conversion Rate

Kg of feed consumed / kg of egg mass produced

Feed Utilisation



Kg of egg mass produced / kg of feed consumed

Feed Consumption Per doz. eggs

Kg of feed consumed / doz. eggs produced

Small changes in efficiency at any feed price will have a significant impact on financial margins

Feed Efficiency: £

Free Range (16 to 76 weeks)

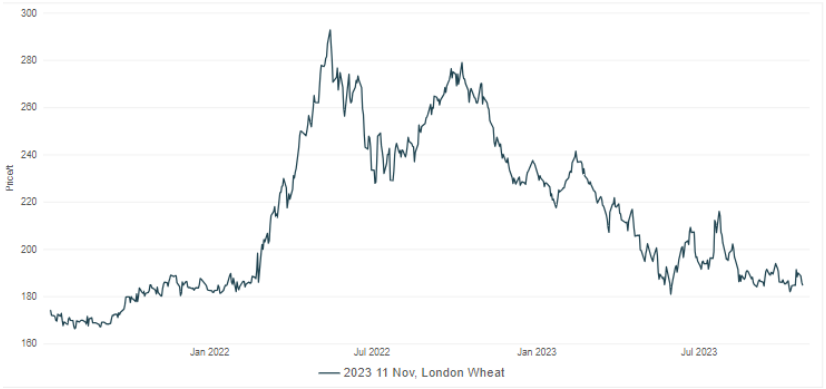
Egg Numbers	Dozen Eggs	Average Feed Intake	FCR (feed per doz eggs)	Cum Feed Intake (kg/bird)	Average Feed Price*	Feed Cost
(HH/bird)		(g/bird)		(kg/bird)	(£/kg)	(£/bird)
345	28.75	125	1.83	52.5	0.31	16.28
345	28.75	120	1.75	50.4	0.31	15.62
Difference Free Range						-£0.66
Difference Colony System						-£0.64

Eight points improvement in FCR equates to a feed cost saving of £0.66/bird

*based on BFREPA feed cost Oct 2023

Increasing Feed Cost

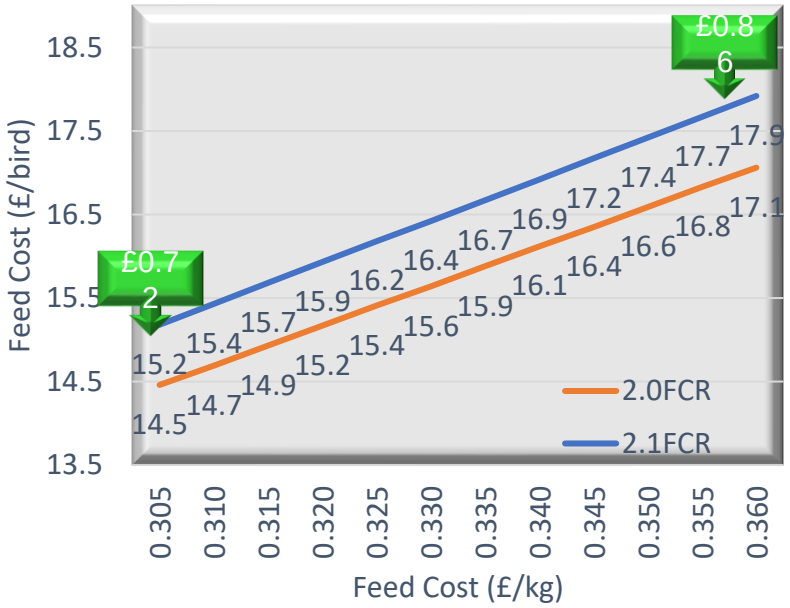
Wheat: £/MT



Soybean: £/MT

Source: AHDB

The effect of feed cost (£/MT) and feed efficiency on feed cost per bird



Optimising FCR becomes even more relevant as feed price increases

Environment

Temperature: Maintain a consistent house temperature, avoid temperature fluctuations to optimise FCR.

The House Should be Capable of Maintaining:

- Controlled 21ºC when outside temperatures vary between - 3ºC to + 18ºC
- Uniform temperature throughout the shed through time :
  - <0.5ºC across and down the length of the shed

Feather cover

Impact Of Plumage On Estimated Daily Energy Maintenance Requirement

		Plumage (%)					
	Unit	100	90	80	70	60	50
Additional maintenance requirement	(MJ/bird/day)	0	0.03	0.06	0.09	0.12	0.15
Additional feed* requirement	(grams/day)	0	2.6	5.2	7.8	10.4	13

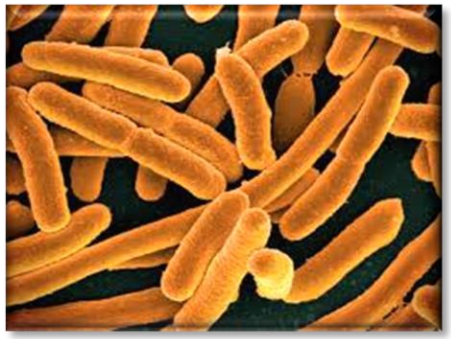
FCR (feed/dozen eggs)	1.75	>1.83	>1.91
Feed Cost (£/bird)	-	> +0.71	> +1.42

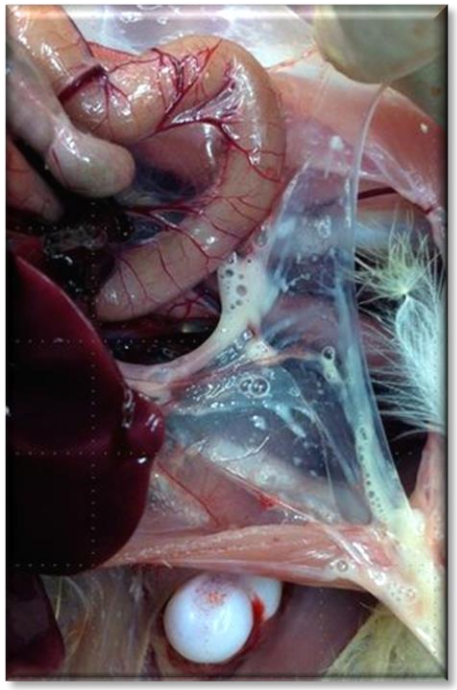
**11.6MJ/kg or 2770kcals/kg energy density*

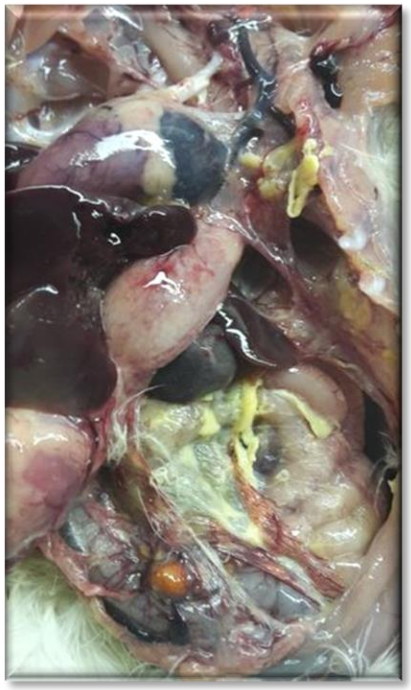
Peguri *et al.* 1993

Stress/Disease Challenge

"Birds challenged with E. Coli have increased requirements for Sulphur amino acids by 20-30% and increased requirements for tryptophan by 20% to attain the same performance as unchallenged birds"







Feed Efficiency

Several ways we can impact efficiency

Stresses the need to measure feed intake!

Measure feed usage, daily!

30-Year Genetic Gain on a Global Scale

1992 Breed Standards vs. 2022 Breed Standards

LESS FEED CONSUMED SAVES

23 grams less feed to produce an egg compared to 30 years ago.

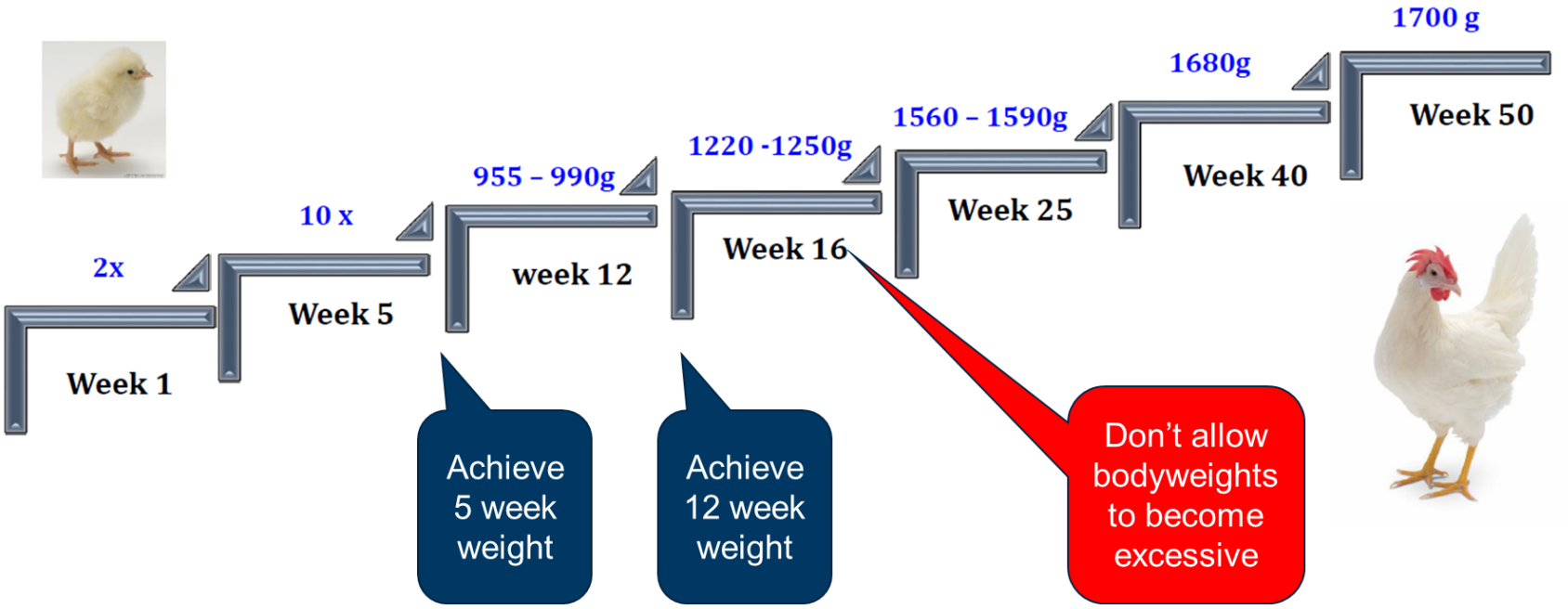
1.1 MILLION FEED TRUCKS

&

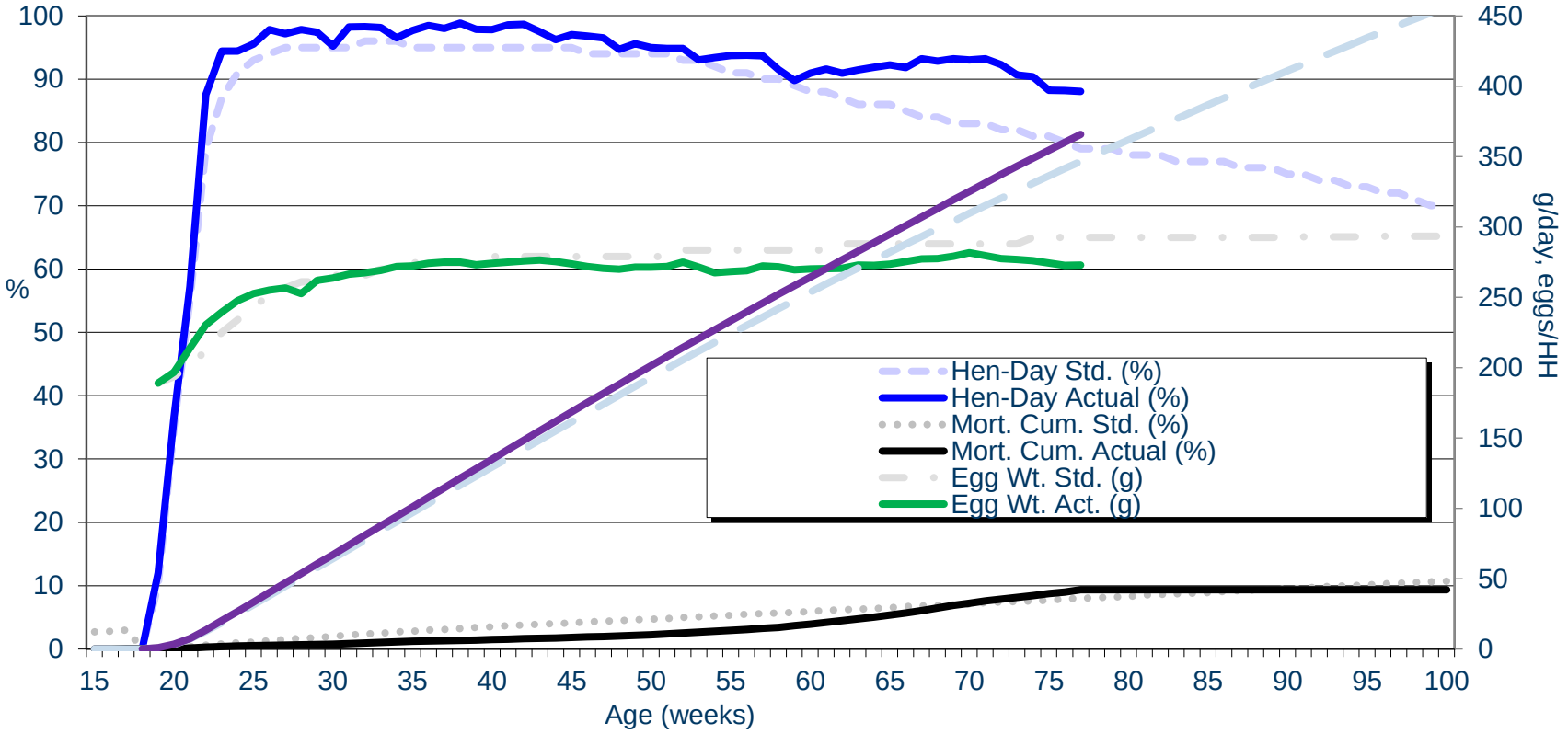
DRINKING WATER FOR 71 MILLION PEOPLE

Represents the cropland size of **New Zealand** saved & eliminates **15.5 million metric tons** of CO_2 emissions annually.

White Strain Varieties

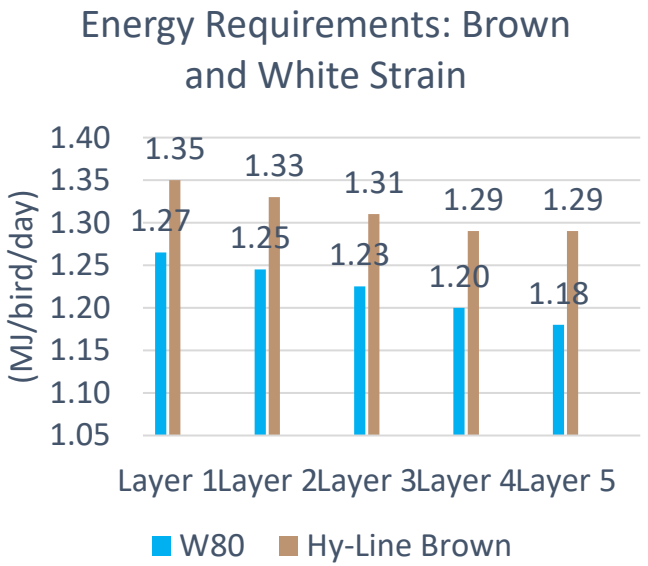


W80 Performance Table: Barn System



Feeding White Strain Varieties

- Example Hy-Line W80
- Lower feed intake 108g to 113g
- Lower bodyweight = lower energy needs
- Achieving bodyweights in rear is critical
- Develop appetite but avoid excessive bodyweight development
- Light stimulate at lower bodyweight: 1.22kg to 1.25kg



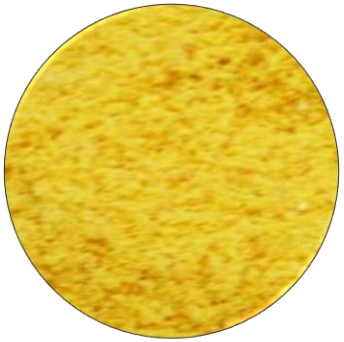
Replacement of soya with alternative proteins

Field Peas

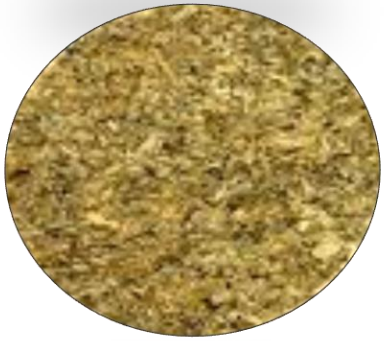
Field Beans

DDGS

Corn Gluten



Sunflower Meal



Rapeseed

Cotton Seed Meal

Wheat Bran

Synthetic Amino Acids

Reduction of soya use assisted through use of synthetic amino acids

Traits Measured in Alternative Systems

Elimination of male chick culling?

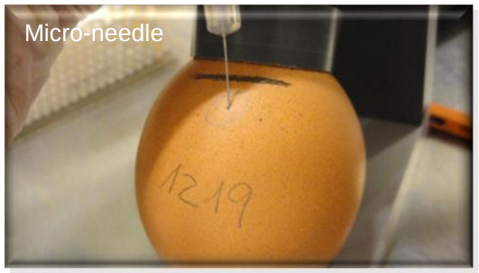
How to eliminate fertile eggs which carry male chicks?

In-Ovo Sex Determination

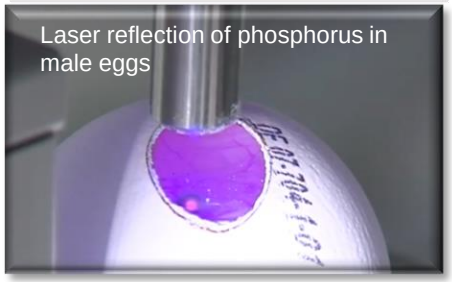
The hormonal approach

Post 9 days incubation

Sex hormones

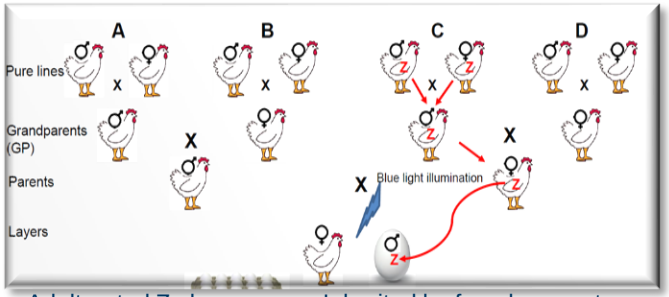


Spectroscopy
(Optical Method)



Hyperspectral Imaging

GMO technology



Adulterated Z chromozone. Inherited by female parent and passes to commercial male embryo

Meeting The Challenges Of Commercial Egg Production

"*Obstacles are those frightful things you see when you take your eyes off your goal.*" – Henry Ford.

The Challenge for Marketing and Insight...

Understanding and Unpicking Consumer Behaviour

Jason Winstanley,
Head of Research & Insight,
Moy Park

Northern Ireland Poultry Conference
31st October 2023

What we'll cover

Long Term

Short Term Challenges


What Chicken Offers


Looking ahead

Mega Trends for the 2020s

A CHANGING POPULATION

Retailers and food service operators will have to reflect the needs of a **shift in population dynamics**, which includes an ageing population, increasing numbers of single households and Millennials/Gen Z

POLARISATION IN SHOPPING

Shopping markets are increasingly polarised – between mainstream and discount; between main estate and on-line/convenience; between health and indulgence

HEALTH RISES UP THE AGENDA

Health, which is driven by both **consumer and legislative factors**, is becoming an ever more important consideration for manufacturers, retailers and food service operators

RISE OF CONVENIENCE

Time poor consumers increasingly value a **helping hand in food preparation**, either via tweaks to primary product or more complete meal solutions

TO YOU

Retailers, food service operators and dotcom businesses are developing their strategies so that their goods can be **delivered to consumers in as timely as fashion as possible**

EVERYONE'S CONNECTED

Technology is continually developing and will become increasingly **key to the way people buy food,** especially as Millennials/Gen Z account for greater share of the market

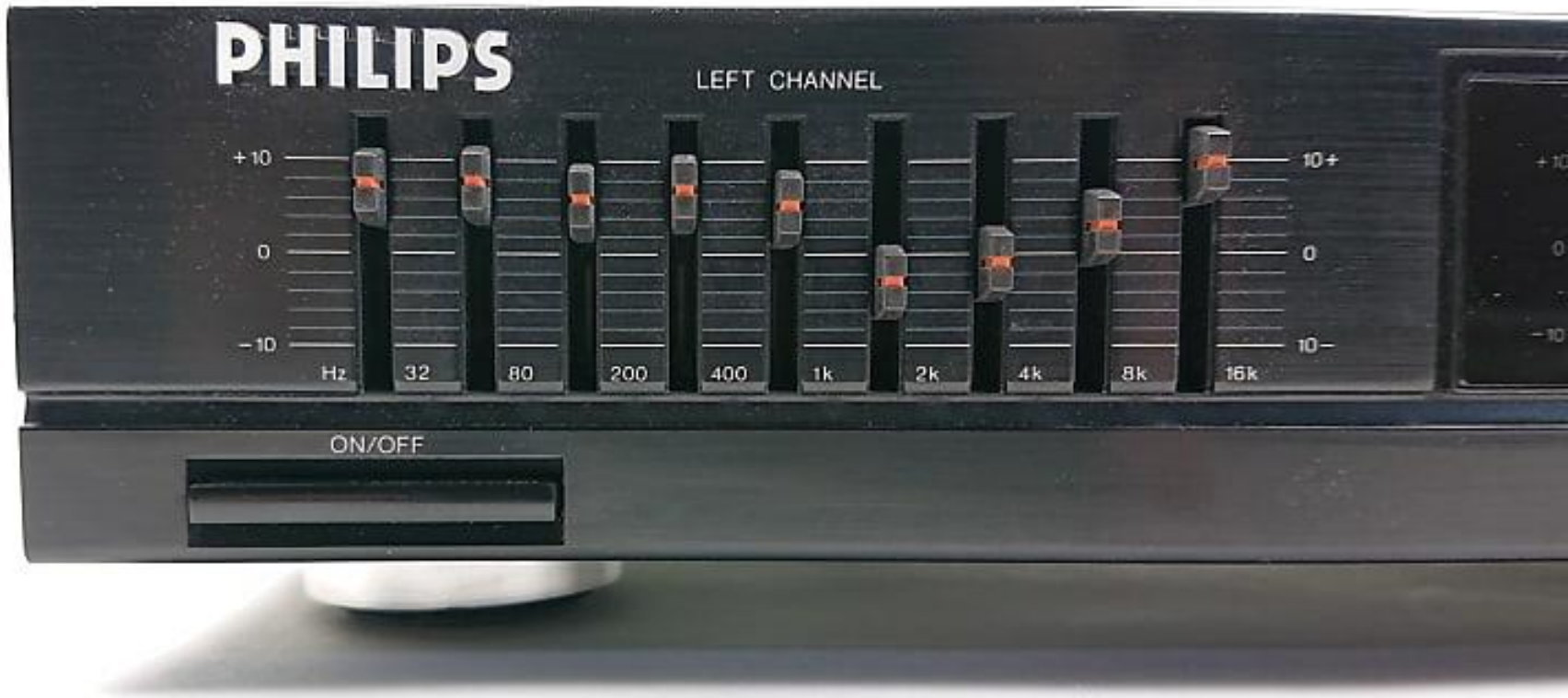
GLOBAL MEAT CONSUMPTION

Continued growth in developing countries and associated **agricultural demand** will have implications elsewhere in more developed markets

RESPONSIBILITY

Consumers are increasingly aware of the impact that their **actions have on the planet**. From single use plastic, to climate change, to food waste, to welfare considerations, a new era of responsibility is dawning

Source: Moy Park Insights Team, July 2023


PHILIPS
LEFT CHANNEL
+10
0
-10
Hz
32
80
200
400
1k
2k
4k
8k
16k
10+
0
10-
ON/OFF


INFLATIO
N


IMPACT
OF
UKRAINE


CORONAVIRUS
STAY HOME
TO HELP US
SAVE LIVES
CORONAVIRUS
STAY HOME
FOR YOUR FAMILY
COVID-19


AVAILABILITY
ISSUES
Please bear with us
We're experiencing high demand


CONSUMER
FOCUS ON
SUSTAINABILIT
Y


AVIAN
INFLUENZ
A
AVIAN
INFLUENZA
CONTROL
MEASURE
SURVEILLANCE
ZONE AHEAD


PLEASE BE
PATIENT
WE ARE VERY
UNDERSTAFFED
Now Hiring
Cooks
Wait Staff
Bartenders
Apply NOW!
LABOUR
SHORTAGE
S


MORTGAG
E RATES
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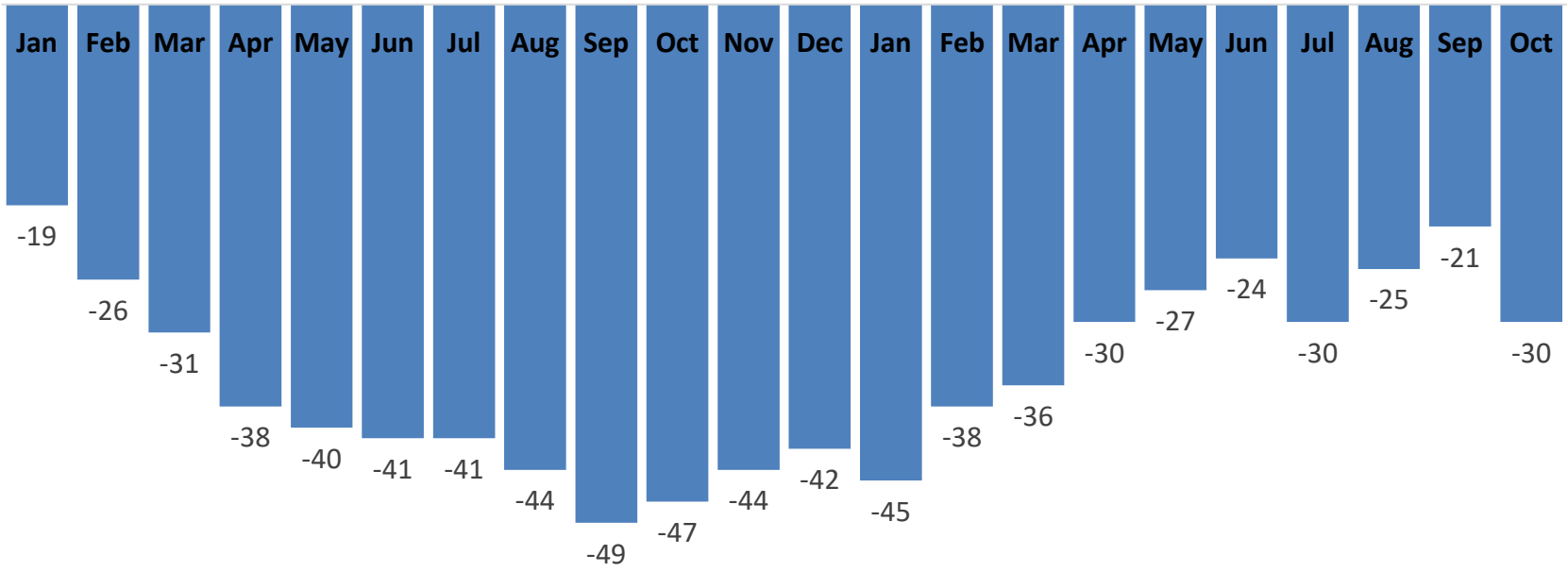
BREXI
T


CONSUMER
FOCUS ON
ANIMAL
WELFARE

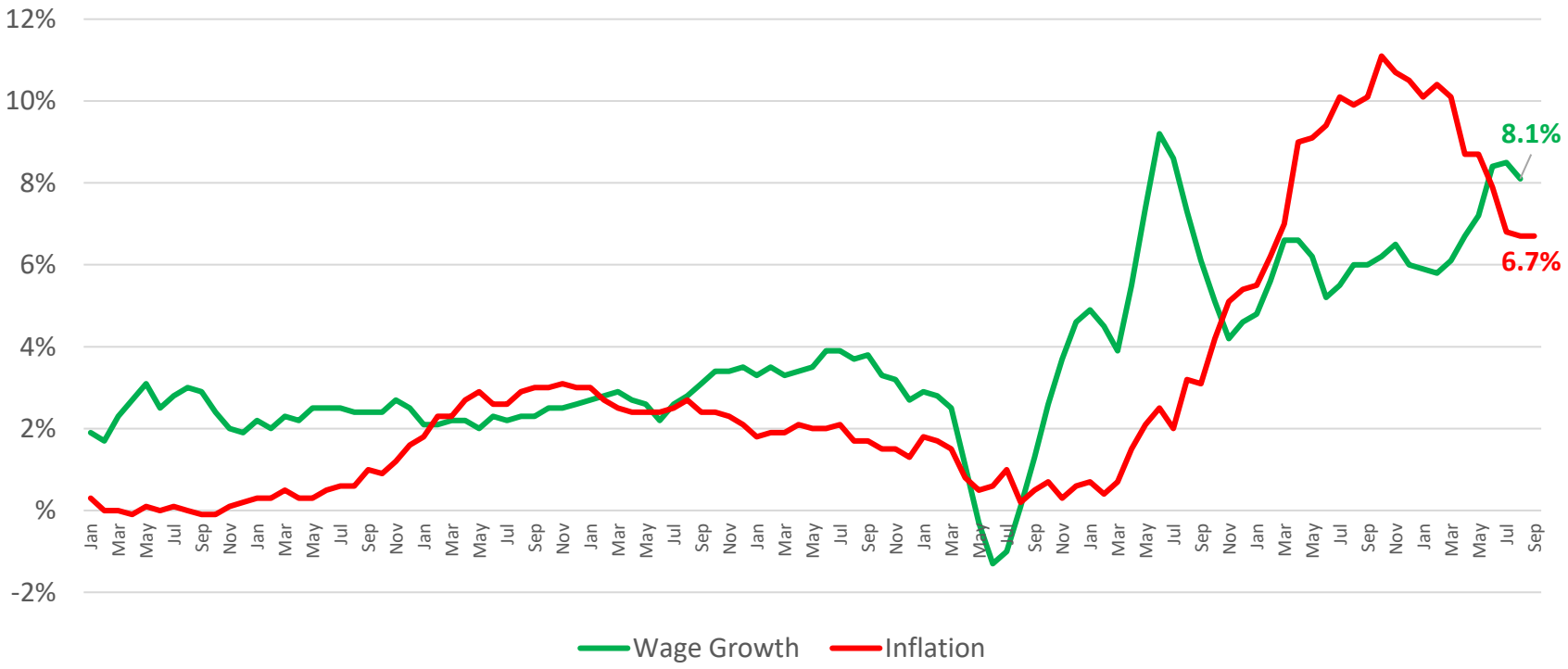

RETAILER
PRICE WARS
Aldi
Price
Match
NEVILLE'S

Consumer Confidence is (mostly) rising steadily, as inflation falls...



Source: GfK UK Consumer Confidence, to September 2023

Wage growth, although slowing, is now ahead of inflation



Source: ONS, October 2023

Consumers will continue to adapt their behaviour in the face of the financial challenge



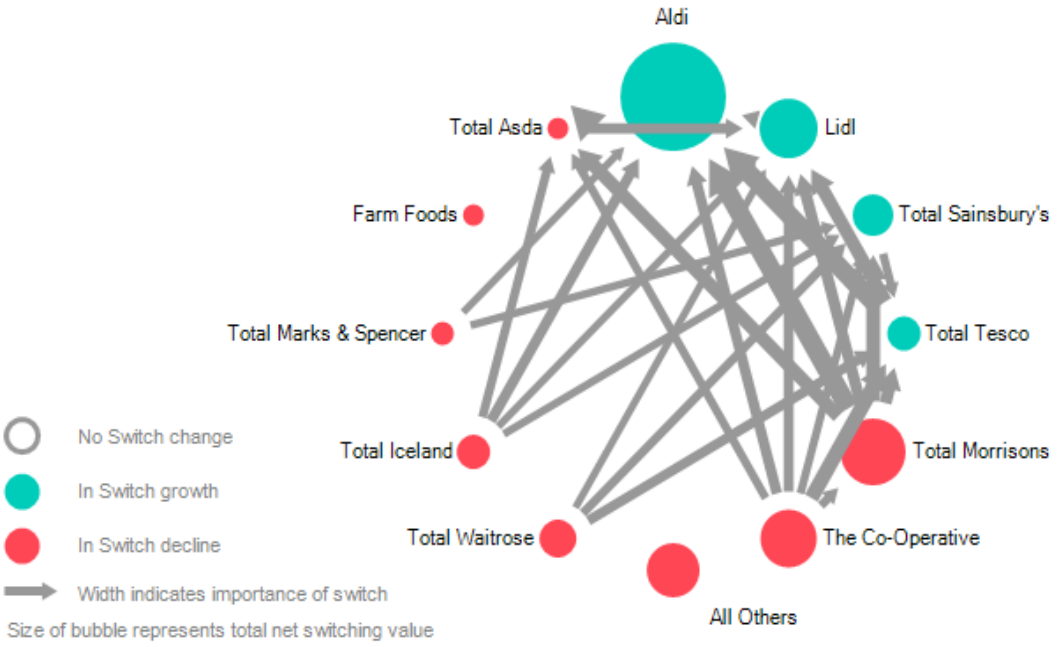




= do more of

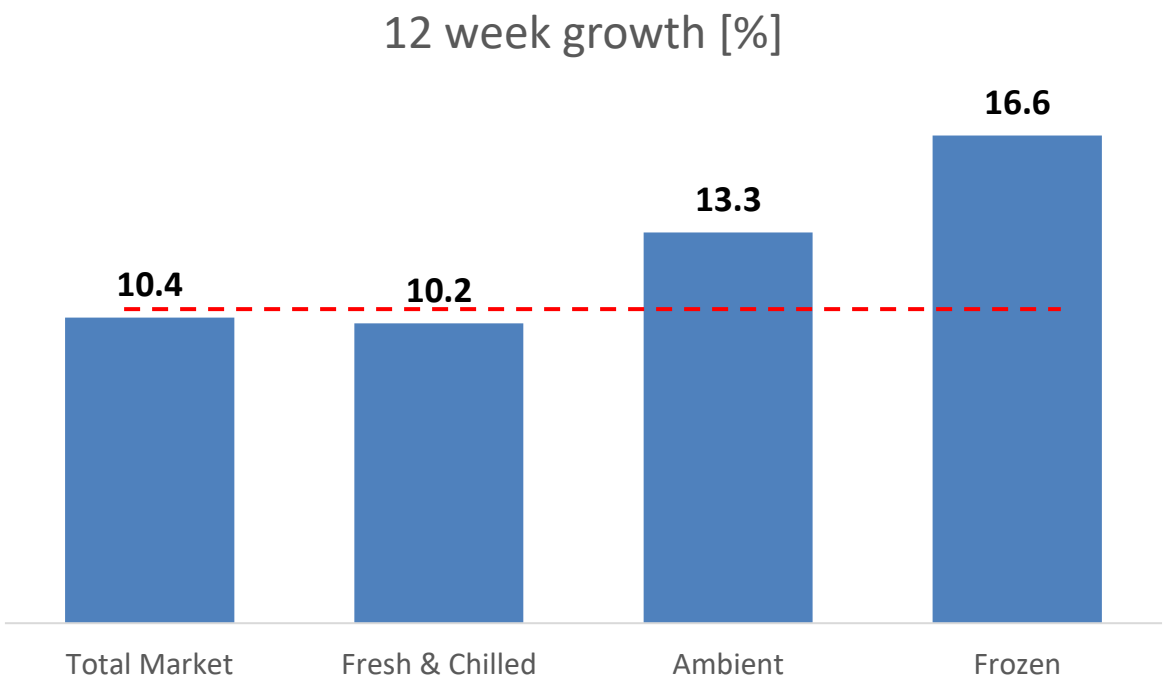
= do less of

Discounter growth is slowing but we still see shoppers moving to them



Source: Moy Park / Toluna survey of 300 respondents each in UK, France, Netherlands and Ireland, August 2023; Kantar Worldpanel, 12 weeks to 6th August 2023

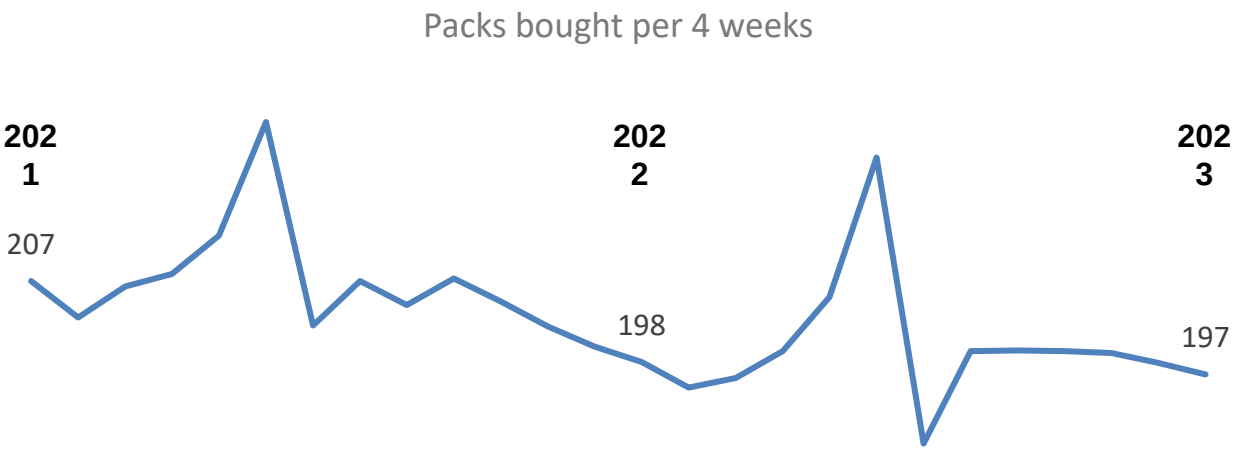
In the UK, Frozen is growing 60% ahead of the Total Market



Note that some categories not shown, specifically Healthcare and Alcohol, are growing significantly behind Total Market

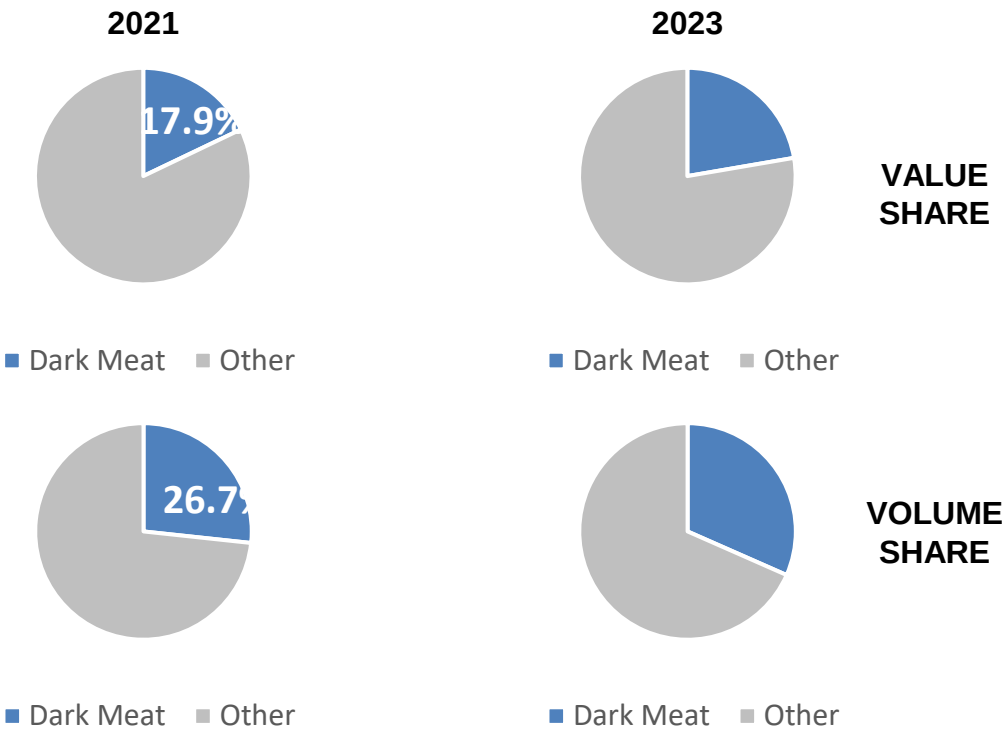
Source: Moy Park / Toluna survey of 300 respondents each in UK, France, Netherlands and Ireland, August 2023; Kantar Worldpanel, 12 weeks to 6th August 2023

Shoppers are buying considerably fewer packs → a couple of categories drop from the repertoire



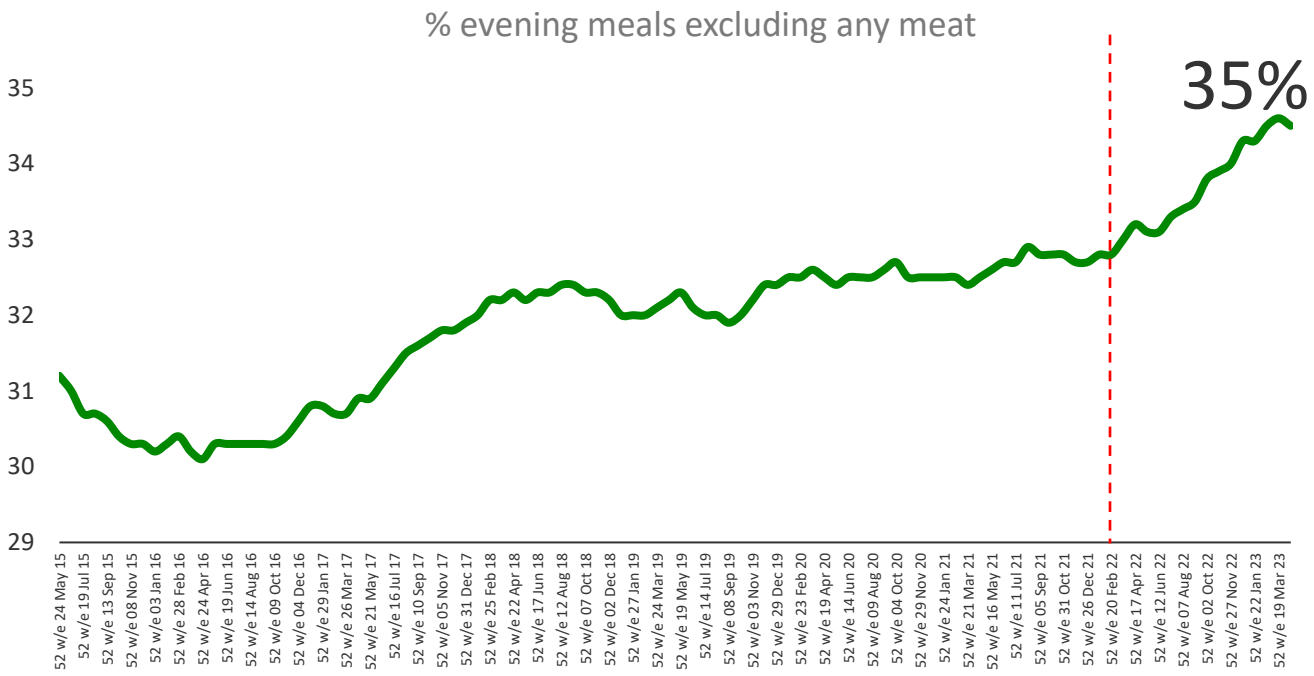
Source: Moy Park / Toluna survey of 300 respondents each in UK, France, Netherlands and Ireland, August 2023; Kantar Worldpanel, 4 weeks and 52 weeks to 6th August 2023

Trading down and buying cheaper products is a key tactic for many



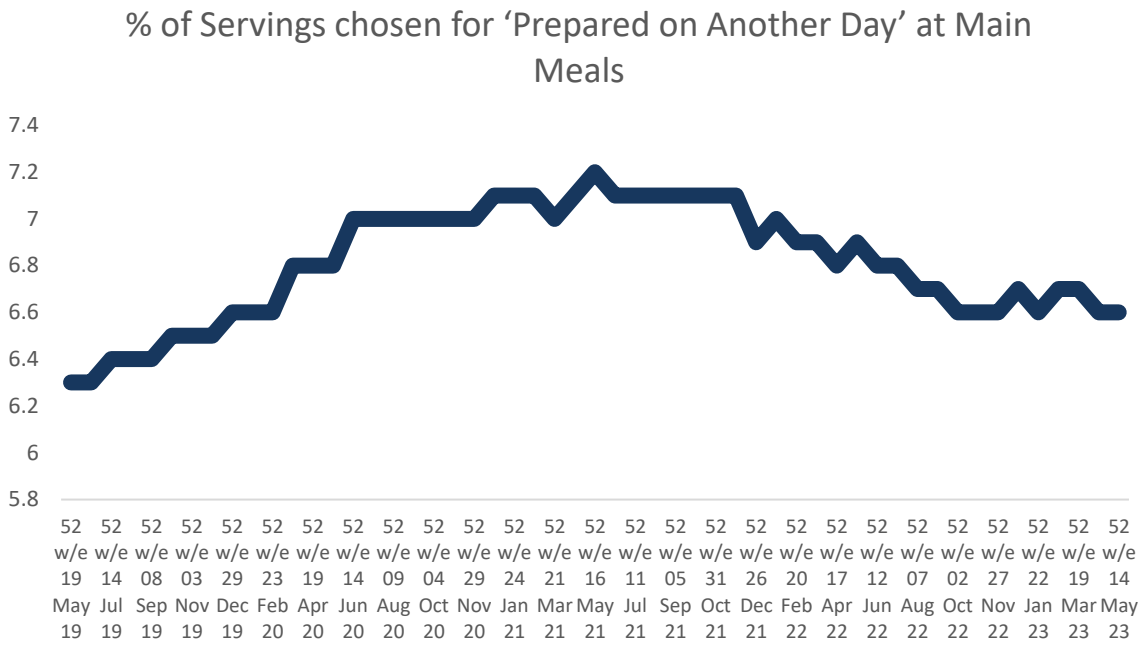
Source: Moy Park / Toluna survey of 300 respondents each in UK, France, Netherlands and Ireland, August 2023; Kantar Worldpanel, 12 weeks to 6th August 2023

Some consumers are using less meat in their meals



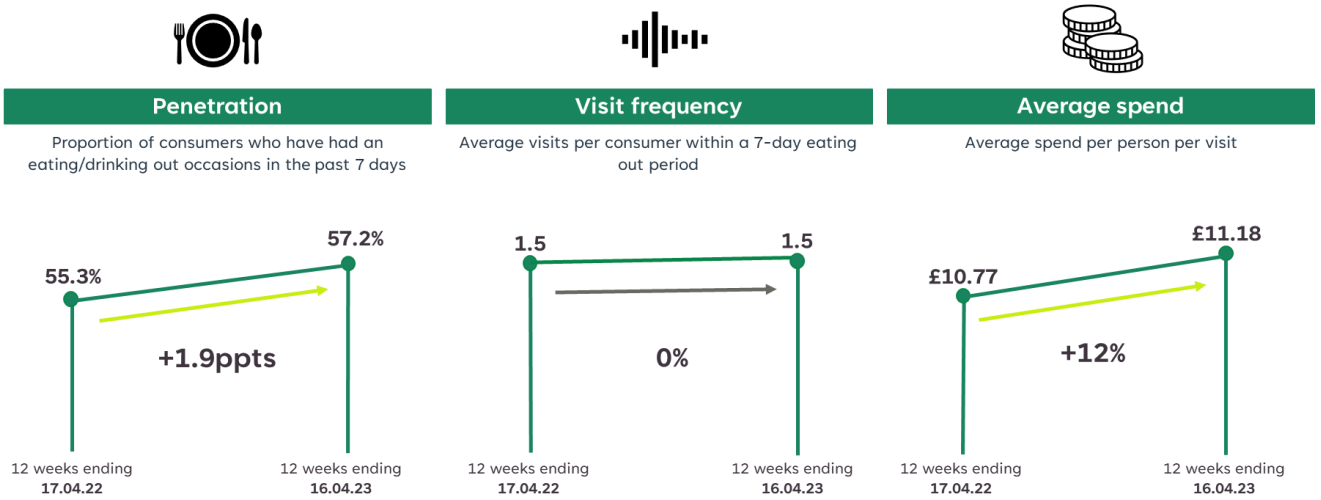
Source: Moy Park / Toluna survey of 300 respondents each in UK, France, Netherlands and Ireland, August 2023; Kantar Worldpanel, 52 weeks to 6th August 2023

Consumers moving to batch cooking may not be as big a factor as you might imagine...



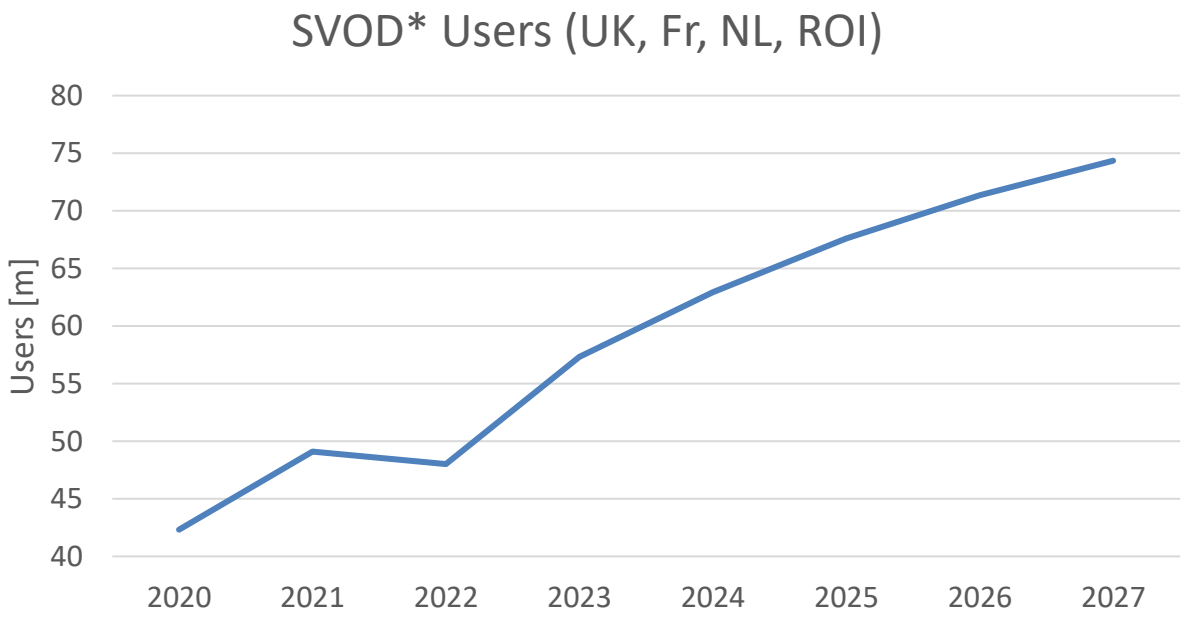
Source: Moy Park / Toluna survey of 300 respondents each in UK, France, Netherlands and Ireland, August 2023; Kantar Worldpanel, 4 weeks and 52 weeks to 6th August 2023

More people are eating out, but they are not eating out more often, and price rises mean that they are often prioritising cheaper venues



Source: Moy Park / Toluna survey of 300 respondents each in UK, France, Netherlands and Ireland, August 2023; Lumina Intelligence, Q2 Debrief, June 2023

Remember, behavioural changes in grocery and food service are not the only ways to save money!



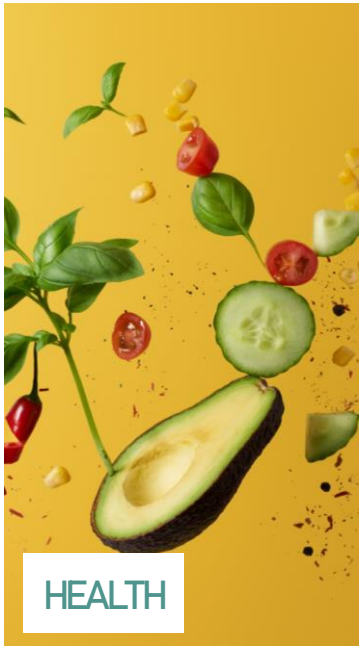
* SVOD = Subscription Video on Demand, eg. Netflix, Disney+

Source: Moy Park / Toluna survey of 300 respondents each in UK, France, Netherlands and Ireland, August 2023; Statista, SVOD Users, August 2023


VALUE


MULTIPLE CATEGORIES


SUSTAINABILITY


HEALTH


VERSATILITY


APPEAL


REPUTATION


FLAVOUR CARRIER

What does value look like?

What can you buy for £2?

90g sea bass fillet

52 week volume growth

12%

313g beef mince

3%

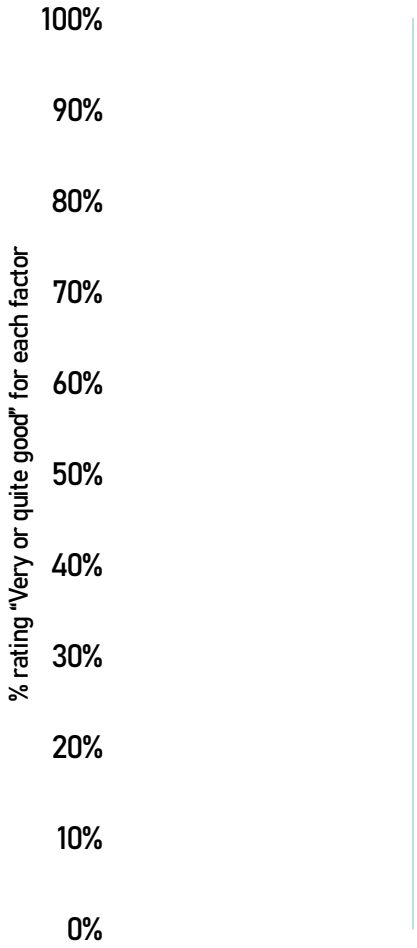
323g breast fillets

5%

800g drumsticks

7%

Source: All products bought from Sainsbury's 14th February 2023. Sea bass £22.22/Kg; Mince £6.40/Kg; Breast Fillet £6.19/Kg; Drumsticks £2.49/Kg.
Kantar Worldpanel, 52 weeks to 22nd January 2023



Source: Moy Park / Toluna survey of 523 respondents, (508 MFP buyers), February 2023

Let's look at health and sustainability...

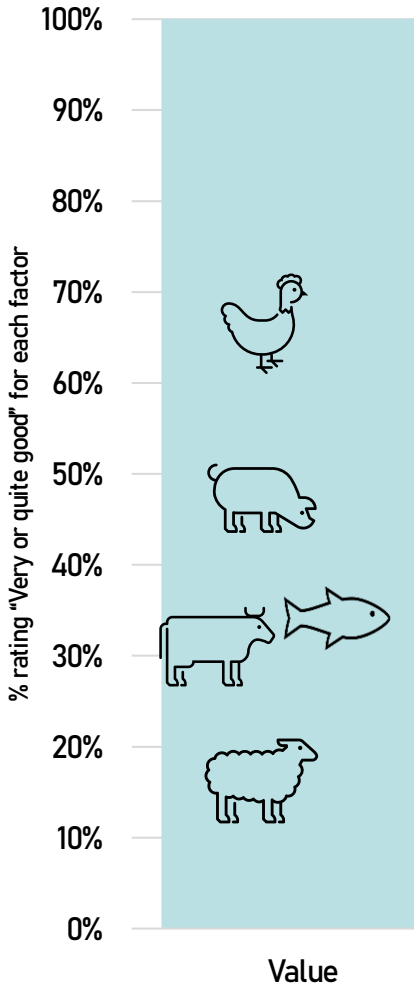
- **Red meat** — Lamb, beef
- **Pink meat** — Pork
- **White meat** — Chicken, turkey
- **Fish** — Cod, salmon
- **Meat alternatives** — Lamb, beef
- **Vegetables**

48%
Eat everything!

4%
Vegan / fully veggie

37%
Reducing

Source: Moy Park / The Mix Research, 2018; Moy Park / Toluna survey of 518 respondents, January 2023



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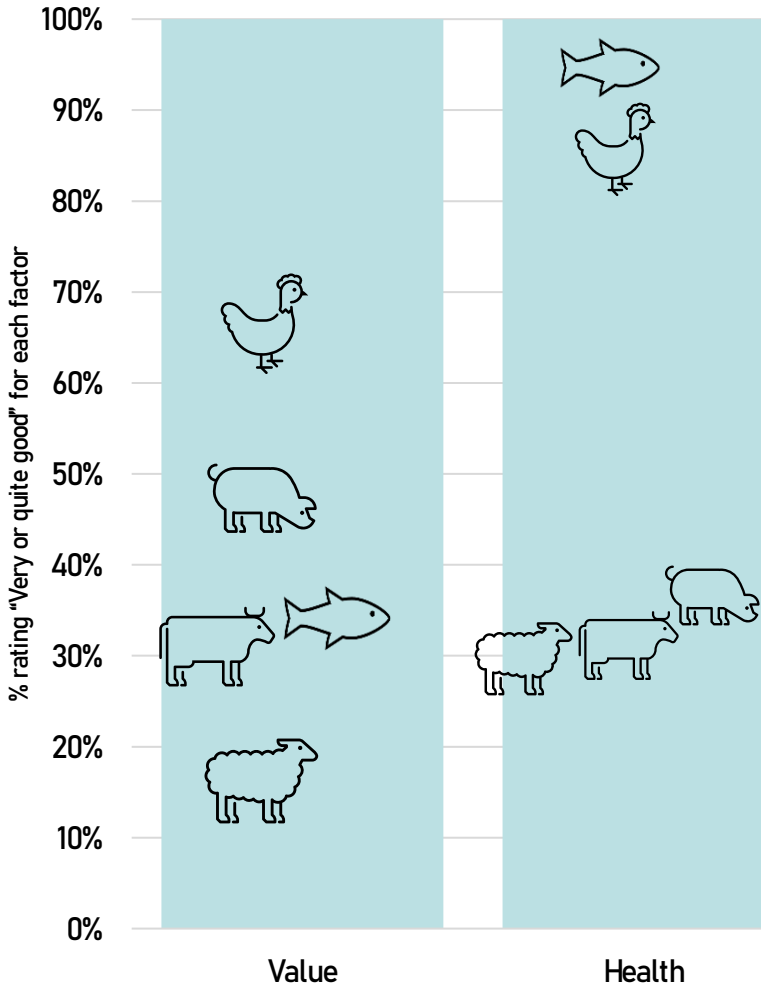
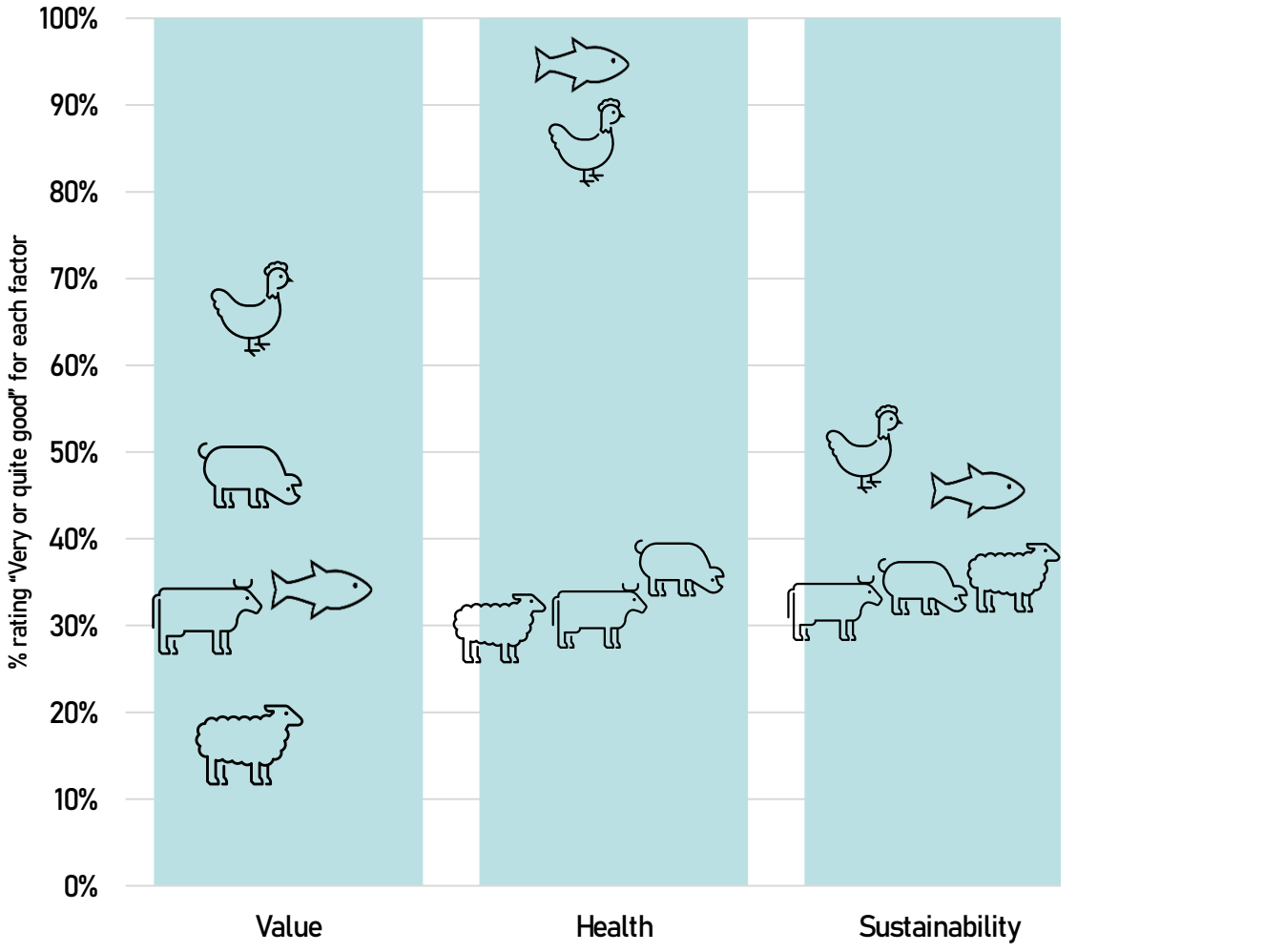
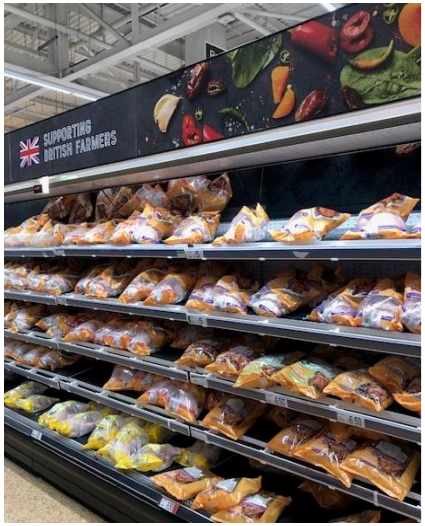


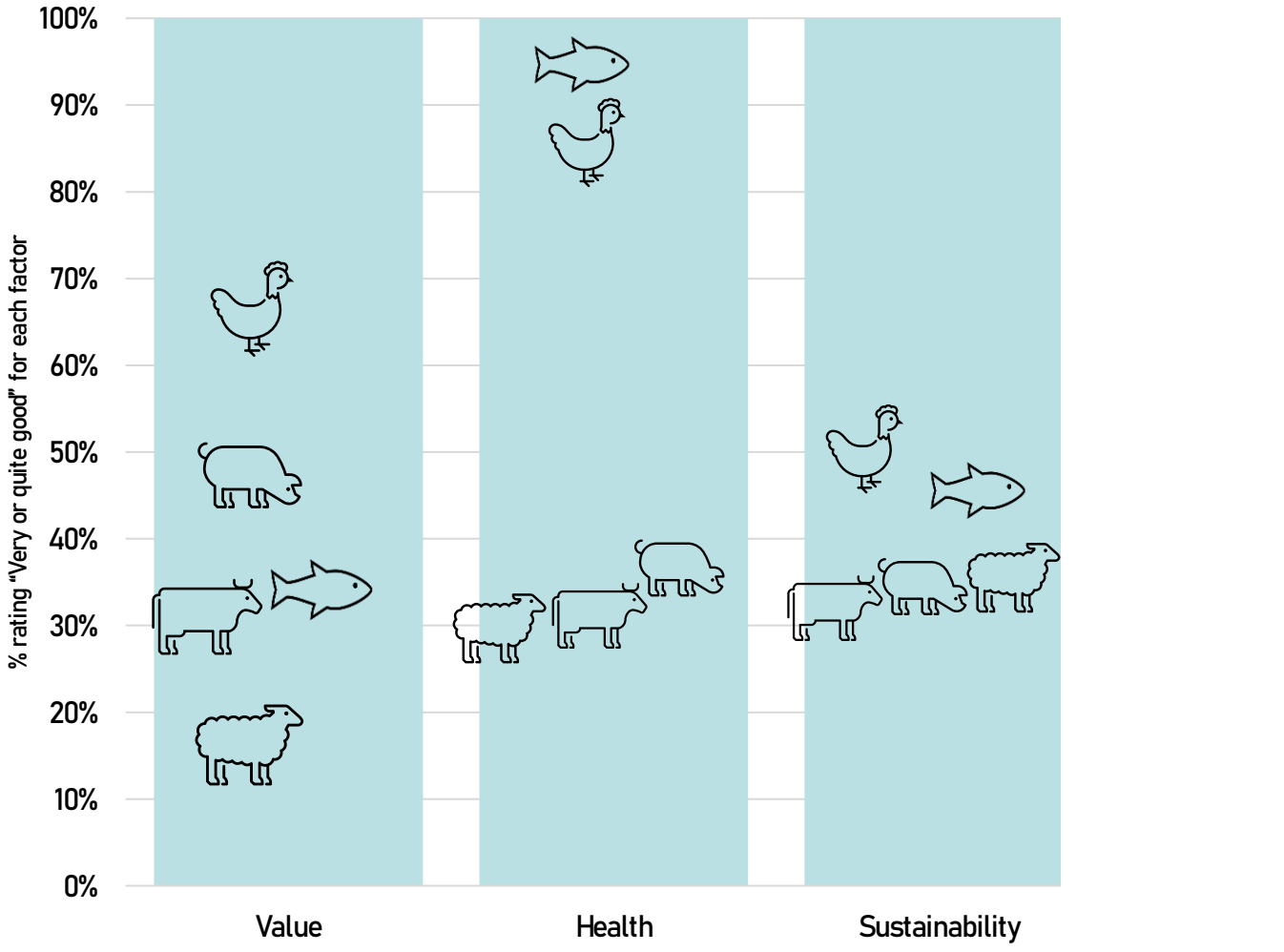
Source: Moy Park / Toluna survey of 523 respondents, (508 MFP buyers), February 2023



Source: Moy Park / Toluna survey of 523 respondents, (508 MFP buyers), February 2023

Chicken appeals to lots of different occasions and consumer groups





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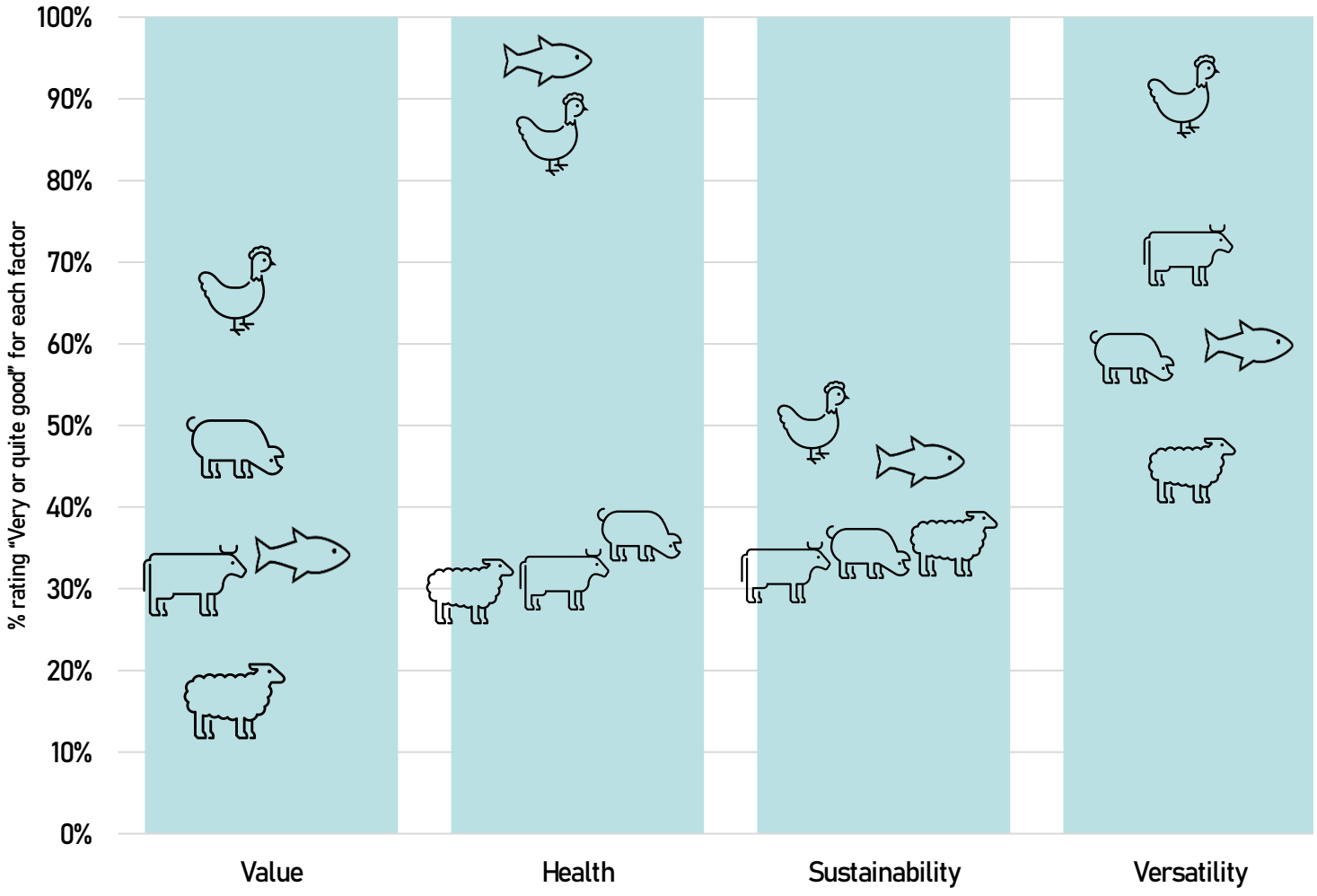

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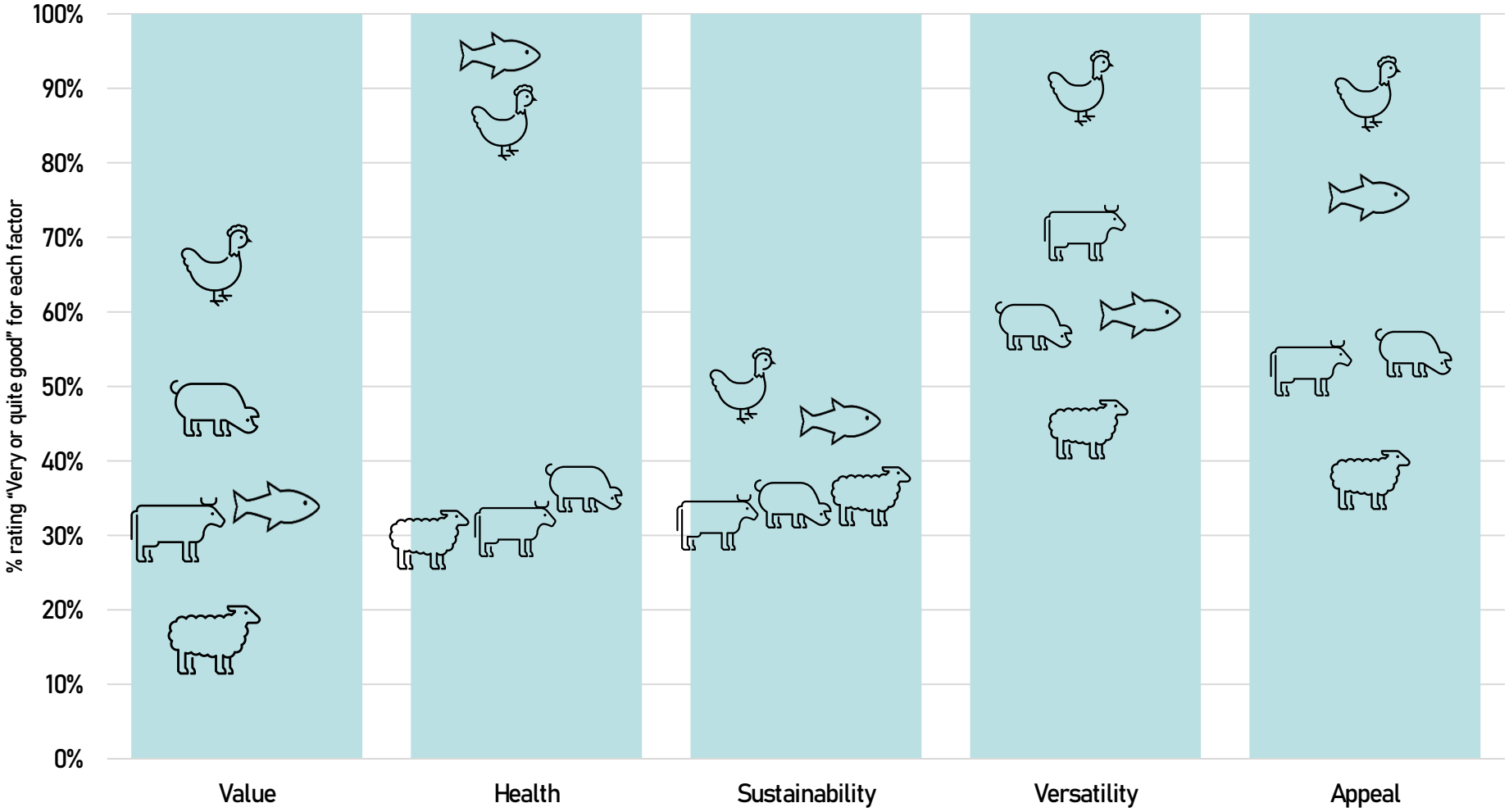
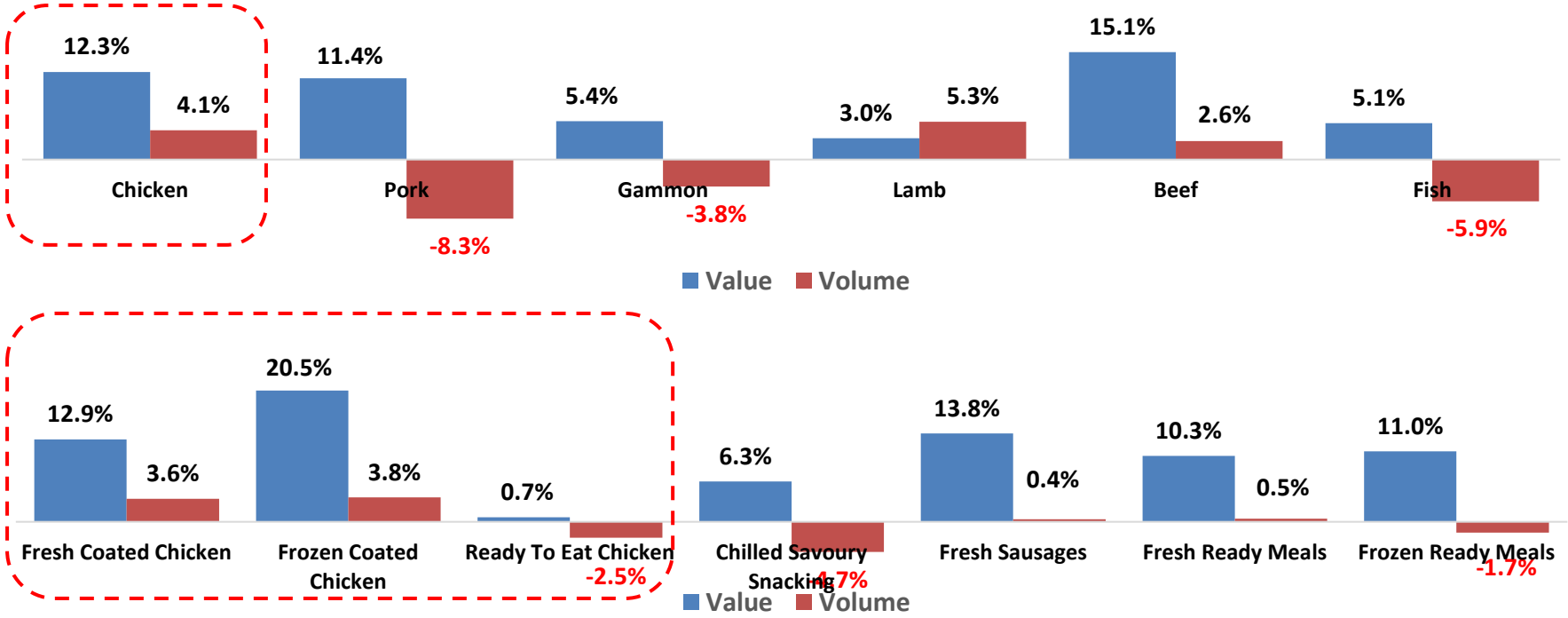


Source: Moy Park / Toluna survey of 523 respondents, (508 MFP buyers), February 2023

Inside the shopper mindset

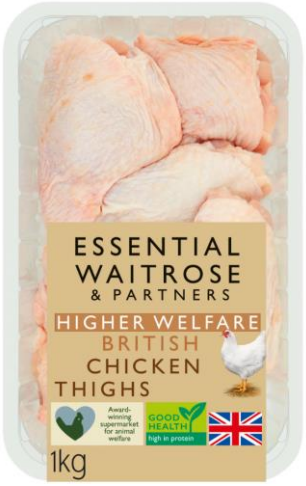
Source: Waitrose.com; Moy Park / Toluna survey of 519 respondents, September 2022.
Numbers show % of respondents rating each factor as a Top 3 consideration factor when buying fresh MFP

All categories see value growth driven by high levels of inflation.
Many also see a volume challenge, although chicken performs well in this regard

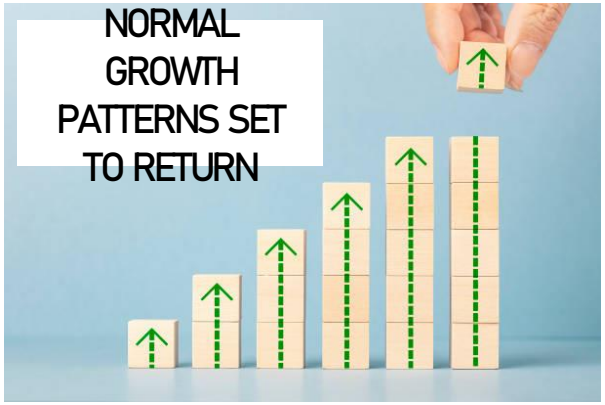


Source: Kantar Worldpanel, 12 weeks to 3rd September 2023

Looking ahead: a couple of good bets



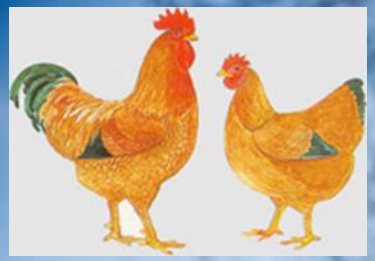
Summarising....



Jason Winstanley,
Head of Research & Insight,
Moy Park

jason.winstanley@moypark.com

Jason Winstanley | LinkedIn

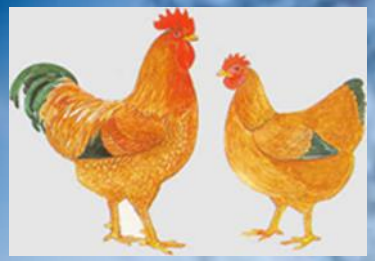


Poultry Industry Education Trust

Developing People for the Poultry Industry

2023
NORTHERN IRELAND POULTRY CONFERENCE

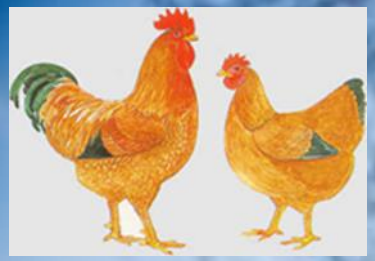
MORNING SESSION DISCUSSION
CHAIRED BY DAVID BROWN



Poultry Industry Education Trust

Developing People for the Poultry Industry

LUNCH IN SHANNON HALL
& TRADE STANDS
12:30 – 14:00



Poultry Industry Education Trust

Developing People for the Poultry Industry

2023 NORTHERN IRELAND POULTRY CONFERENCE

AFTERNOON SESSION CHAIRMAN NIGEL SWEETNAM CHAIRMAN IFA POULTRY COMMITTEE

IFA

AGRI-FOOD
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INSTITUTE

Leading | Protecting | Enhancing

Meeting the challenges of environmental sustainability

Prof Elizabeth Magowan

31st October 2023

afbini.gov.uk

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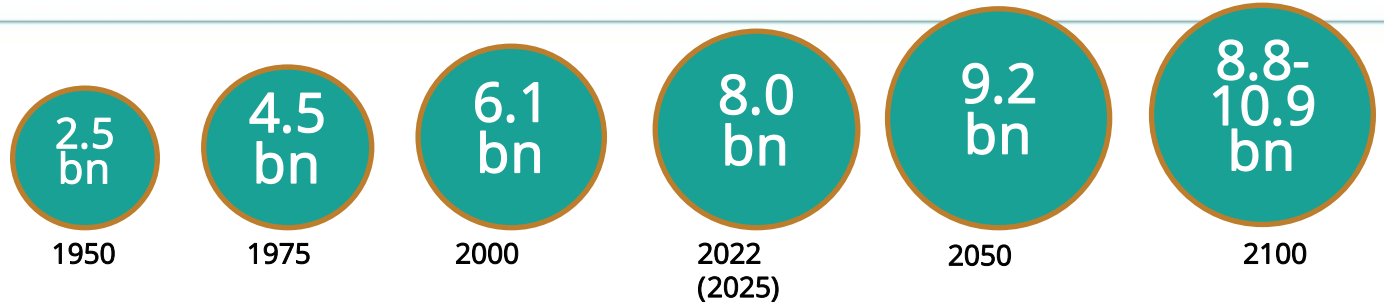

Demand for energy and (real) protein from meat, milk:

- population growth
- economic growth

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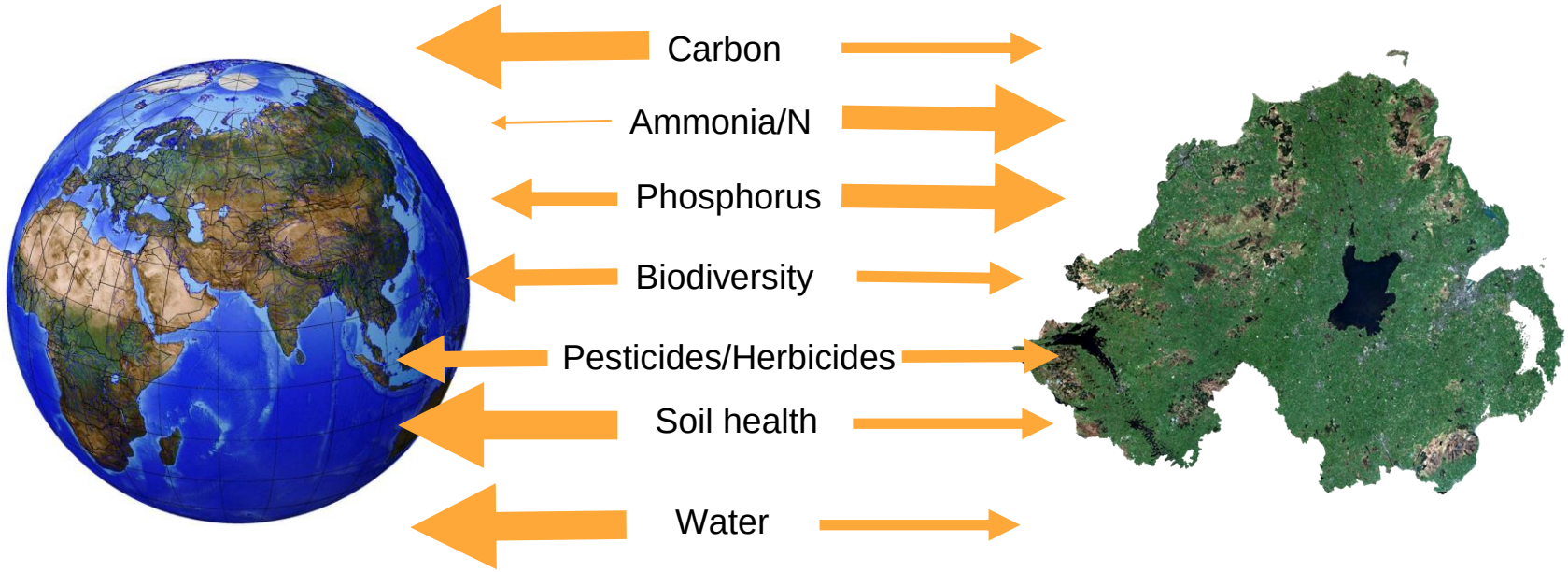
Environmental – Global and Local pressures



Targets in place for most

Need meaningful targets for Biodiversity and Soil health

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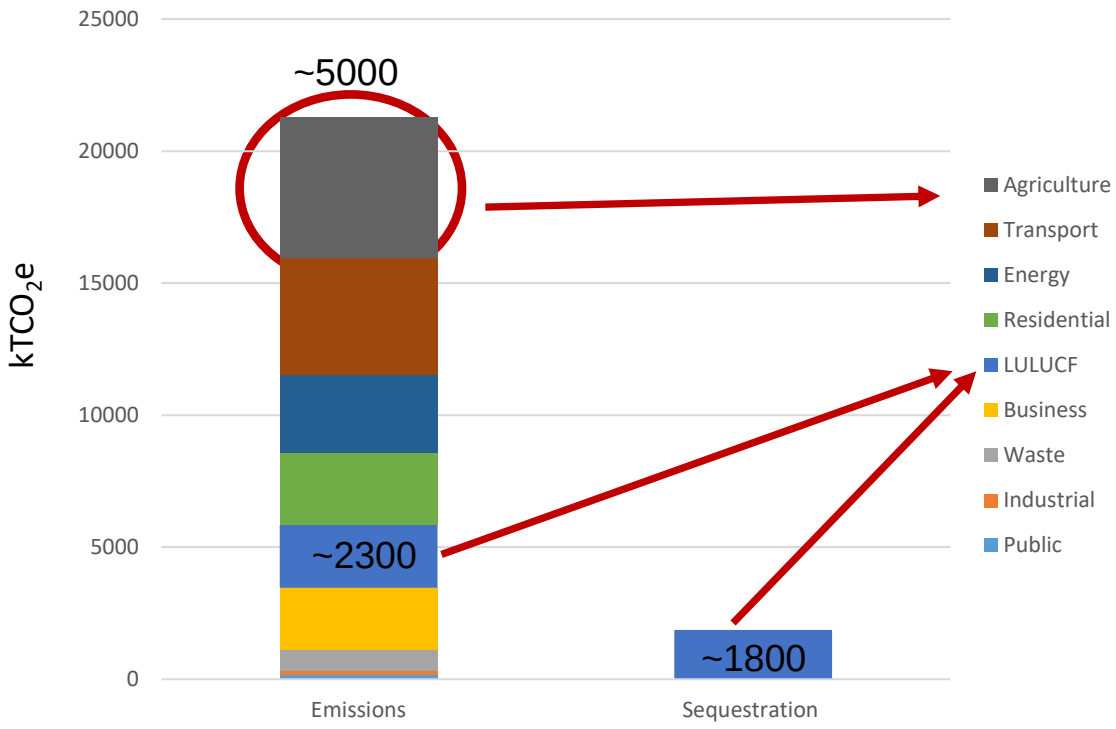
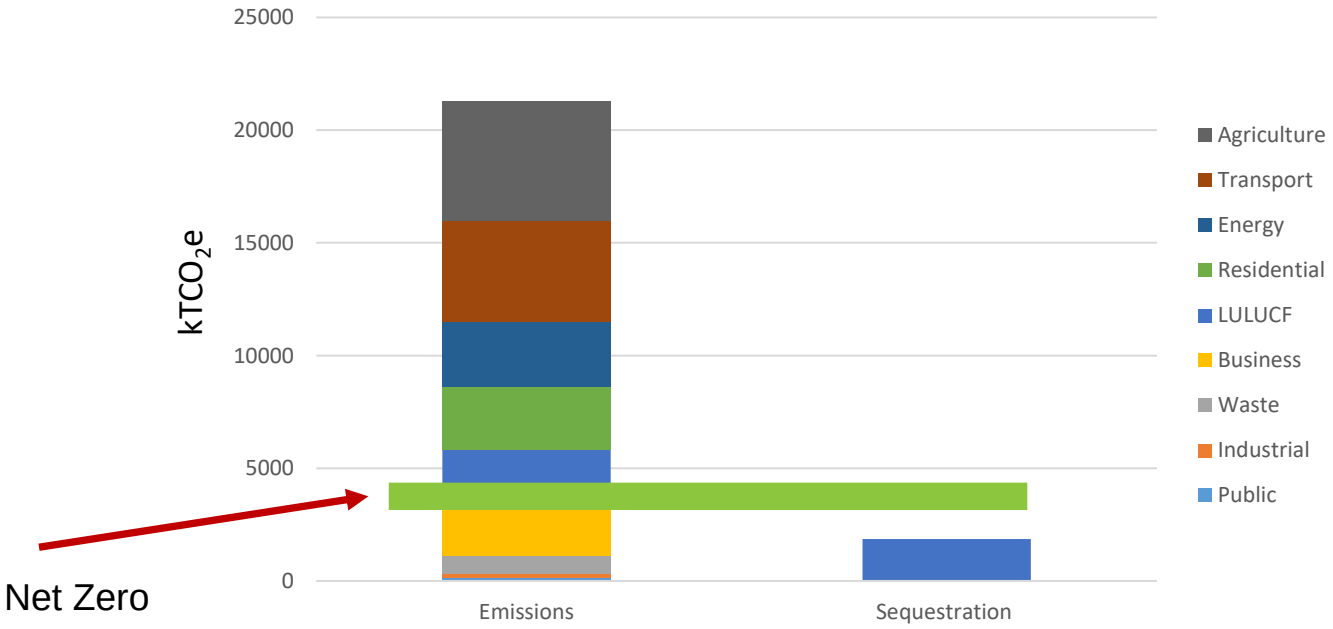
Sectoral profile of emissions and sequestration in NI



Net Zero in 2050:

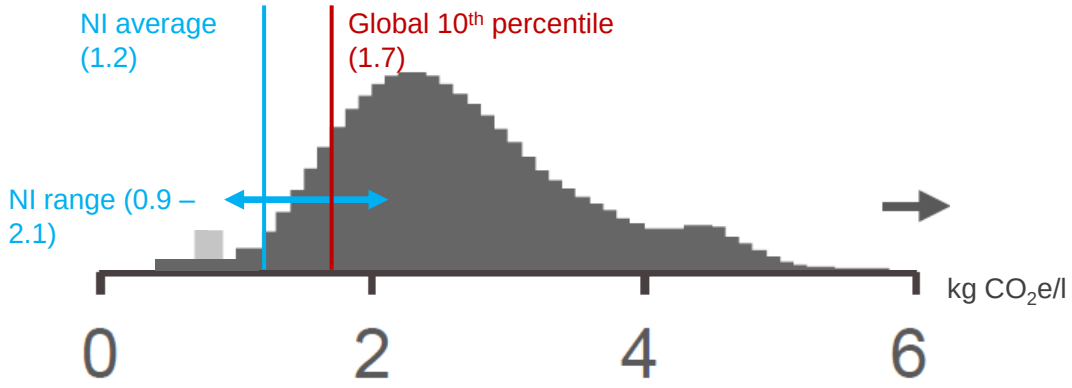


AGRICULTURE AND LULUCF DRIVERS

Agriculture Inventory ($KTCO_2e$)	
Cattle & Sheep enteric methane	2991
Manure Management (and applied to soils)	786
Agri/Forestry/Fishing off road	484
Inorganic Fertiliser	392
	4643
Total Ag	**5323**
These contribute 87% of Ag emissions and Methane = 56%	

LULUCF ($KTCO_2e$)	
Grass to Settlement	+828
Grass to Crops	+622
Crops to Crops	+486
Settlement to Settlement	+206
Wetland to Wetland	+101
	2243 (94% of)
Total emitted	**2281**
Crops to Grass	-408
Forest as Forest	-583
Grass as Grass	-690
	1681 (90% off)
Total sequestered	**-1866**
Net	+515
LULUCF needs to be a sink – not a source	

Global distribution of carbon footprint of milk vs NI average



NI's C footprint – v competitive at a global level

Poore and Nemecek (2018), DAERA (2017), DAERA (2022)

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Ammonia and Phosphorus

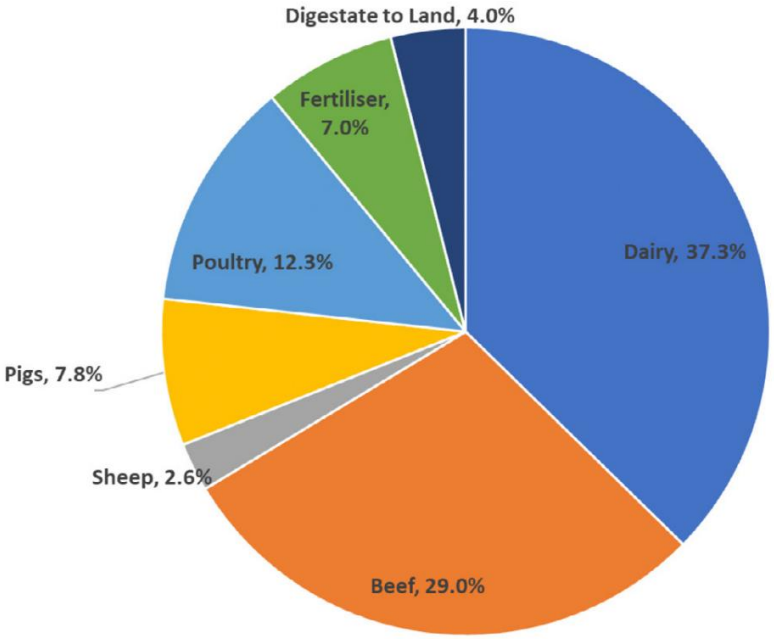

Figure 6. NI agricultural ammonia emissions (2020) by livestock and fertiliser category.[22]

DAERA Draft Ammonia Strategy Consultation

EU Nitrates Directive (2004)
P Regulations (2006)

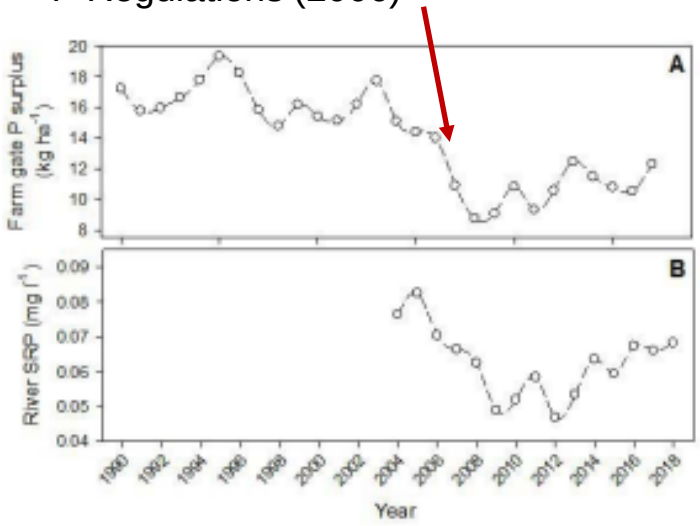

Figure 1: Changes in the national farm gate P surplus and average soluble reactive P in Northern Ireland Rivers

Target = Under 5 kg/ha

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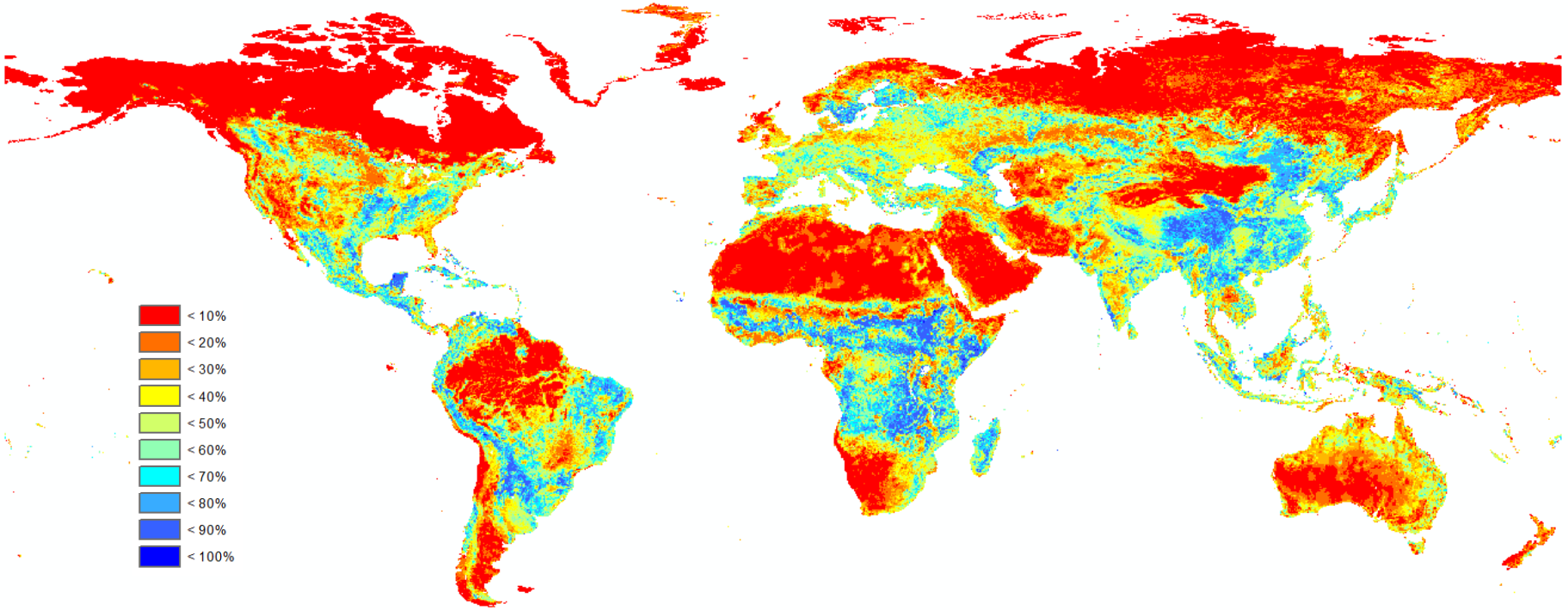
RePhOKUs

Suitability for arable conversion:



Čengić *et al*. (2023). Similar results from Ramankutty *et al*. (2002), Zabel *et al*. (2014), Schneider *et al*. (2022) and others.

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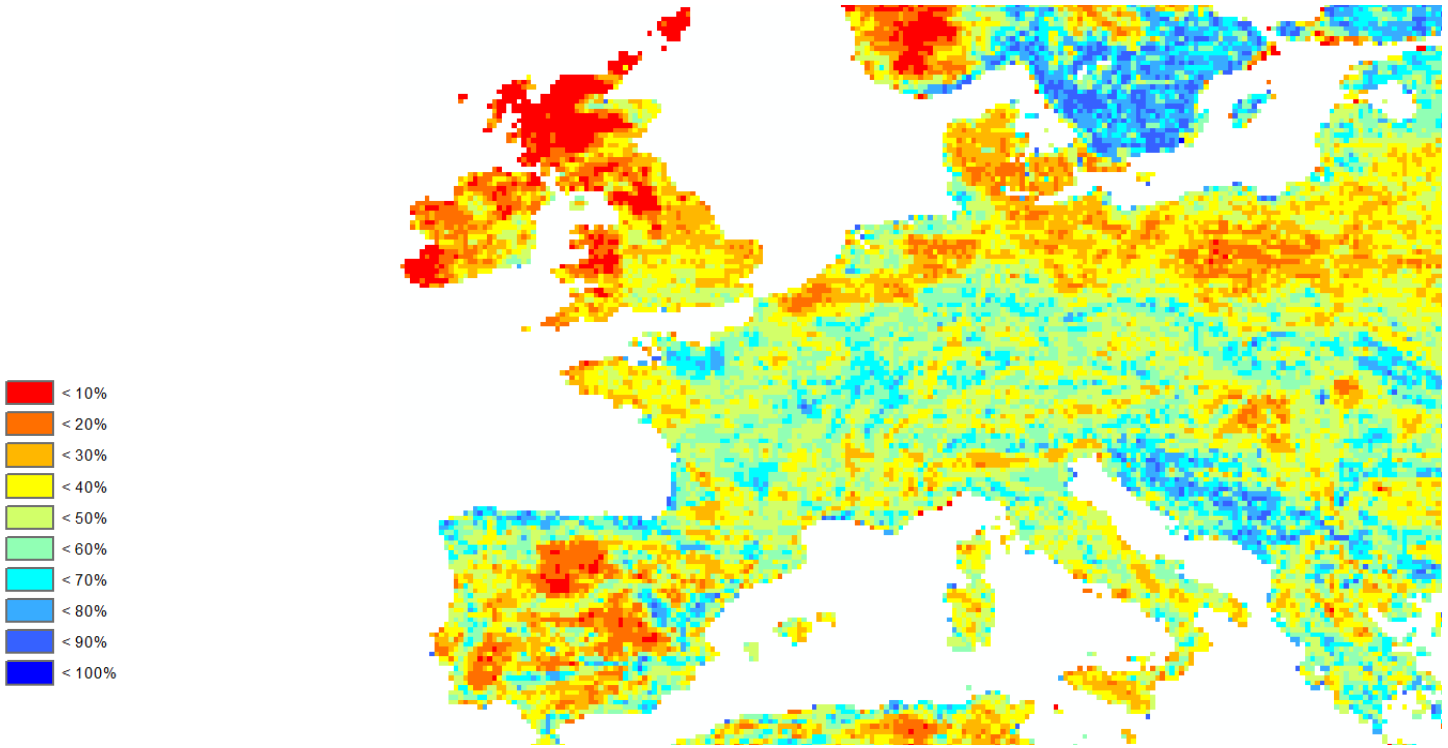
Suitability for arable conversion:



Čengić *et al*. (2023). Similar results from Ramankutty *et al*. (2002), Zabel *et al*. (2014), Schneider *et al*. (2022) and others.

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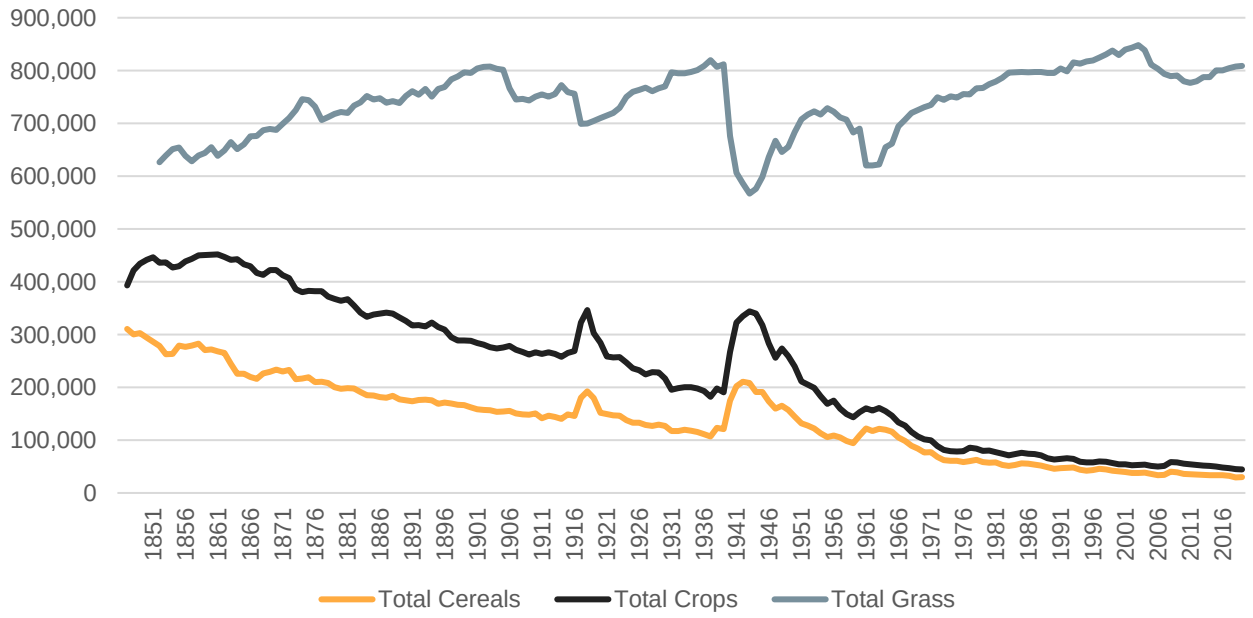
Ha of grass, crops and cereal from 1851 in NI



Opportunity for more incorporation of arable, co-cropping, high-value crops, peas and beans?

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10 YEAR ANNIVERSARY 2006-2016

Solutions for farming:

Measure, Monitor, verify – at scale

SOIL NUTRIENT HEALTH SCHEME

Carbon Benchmarking

Genetics

Food Futures Tool

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Solutions for farming: Nature Based at scale

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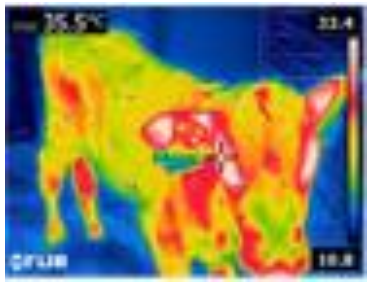
Solutions for farming: Technical Based at scale

Carbon
Tariffs



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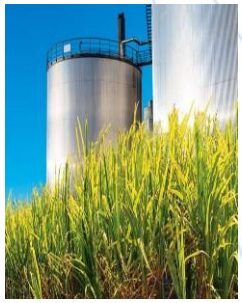
Carbon Removal Strategies such as:

Forestry / agroforestry

Soil C sequestration

Biochar application

Enhanced weathering



Bio-energy with Carbon Capture and Storage

Direct Air Capture & Carbon Storage

Considerations:

- 26,000 people to influence
- Significant variation – one size doesn't fit all
- Pace of change
- Balance between regulations vs initiatives vs knowledge
- Market forces…
- Opportunity for circular systems – energy and transport

What is the 'Safe Operating Space' for NI to support the environment, food and energy security and society's wellbeing?

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Agri-Food and Biosciences Institute 10 YEAR ANNIVERSARY 2006-2016

NI Poultry Systems Ammonia Modelling

- Two representative NI poultry systems had their ammonia emissions estimated:

	1. Standard Broiler System	2. Multi-Tier Free-Range Layer System
Number of Animals	**45,000 Broilers**	**16,000 Layers**
Housing Type	**Mechanically ventilated litter system**	**Multi-tier system with belt removal of litter – 20% of time spent outdoors**
Manure Storage	Litter heap	Litter heap
Manure Spreading	Broadcast (to grassland)	Broadcast (to grassland)

- Three ammonia reduction measures were then applied:

Genetic Improvement
(5% FCR Improvement)

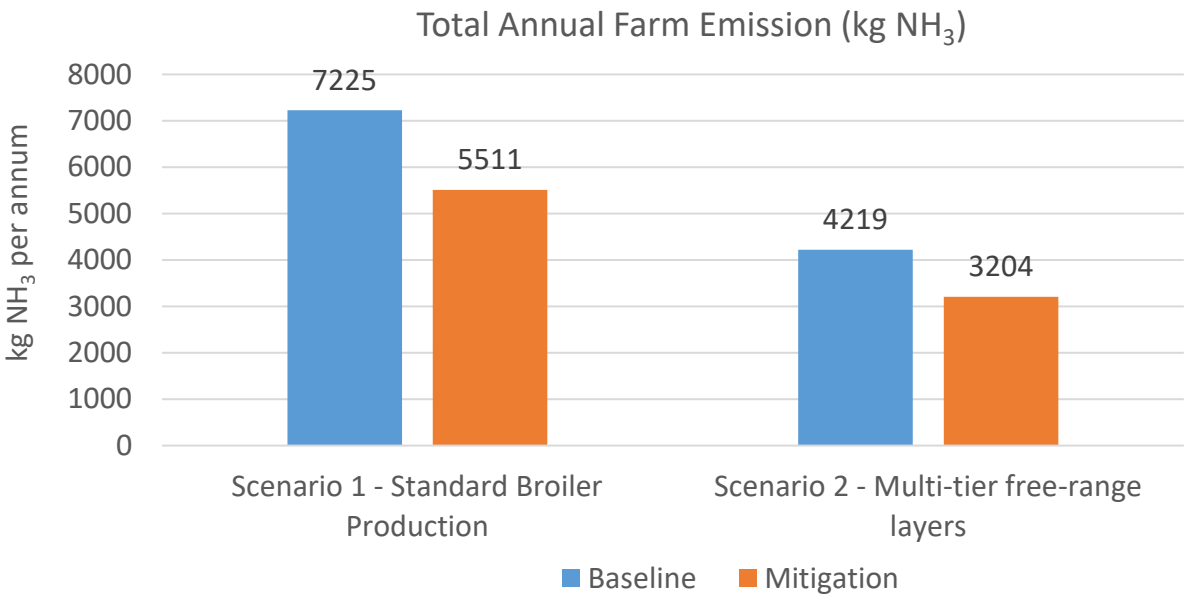
+

Reduce Dietary Crude Protein
(1% Reduction)

+

Litter Drying
(30% Reduction in house NH_3)

Poultry Sector Ammonia Emission Reductions



Ammonia reduction for both mitigation scenarios

24%

ROTHAMSTED RESEARCH

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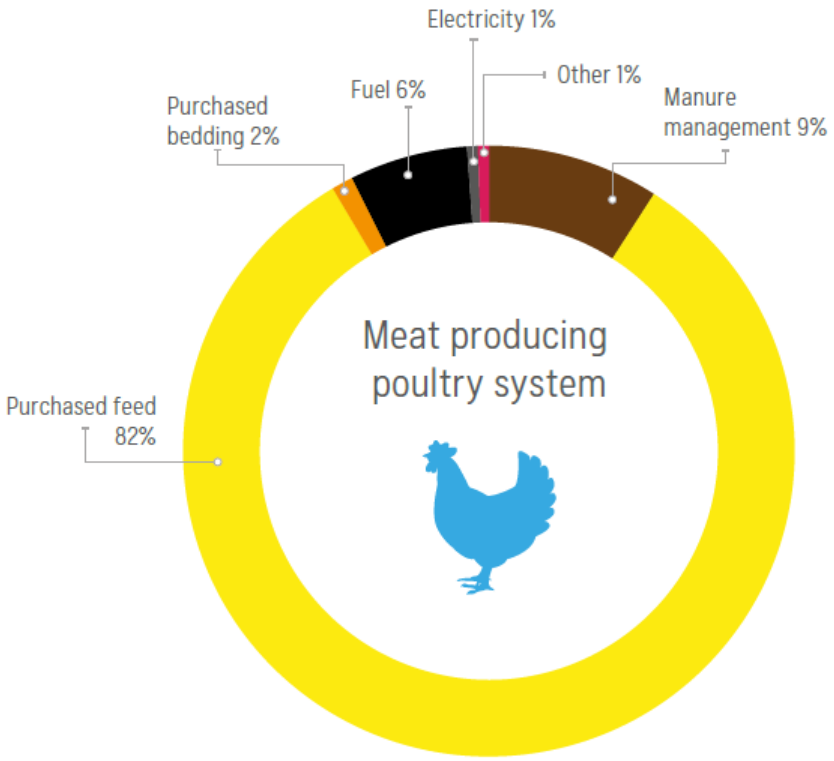
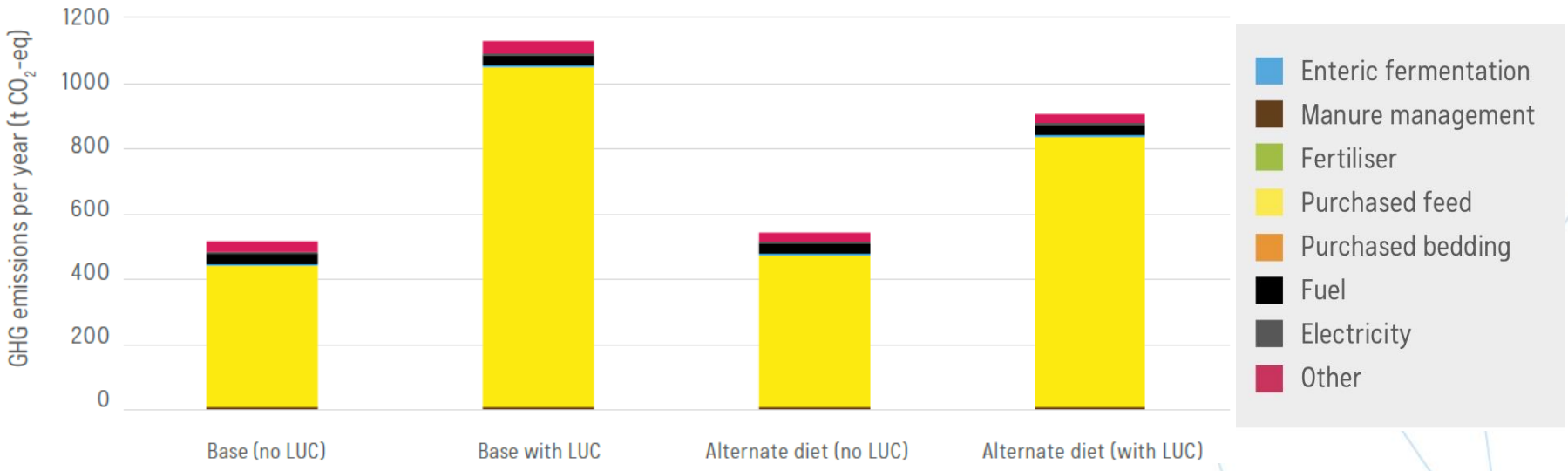
Contribution of activities to the overall carbon footprint (kg CO_2eq/kg deadweight) of a broiler farm



NET ZERO & LIVESTOCK

CIEL

Total annual emissions and proportions from different feed inputs and practices in the broiler system considered

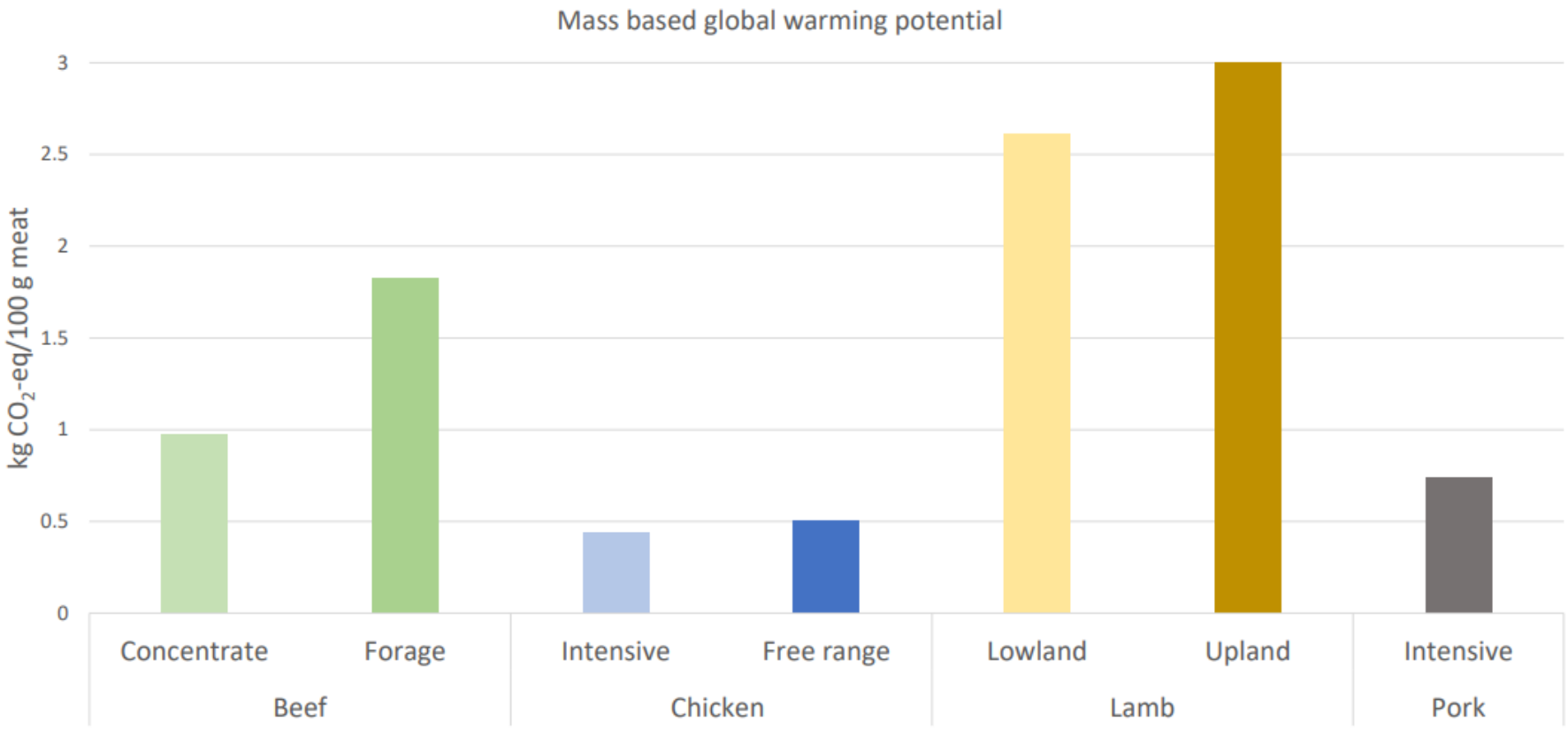


Land use change – largest impact
Home grown/non land use change supports climate mitigation

NET ZERO & LIVESTOCK

CIEL

Baseline: conventional GWP (mass-based)



Chicken performs best

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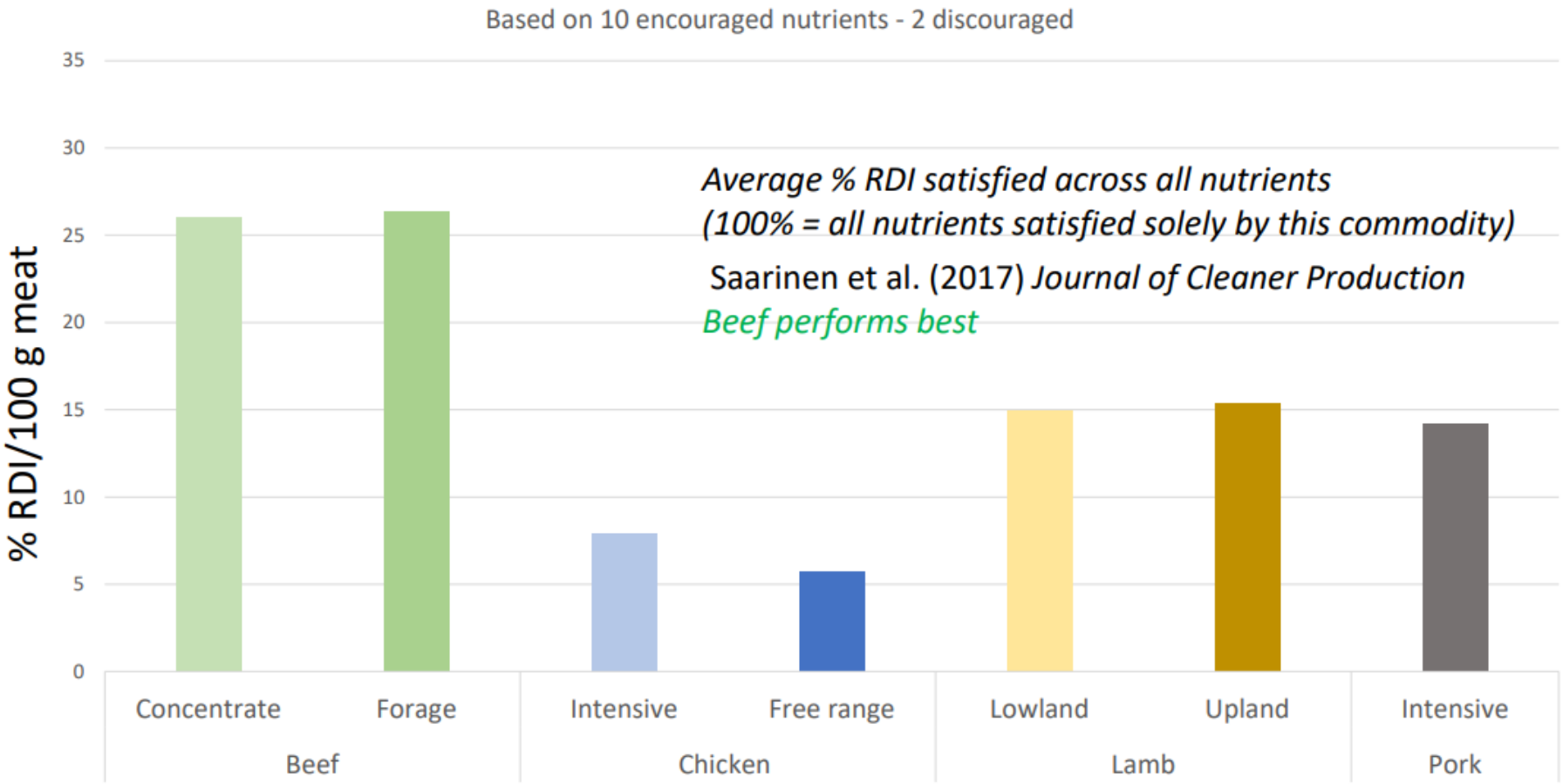
Accounting for nutritional quality: nutrient index (NI)



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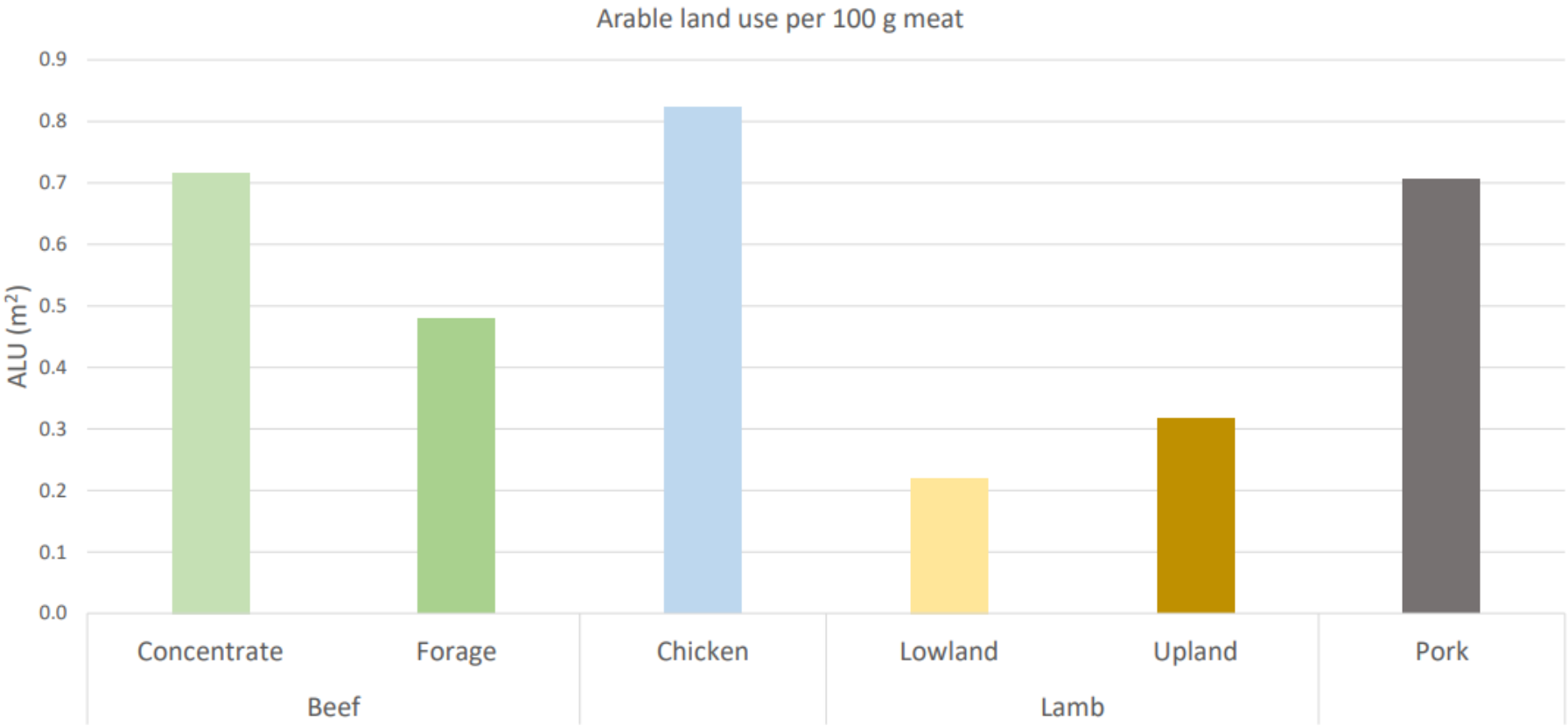
Accounting for other metrics: arable land use (ALU)



Lamb performs best

Wilkinson and Lee (2018) *animal*

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Future key challenges - Feed vs food & Water Footprint

Challenge is to create protein from local, soilless and circular alternatives:

- Genetically modified/engineered protein crops and alternative cultivation methods
- Cellular agriculture
- Former foods, food waste and industry by products and waste streams
- Animal by-products and insects

The Future of Animal Feed
Dr Georgios Pexas, Prof Ilias Kyriazakis, Prof Bob Doherty
DOI : https:doi.org//10.46756/sci,fsa.gzi586

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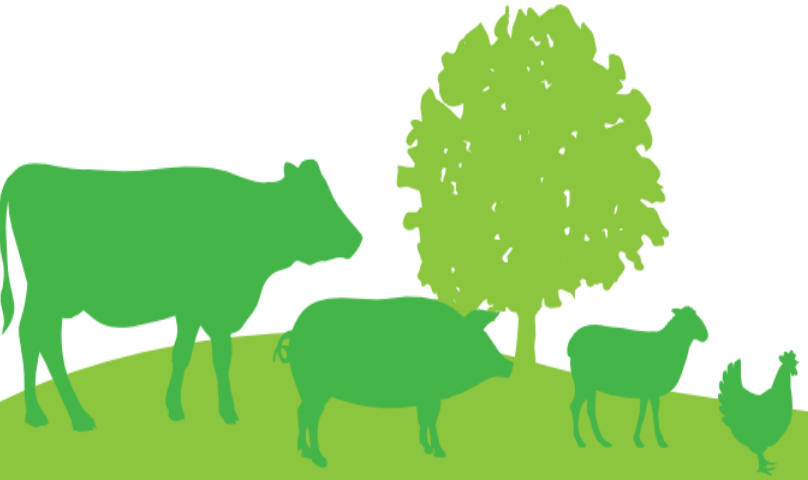
Conclusions

NI Livestock production provides vital nutrients, in support of human health, from a range of land types, many of which are not suitable for production of food for direct human consumption

However the challenge of ‘environmental sustainability in the livestock sector, especially ruminants is significant

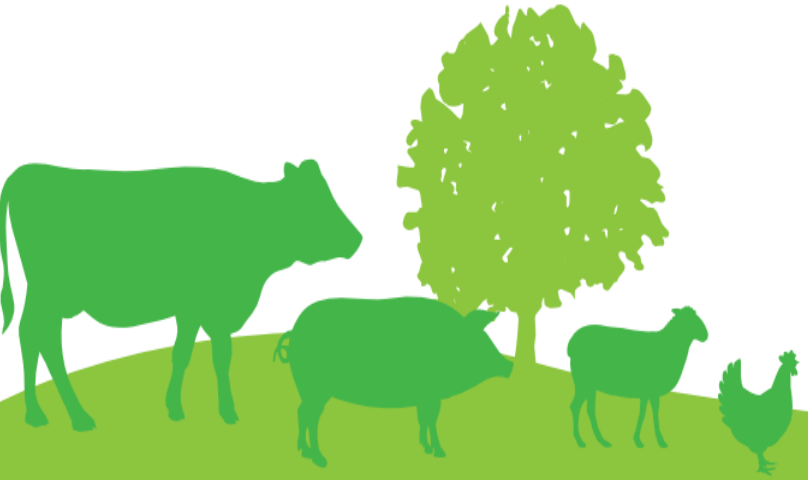


But

Innovation from science and industry has the potential to deliver and build on the foundations being laid presently

Accelerated adoption of current known technologies will kick start the industry on the road to net zero and

Livestock farming can collaborate with other industries and sectors to achieve environmental sustainability, and these collaborations should be recognised



Questions? After last paper at Q&A

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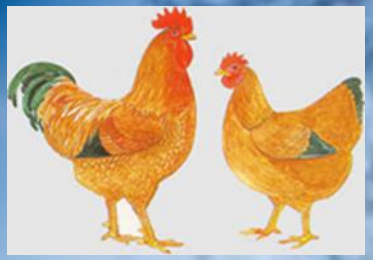


Poultry Industry Education Trust

Developing People for the Poultry Industry

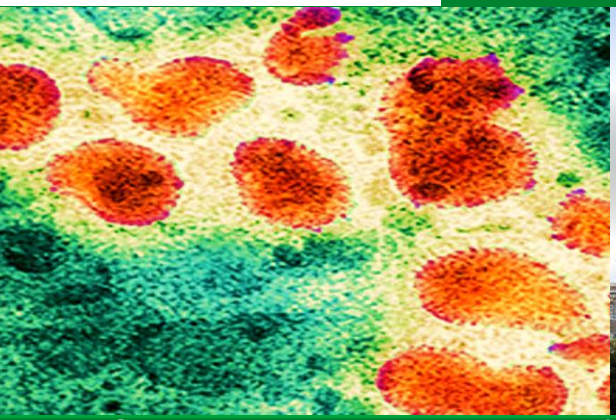
2023 NORTHERN IRELAND POULTRY CONFERENCE

AFTERNOON Q&A
CHAIRED BY NIGEL SWEETNAM

Feirmeoirí Aontaithe na hÉireann
The Irish Farmers' Association
IFA

Animal & Plant Health Agency

Meeting the challenges of notifiable poultry diseases



Prof Ian Brown, Animal and Plant Health Agency-Weybridge

Northern Ireland Poultry Industry Conference

Cookstown, 31/10/23

Animal & Plant Health Agency

Animal & Plant Health Agency

HPAI disease impact

- Increasingly important disease of poultry
  - Societal impact in many developing countries
  - c2 billion poultry culled/killed due to H5N1, H5Nx
  - >$50?? billion to global economy
- Global changes in distribution
  - Uncontrolled spread
  - Endemnicity in several countries/regions
  - Emergence of new clades/waves of infection
- Zoonotic infection
  - Implications for pandemic preparedness
- Spread to other host populations
- Real threat to global food security

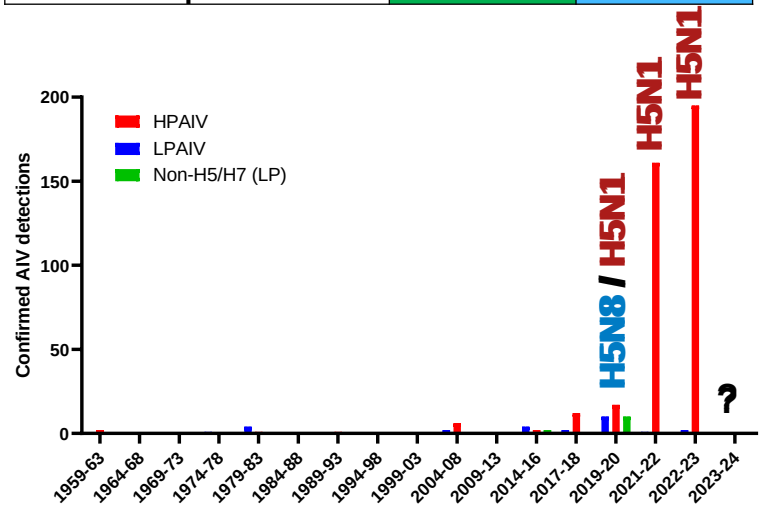
Animal & Plant Health Agency

Current European epizootic with H5N1 HPAI

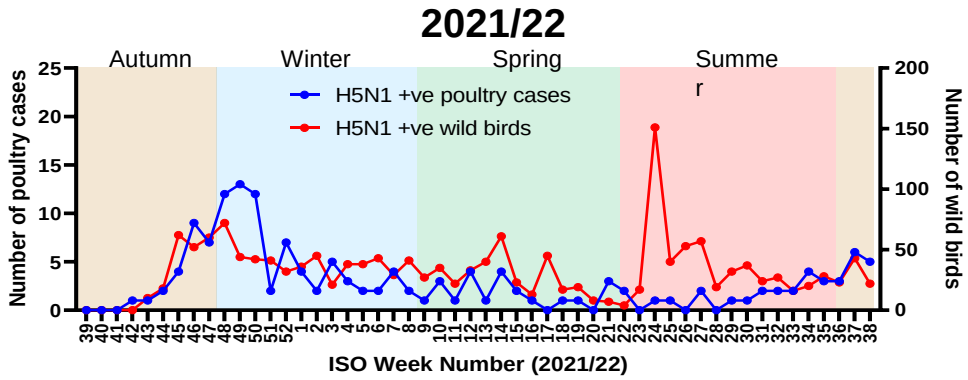
- October 2021 – current
- Case reduction in poultry and wild birds since August??
- Whole year circulation novel event
- >4000 outbreaks in poultry
- 100+ million poultry culled
- 36 countries
- Vaccination permitted with strict controls
  - Continuous review in EU

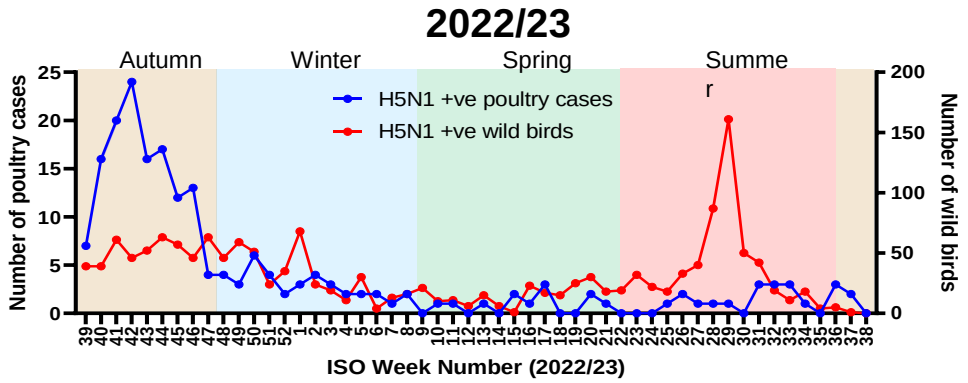
HPAIV H5N1 detections in GB; NI -7‘poultry’ 2021-23

	Epizootic period	
	21-22*	22-23#
Lab confirmed	158	195
Influenza positive wb	1726	1586



*2021/22 Epizootic (06/09/21 – 01/10/22)
2022/23 Epizootic (01/10/22 – 01/10/23)





What happened to seasonality of avian influenza?

H5N1: Wild Bird cases over the 2021-23 summer period

viruses

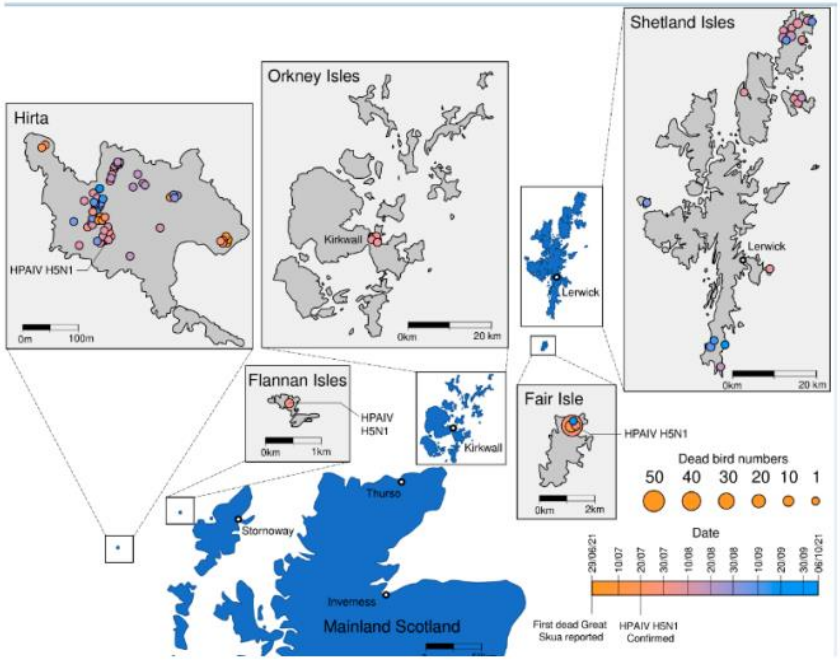
MDPI

Communication

Detection of Highly Pathogenic Avian Influenza Virus H5N1 Clade 2.3.4.4b in Great Skuas: A Species of Conservation Concern in Great Britain

Ashley C. Banyard [1,*], Fabian Z. X. Lean [1], Caroline Robinson [2], Fiona Howie [2], Glen Tyler [3,4], Craig Nisbet [5], James Seekings [1], Stephanie Meyer [1], Elliot Whittard [1], Henry F. Ashpitel [1], Mehmet Bas [1], Alexander M. P. Byrne [1], Tom Lewis [1], Joe James [1], Levon Stephan [6], Nicola S. Lewis [1,7], Ian H. Brown [1], Rowena D. E. Hansen [1] and Scott M. Reid [1]

- Skua detection over July/August
- Disease die off largely reported by citizen science/birders/conservationists
- Virus was similar to H5N1 previously circulating in UK at low level while H5N8 predominated



Animal & Plant Health Agency

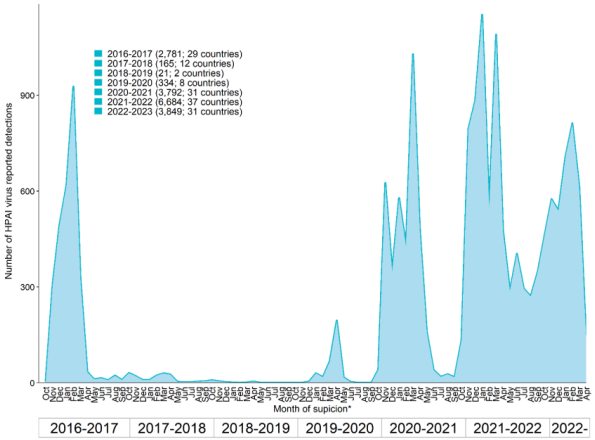
The Scottish Government Riaghaltas na h-Alba | Llywodraeth Cymru Welsh Government | Department for Environment Food & Rural Affairs

H5N1 in sea birds- an ecological disaster- 2022

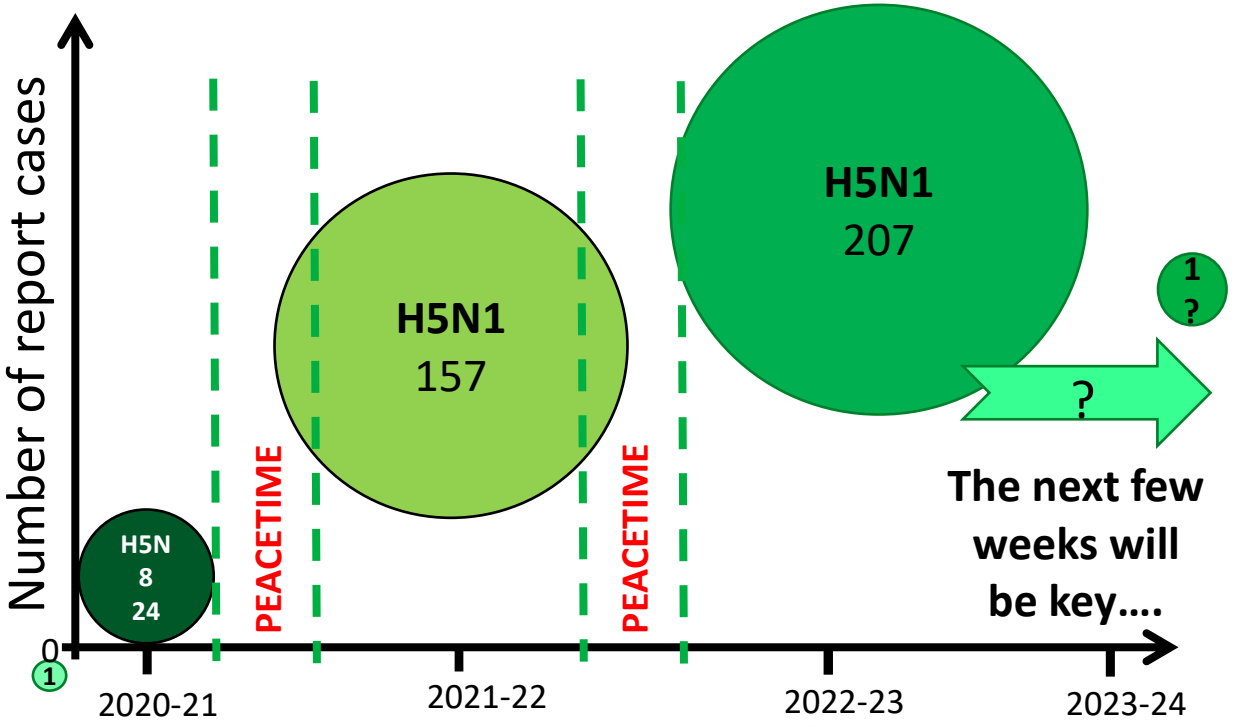
- Hit skua populations early
- Sea birds have come onto land to breed
- Close proximity is aiding virus spread
- Numerous endangered species being hit
- Birds washing up in NI
- Genetic diversity of mass mortality events being assessed:
  - Solway firth – geese
  - Off islands-
    - Skuas,
    - Gannets,
    - Eider

Host specific viral adaptation required?

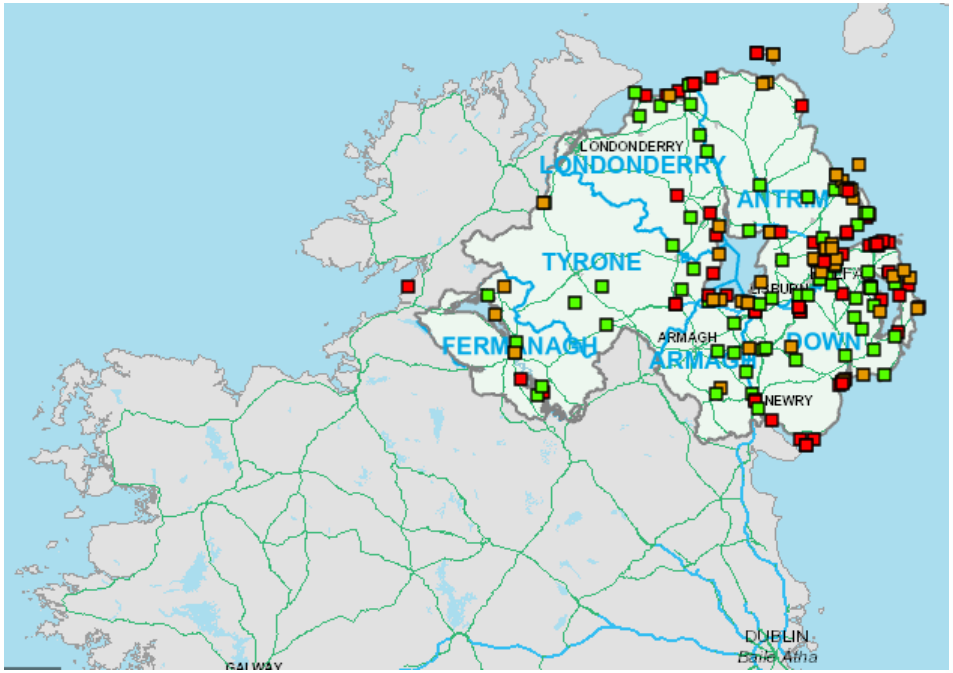
The ‘over-summering’ phenomenon

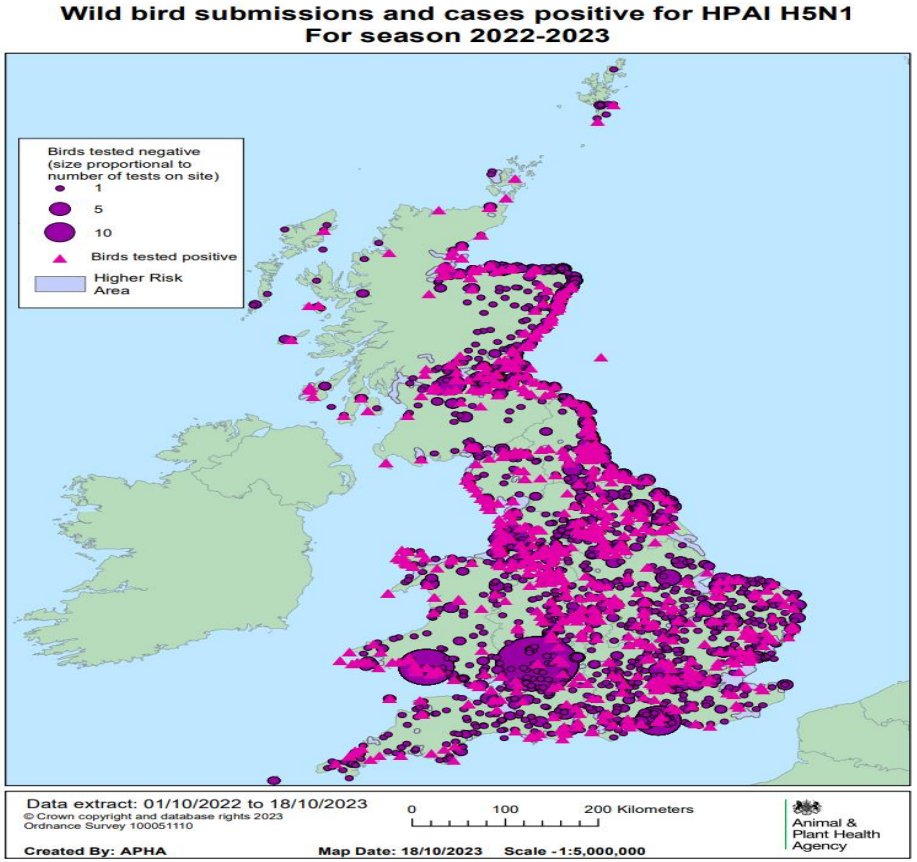


EFSA Avian Influenza overview March –June 2022; https://www.efsa.europa.eu/en/efsajournal/pub/8039



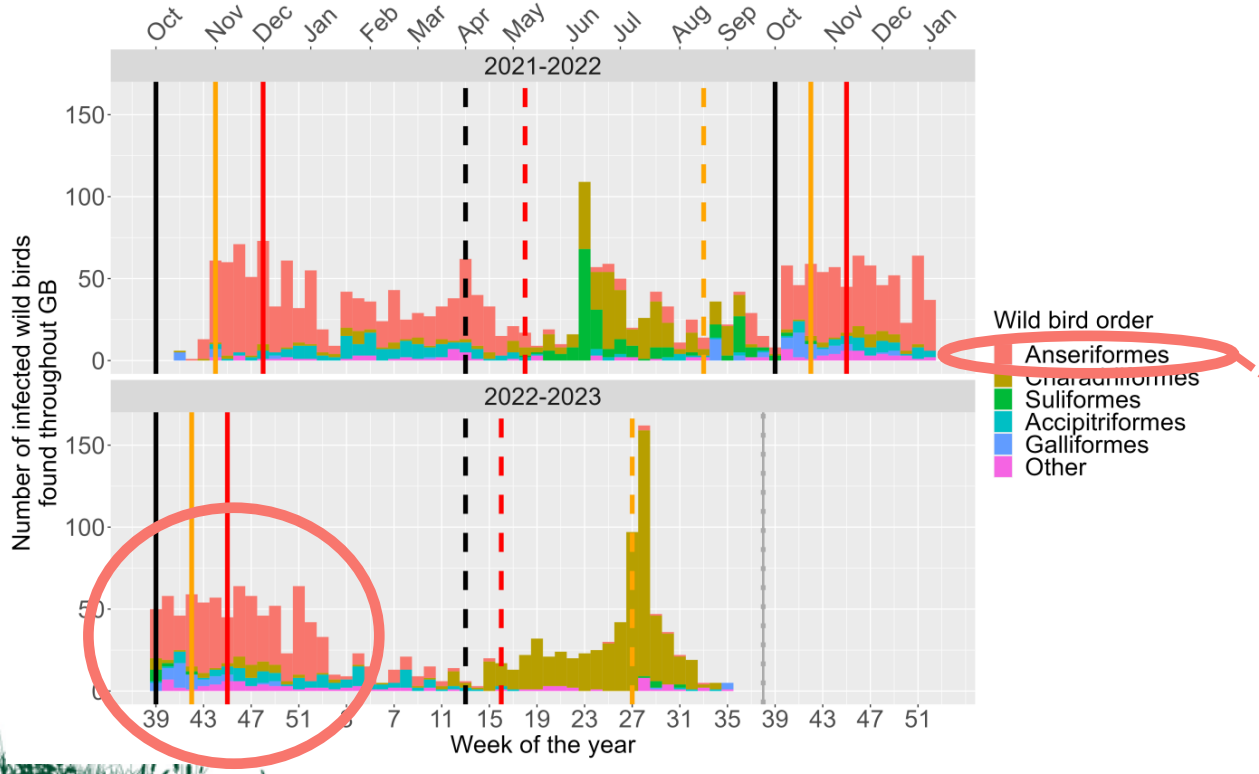
Animal & Plant Health Agency





Latest NI positive wild bird: swan sp 15/9/23

AIV Surveillance in Wild Birds (GB): season 2022/2023



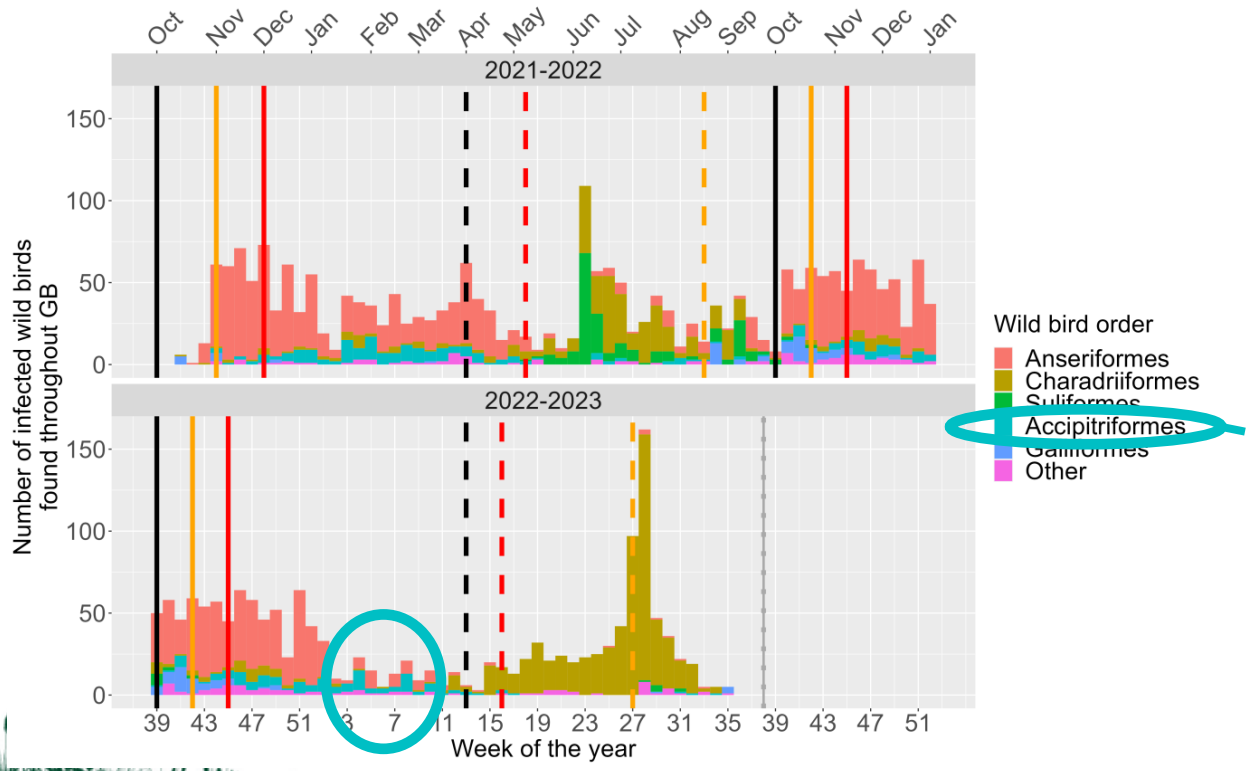
Autumn 2022

- Mass die-offs in released pheasants

Autumn / Early Winter 2022

- Wild Anatidaes severely affected
- Main species: Canada Geese, Greylag Geese, Mute Swans

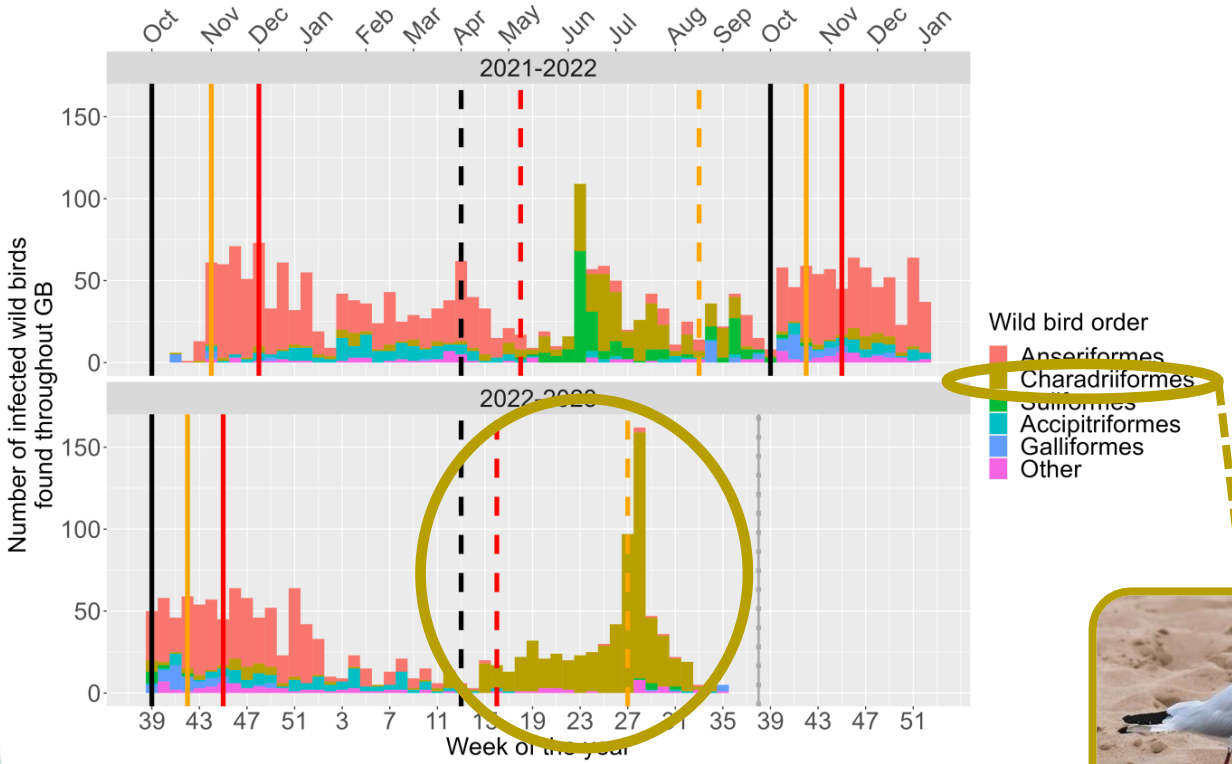
AIV Surveillance in Wild Birds (GB): season 2022/2023



Late Winter 2023

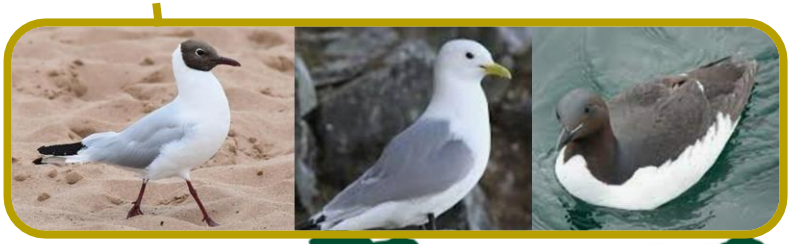
- Since mid-January numbers of dead wild waterfowl plummeted
- Bird of prey main species affected: Common Buzzards, Sparrowhawks, Peregrine Falcons
- Infection route for some species not fully understood

AIV Surveillance in Wild Birds (GB): season 2022/2023



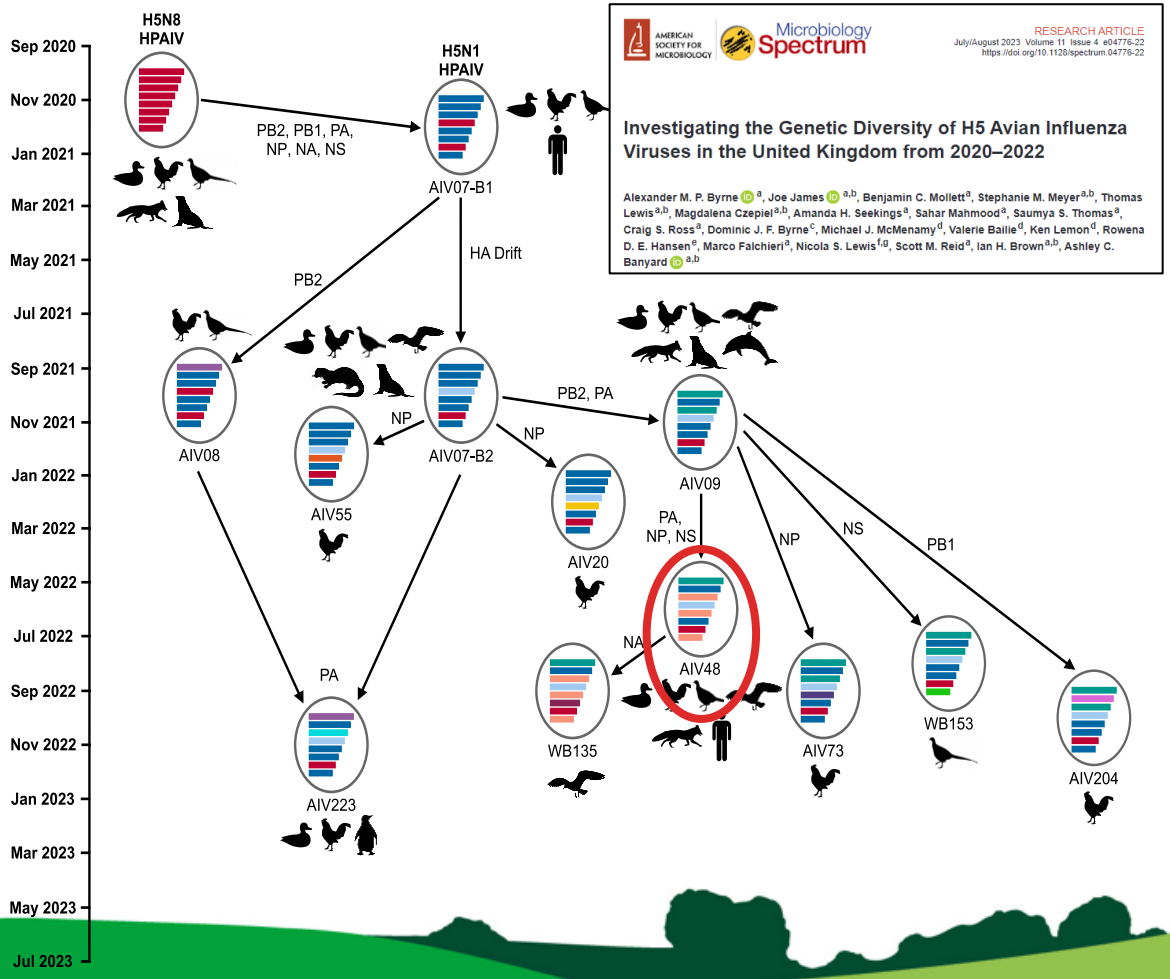
Summer/Autumn 2023

- Mass mortalities in guillemots/ kittiwakes and gulls
- BHGs share breeding areas with other seabirds (e.g., terns) and move inland so increased risk to poultry
- Close linkages with international collaborators



Tracking H5N1 in the UK

- Generating WGS from both poultry ‘report cases’ as well as wild bird incursions
- Critical to understand threat from migratory birds returning to the UK
- Prioritising positive samples that are emerging in key migratory locations

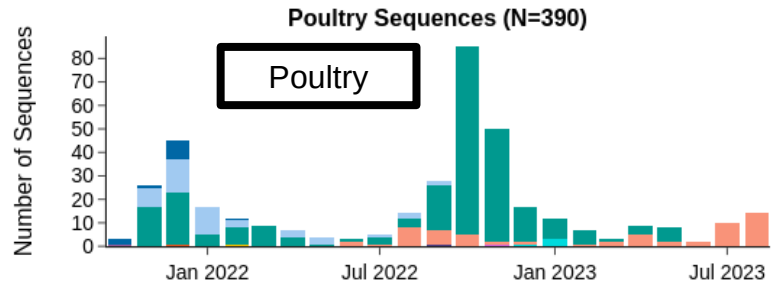


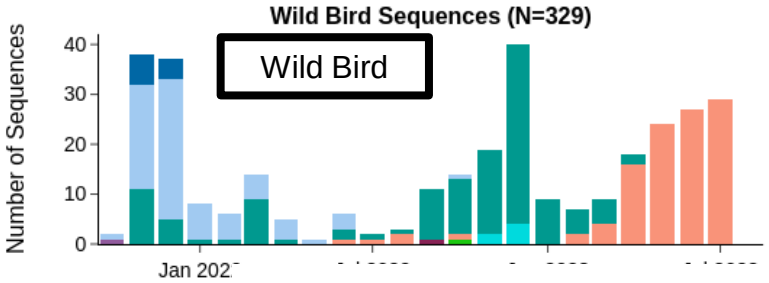
AMERICAN SOCIETY FOR MICROBIOLOGY | Microbiology Spectrum
RESEARCH ARTICLE
July/August 2023 Volume 11 Issue 4 e04776-22
https://doi.org/10.1128/spectrum.04776-22

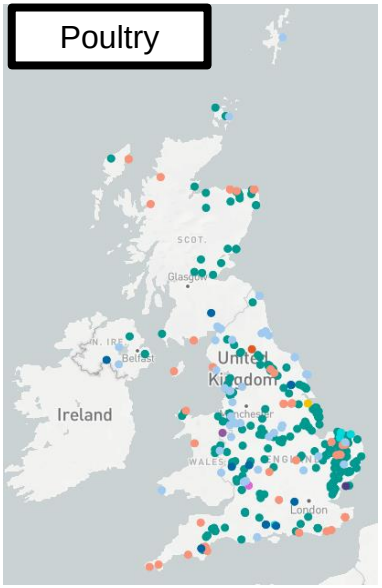
Investigating the Genetic Diversity of H5 Avian Influenza Viruses in the United Kingdom from 2020–2022

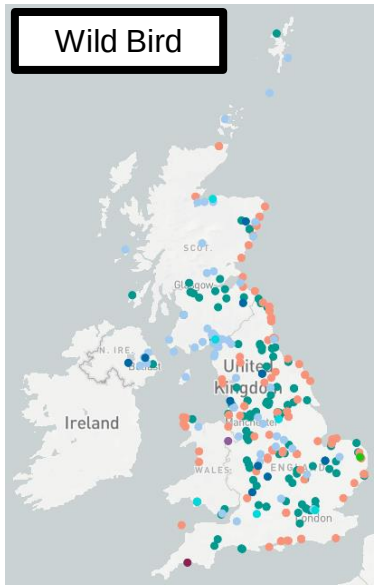
Alexander M. P. Byrne [a], Joe James [a,b], Benjamin C. Mollett[a], Stephanie M. Meyer[a,b], Thomas Lewis[a,b], Magdalena Czepiel[a,b], Amanda H. Seekings[a], Sahar Mahmood[a], Saumya S. Thomas[a], Craig S. Ross[a], Dominic J. F. Byrne[c], Michael J. McMenamy[d], Valerie Baillie[d], Ken Lemon[d], Rowena D. E. Hansen[e], Marco Falchieri[a], Nicola S. Lewis[f,g], Scott M. Reid[a], Ian H. Brown[a,b], Ashley C. Banyard [a,b]

Tracking H5N1 in the UK

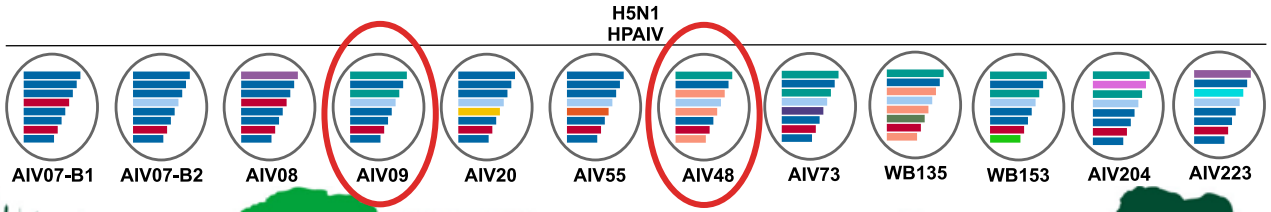






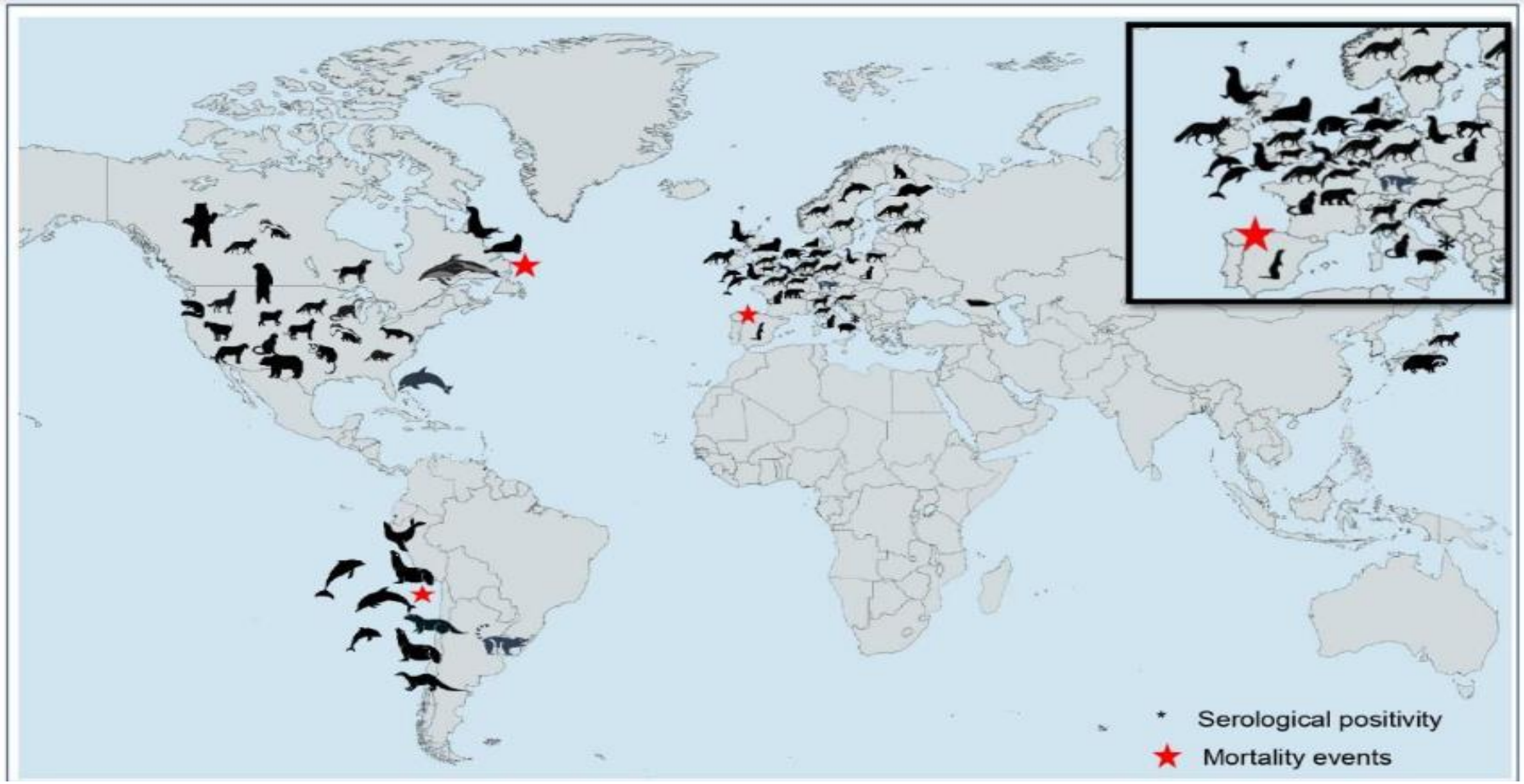


Genotype
- AIV07-B1
- AIV07-B2
- AIV08
- AIV09
- AIV55
- AIV20
- AIV48
- AIV73
- WB135
- WB153
- AIV204
- AIV223



Animal & Plant Health Agency

Mortality events in mammalian species with H5N1 clade 2.3.4.4b viruses 2022-

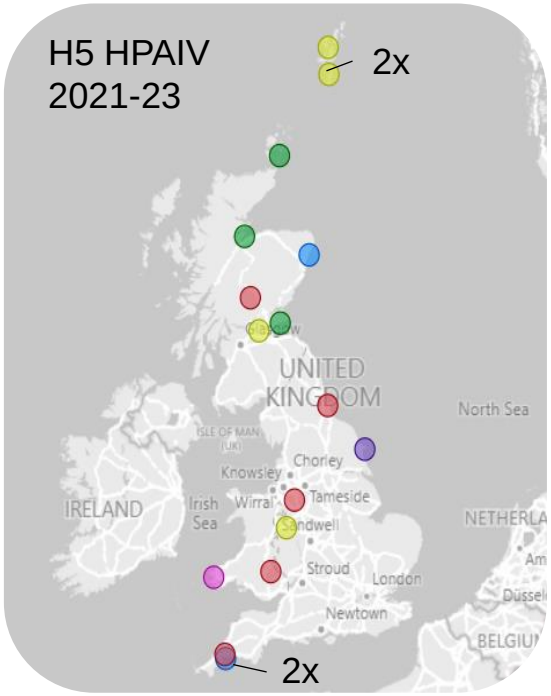


Animal & Plant Health

Non-avian wildlife testing for H5 HPAIV

https://www.gov.uk/government/publications/bird-flu-avian-influenza-findings-in-non-avian-wildlife

Species	Negative	HPAIV H5N1	HPAIV H5Nx	Influenza A (non-H5 HPAIV)	Total tested
Red fox (*Vulpes vulpes*)	28	6	0	0	34
Otter (*Lutra lutra*)	52	6	0	0	58
Badger (*Meles meles*)	1	0	0	0	1
Grey seal (*Halichoerus grypus*)	46	5	1	0	52
Harbour seal (common seal, *Phoca vitulina*)	50	3	0	3	56
Harp seal (*Pagophilus groenlandicus*)	1	0	0	0	1
Unspecified seal	41	0	0	0	41
Stoat (*Mustela erminea*)	2	0	0	0	2
Common dolphin (*Delphinus delphis*)	35	1	1	0	37
Harbour porpoise (*Phocoena phocoena*)	4	1	0	0	5
Total	**260**	**22**	**2**	**3**	**287**



Harbour seal (*Phoca vitulina*)

Common dolphin (*Delphinus delphis*)

Harbour porpoise (*Phocoena phocoena*)

Eurasian otter (*Lutra lutra*)

Red Fox (*Vulpes vulpes*)

Grey seal (*Halichoerus grypus*)

Animal & Plant Health Agency

The Scottish Government | Llywodraeth Cymru Welsh Government | Department for Environment Food & Rural Affairs

Animal & Plant Health

Animal & Plant Health Agency

H5N1 clade 2.3.4.4b 2020-2023 Human involvement- H2H transmission not shown

UK Health Security Agency

Case	Country	Date	Disease Severity	Sequence ID	PB2 E627K	PB2 D701N	PB2 T271A
1	England	Dec 2021	Asymptomatic	A/England/215201407/2021	E	D	T
2	United States	Apr 2022	Fatigue only, survived	No sequence available	N/A	N/A	N/A
3	Spain	Sep 2022	Asymptomatic	A/CastillaLaMancha/3739/2022	E	D	T
4	China	Sep 2022	Critical illness, died	No sequence available	N/A	N/A	N/A
5	Spain	Oct 2022	Asymptomatic	No sequence available	N/A	N/A	N/A
6	Ecuador	Dec 2022	Critical illness, survived	No sequence available	N/A	N/A	N/A
7	China	Jan 2023	Hospitalised, outcome not reported	A/Jiangsu/NJ210/2023	E	D	T
8	Chile	Mar 2023	Severe disease	A/Chile/25945/2023	E	**N**	T

First UK person to catch H5N1 bird flu strain is named

Alan Gosling, 79, tested positive having lived with about 20 ducks inside his home in Devon

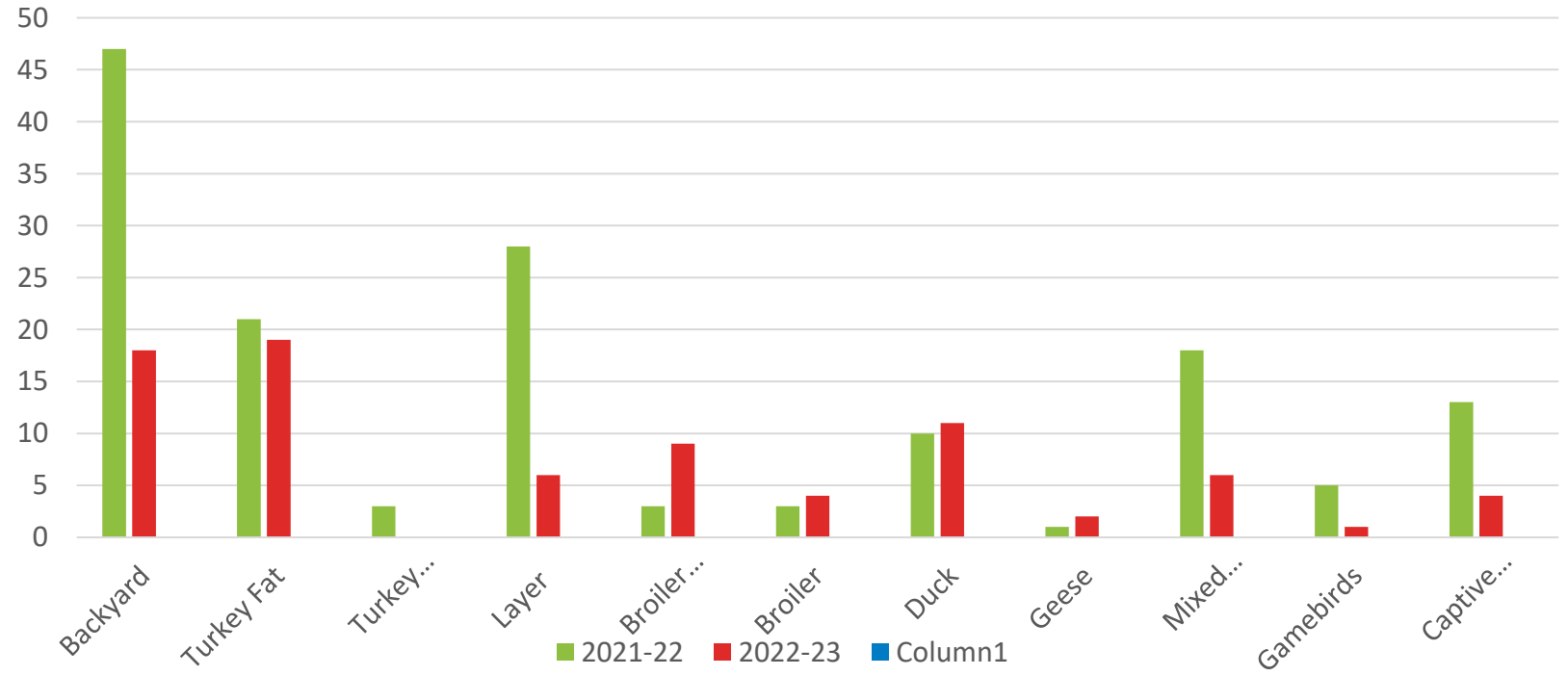
Research and analysis

Investigation into the risk to human health of avian influenza (influenza A H5N1) in England: technical briefing 3

Updated 29 March 2023

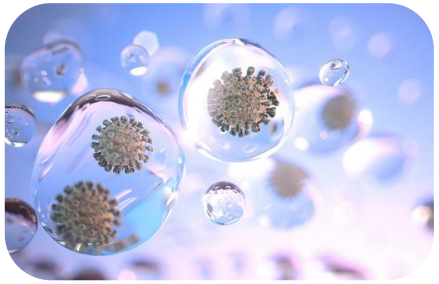
Animal & Plant Health Agency

H5N1 HPAI outbreak 2021-22 by production type



How does the virus get into poultry premises?

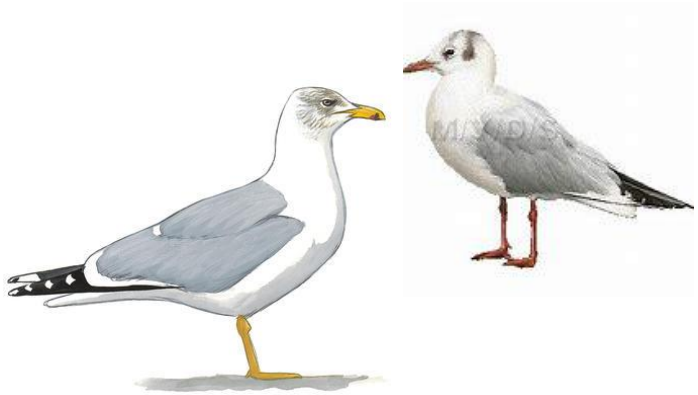
- Infectiveness
- Transmissibility
- Environmental contamination
- Virus persistence
- Biosecurity and risk routes

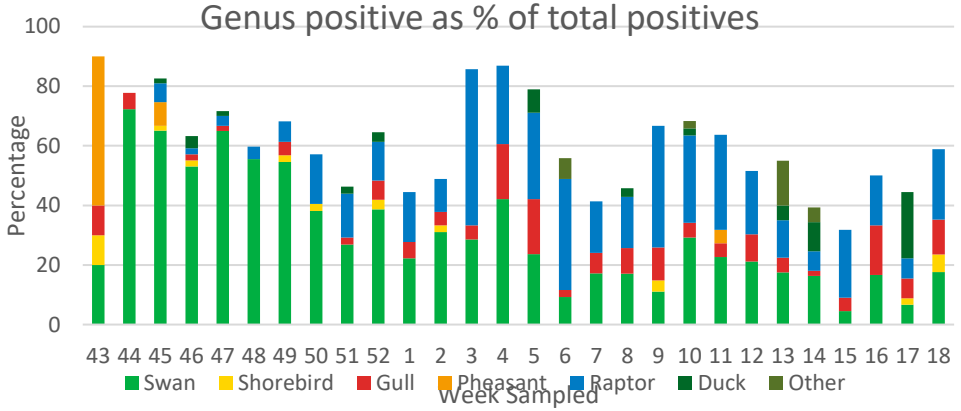


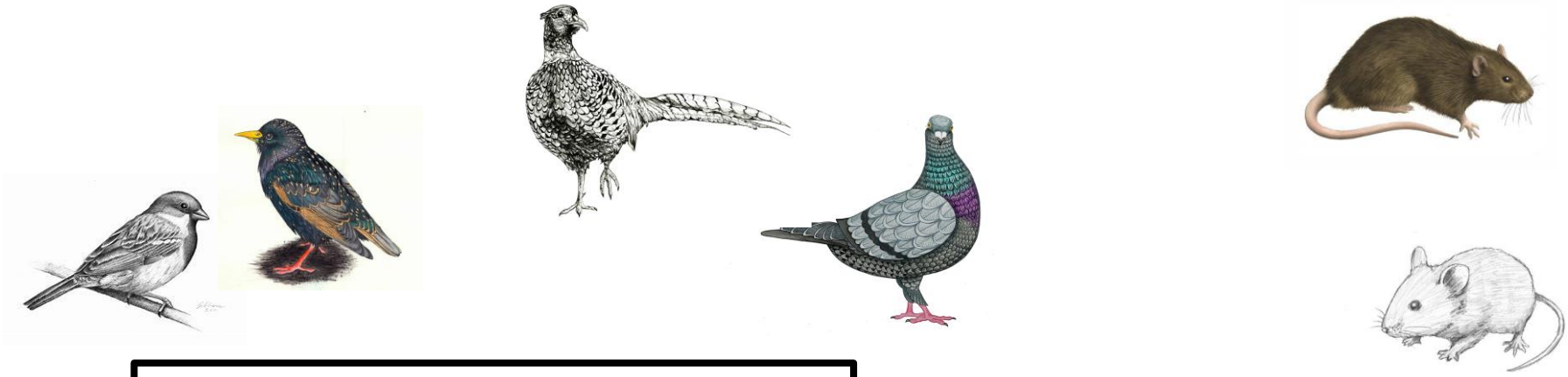
Animal & Plant Health

Animal & Plant Health Agency

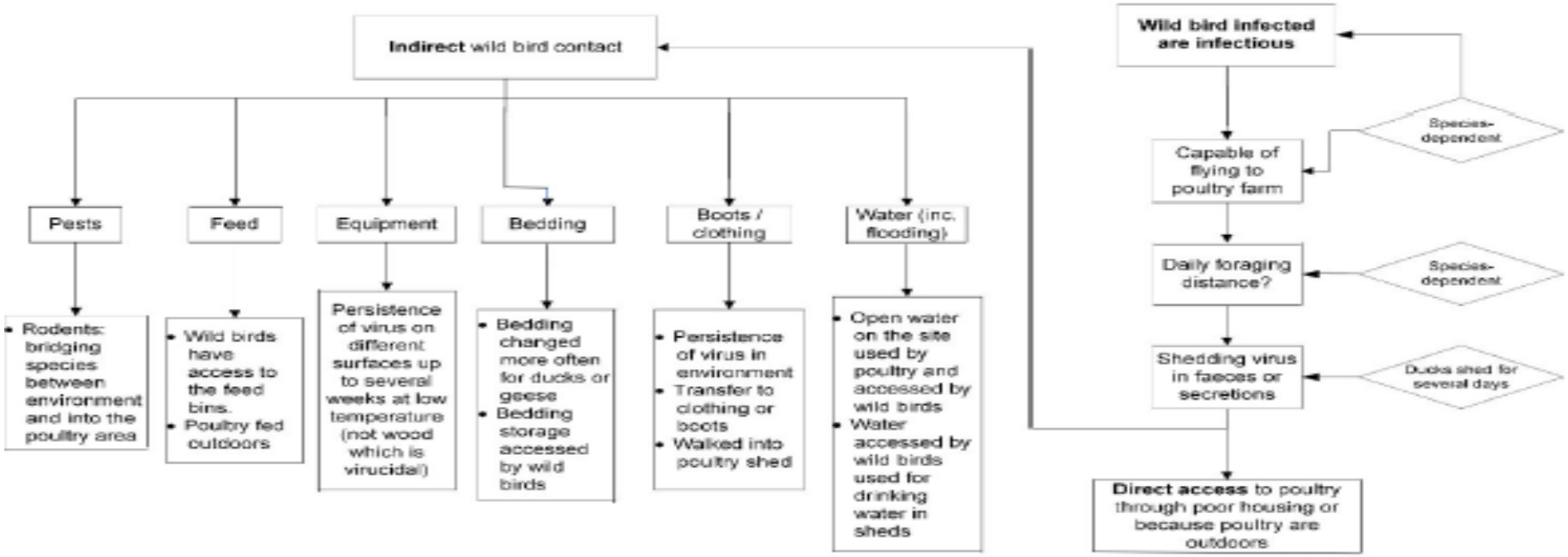
Critical species for poultry farm risk??







Some are fomite spreaders



There are multiple pathways for the exposure of poultry to influenza viruses causing notifiable avian diseases via direct or indirect contact with infected wild birds

The curtilage immediately around where birds are kept is very high risk for source of virus

Animal & Plant Health

FLU MAP

Ethnographic work on Biosecurity

Themes and patterns emerging from the data so far:

- **Some biosecurity measures are more consistently followed across all farms:** These include the use of **foot dips**, **changing boots/wellies** and using **wheel washes.** Farm managers all cited these as some of the most important biosecurity measures to them.

- **Noticeably different biosecurity levels across case vs non-case farms:** most non-case farms appeared to follow basic biosecurity protocols better and have **stronger biosecurity added since the threat of AI.**

- **Poor quality of buildings/sheds limit biosecurity implementation**: The age and quality of sheds/ buildings has made it difficult to implement biosecurity well. Most sheds are **50+ years old** and require **financial investment** to improve moving forward.

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FLU MAP

Ethnographic work on Biosecurity

Themes and patterns emerging from the data so far:

- **Structure and layout of farms impact how farms are accessed and used**: Visitor buildings are often **poorly located**, as with changing areas. Sometimes **no clear distinction between a farm's clean vs dirty sid**e, and a general **lack of fencing and gates** across most farms.

- **Poor wild bird biosecurity:** While most farm managers perceive wild birds as a risk, many do **not think much could be done** in terms of biosecurity to limit the risk from wild birds and other animals.

- **High levels of stress and anxiety experienced by farm managers across all farms**: farmers that experienced outbreaks had high levels of stress and responsibility. All felt anxious for the possibility of an outbreak, and some felt alone

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Ethnographic work on Biosecurity

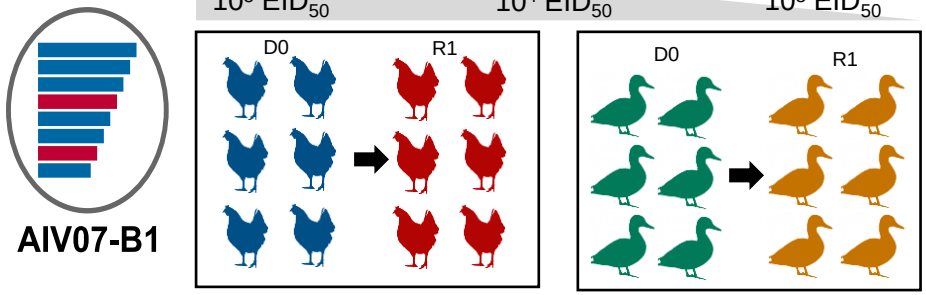
Factors linked to/lack of biosecurity implementation

Perceptions of risk:

- **Risk of walking AI into the farm externally, or through dirt/muck etc around the farm:** Use of foot dips, wheel washes, boot changing etc were stated to help reduce this risk.
- **Risk of airborne transmission between farms:** Many feel they could not do much about this.
- **Wild birds:** Seen as a threat. However, most believed that not much can be done to limit the risk from wild birds either.
- **Free range risk:** Biosecurity was felt to be ineffective for free range farms.

- **Age, length of experience and language barriers may affect the level of biosecurity being followed**
- **Financial limitations and/or lack of autonomy**

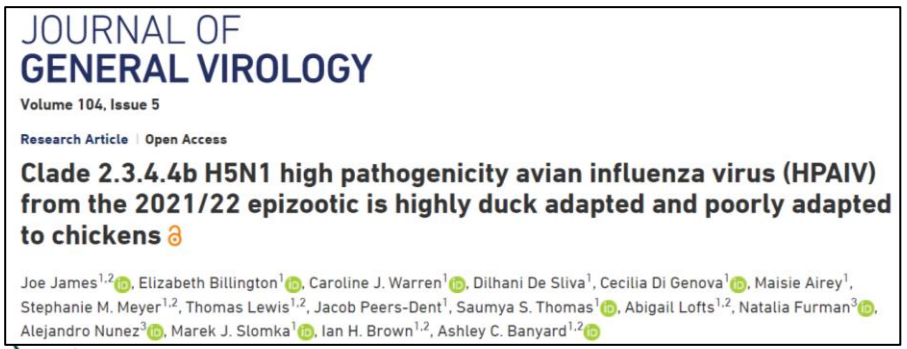
How infectious and transmissible are current H5N1 HPAIVs?



Ducks: low infectious dose, efficient transmission.
Chickens: High infectious dose, no transmission.
Potentially enhanced fitness in wild birds

Epizootic period	Subtype	Infectious Dose	Experimental Mortality in ducks (%)	Duck-to-duck Transmission
2014	H5N8	Medium	5%	Efficient [a,b]
2016	H5N8	Low	17%	Efficient [c]
2017	H5N6	Medium	7%	Inefficient [d]
2021/22	**H5N1**	**Low**	**5-100% (variable)**	**Very Efficient**

[a]Slomka et al 2019; [c]Puranik et al 2020; [d]Seekings et al 2021


JOURNAL OF
GENERAL VIROLOGY
Volume 104, Issue 5
Research Article | Open Access
Clade 2.3.4.4b H5N1 high pathogenicity avian influenza virus (HPAIV) from the 2021/22 epizootic is highly duck adapted and poorly adapted to chickens
Joe James[1,2], Elizabeth Billington[1], Caroline J. Warren[1], Dilhani De Silva[1], Cecilia Di Genova[1], Maisie Airey[1], Stephanie M. Meyer[1,2], Thomas Lewis[1,2], Jacob Peers-Dent[1], Saumya S. Thomas[1], Abigail Lofts[1,2], Natalia Furman[3], Alejandro Nunez[3], Marek J. Slomka[1], Ian H. Brown[1,2], Ashley C. Banyard[1,2]

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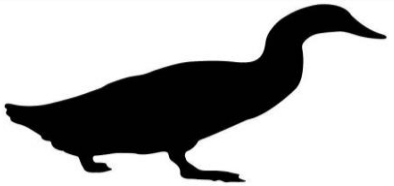
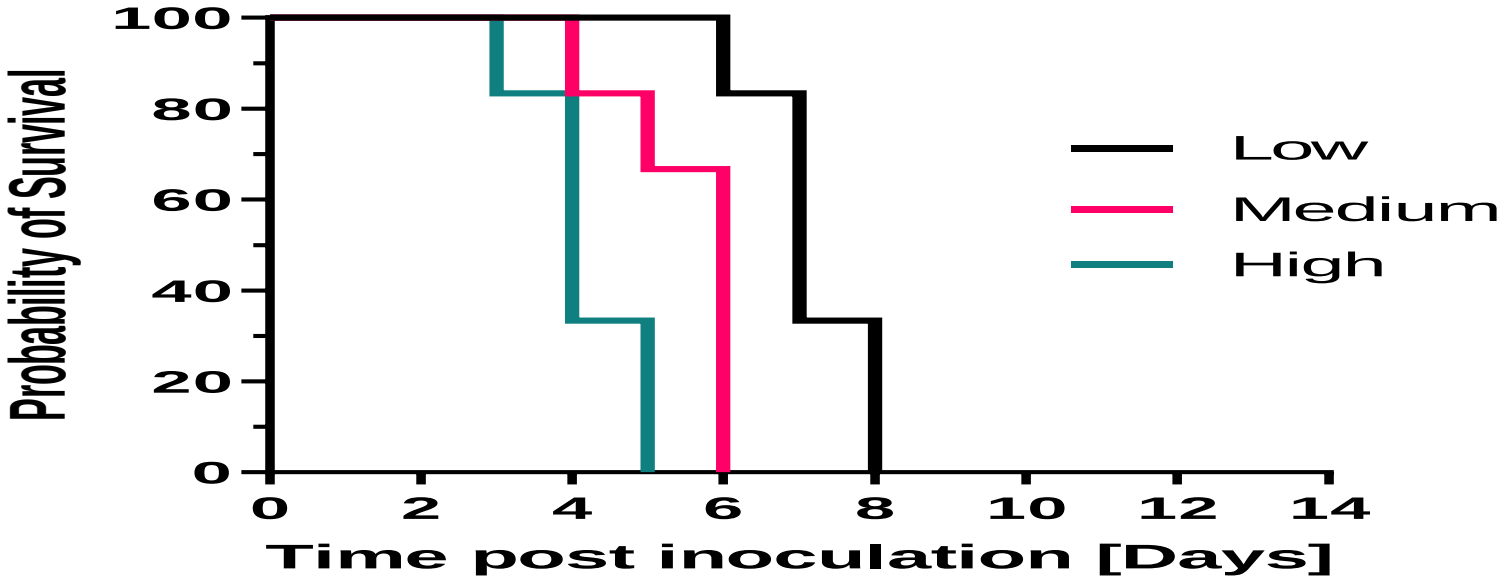
Infection consequence in 3 w.o ducks with different doses of H5N1 HPAI 2021/2 virus





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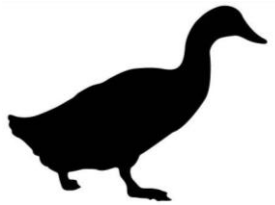
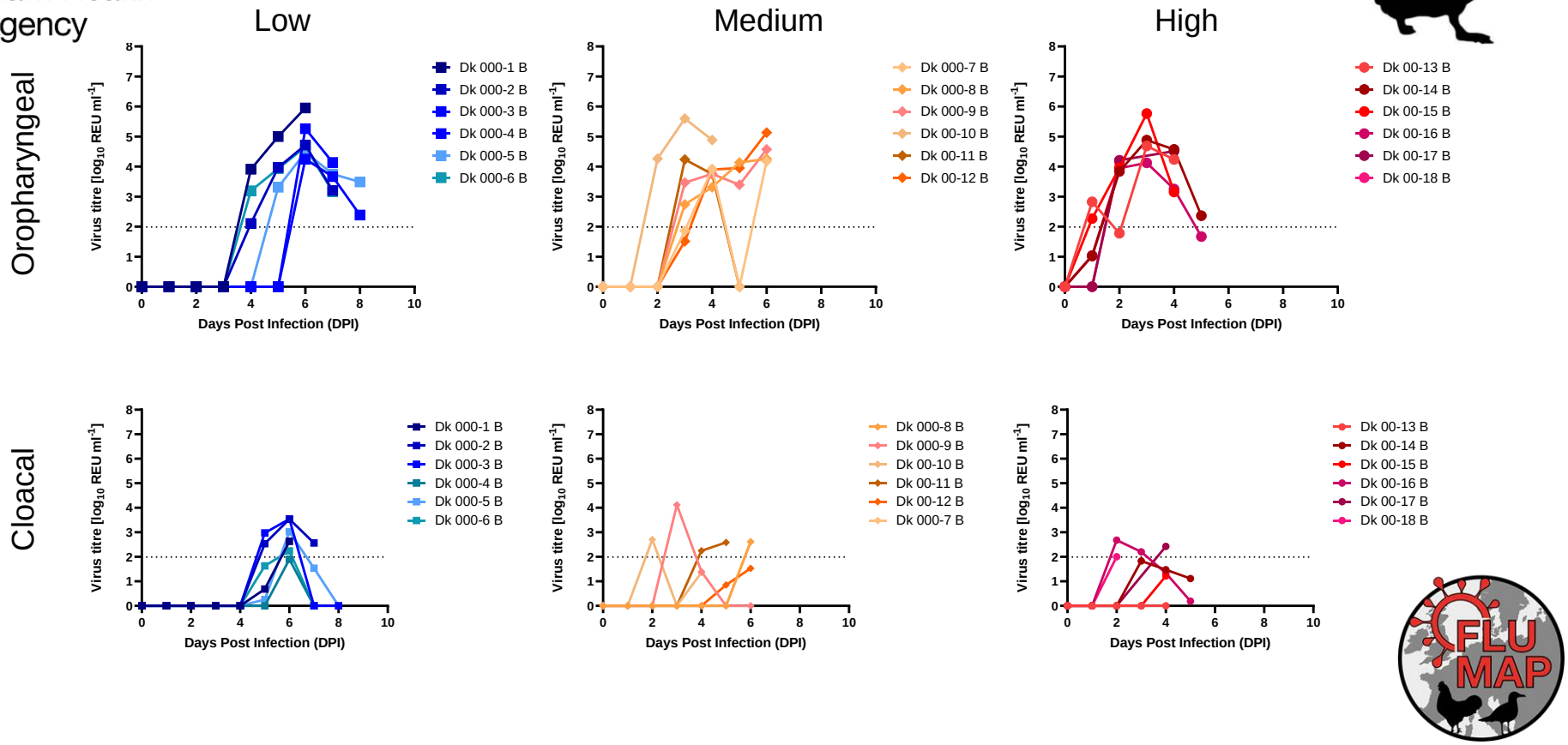
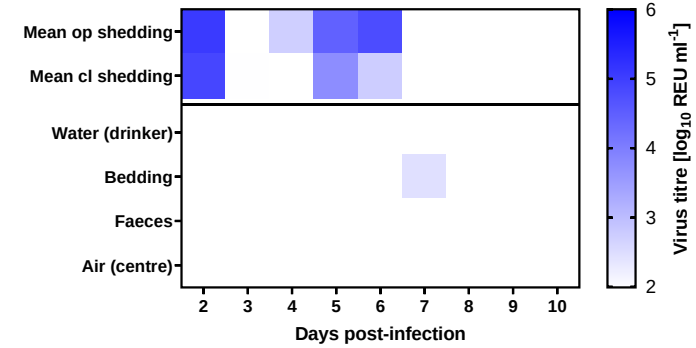
Virus shedding in ducks



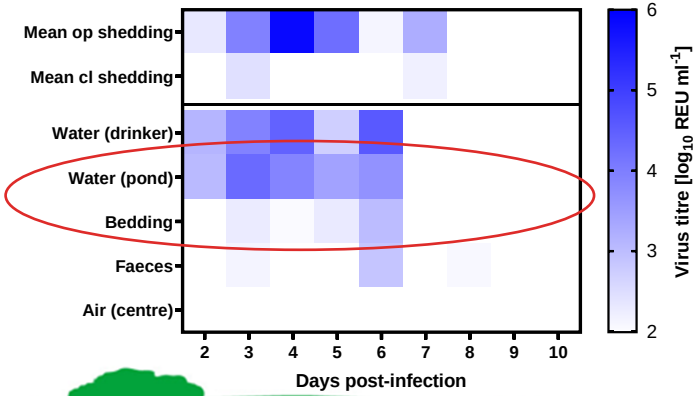


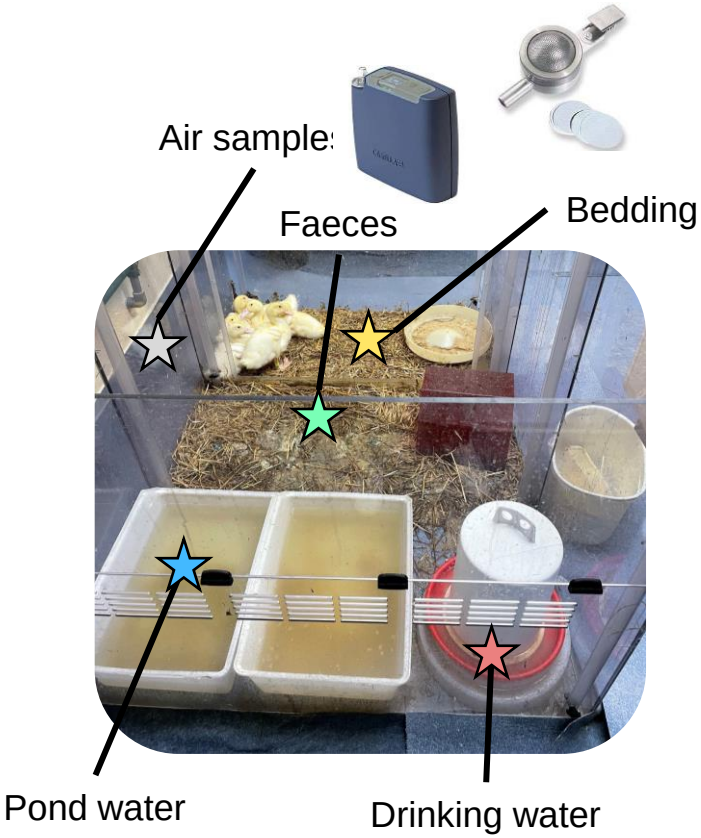
What are the likely transmission routes?

Low environmental contamination



High environmental contamination





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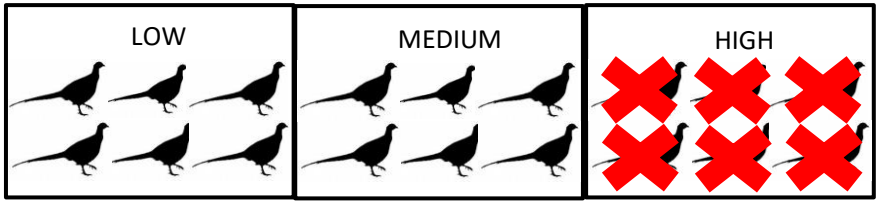
Gamebird infections with H5 HPAI

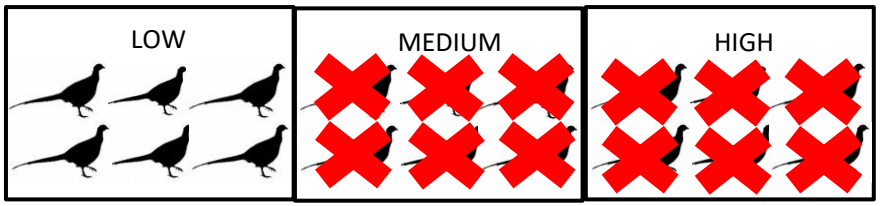
Yuan Liang
PhD Student

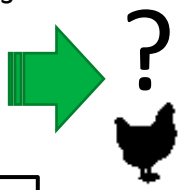
H5N1-2021
A/pheasant/Scotland/11039/2021

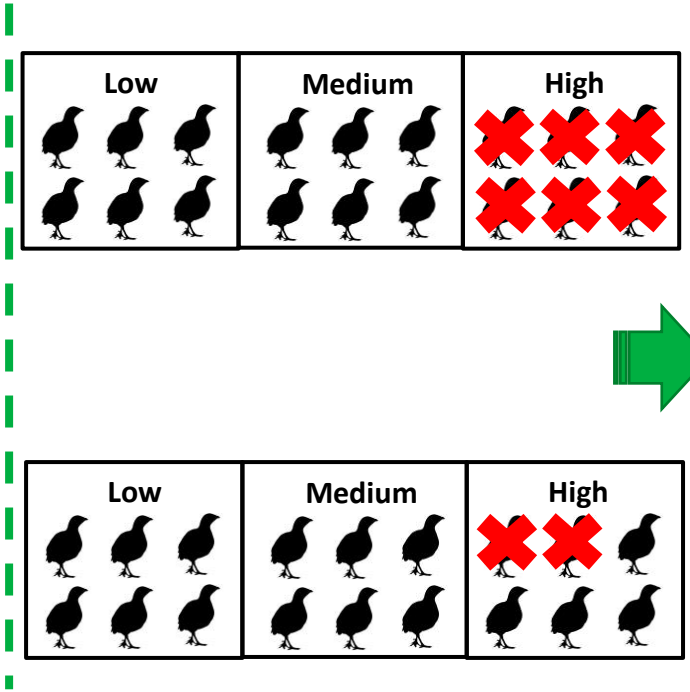


MDT: 3.00 days

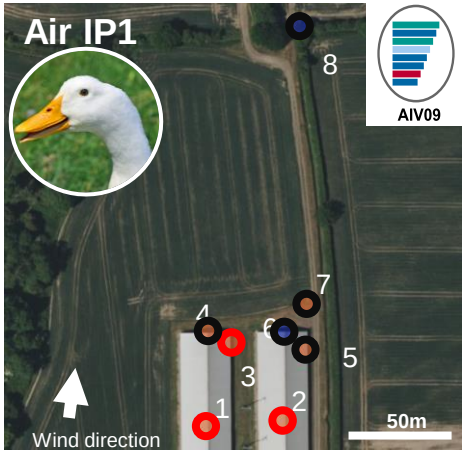
H5N8-2021
A/pheasant/Wales/9383/2021

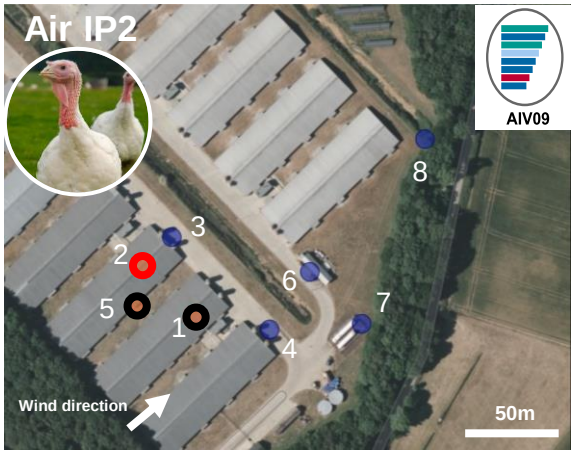


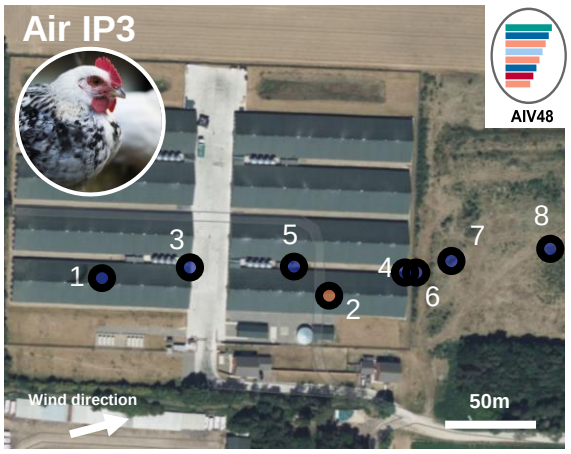




Can the current H5N1 HPAI viruses spread farm to farm by air?

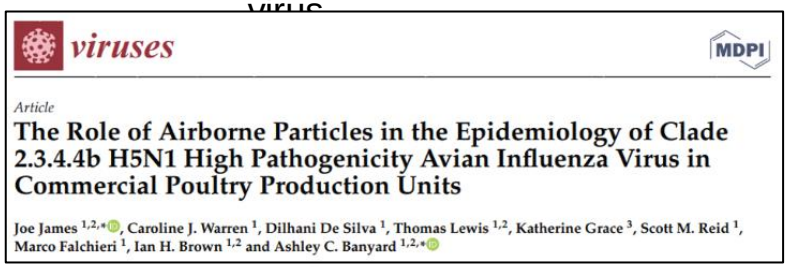






H5 HPAIV RNA | Infectious virus | No H5 HPAIV RNA | No infectious virus

- Over 150 samples of air, dust, feather and water tested from H5N1 +ve IPs
- Samples were collected:
  - Inside infected houses
  - Outside infected houses at different distance (e.g. <10m, 25m, 60m, 120m depending on site)



viruses MDPI

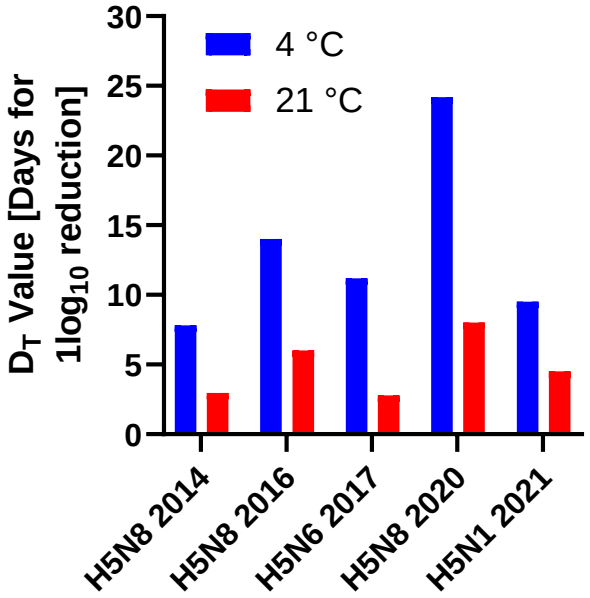
Article

The Role of Airborne Particles in the Epidemiology of Clade 2.3.4.4b H5N1 High Pathogenicity Avian Influenza Virus in Commercial Poultry Production Units

Joe James [1,2,*], Caroline J. Warren [1], Dilhani De Silva [1], Thomas Lewis [1,2], Katherine Grace [3], Scott M. Reid [1], Marco Falchieri [1], Ian H. Brown [1,2] and Ashley C. Banyard [1,2,*]

Live virus can be translocated short distances (<10m) via air

What about environmental contamination?



Virus survival; days at 21ºC, Weeks at 4ºC

pathogens

MDPI

Article

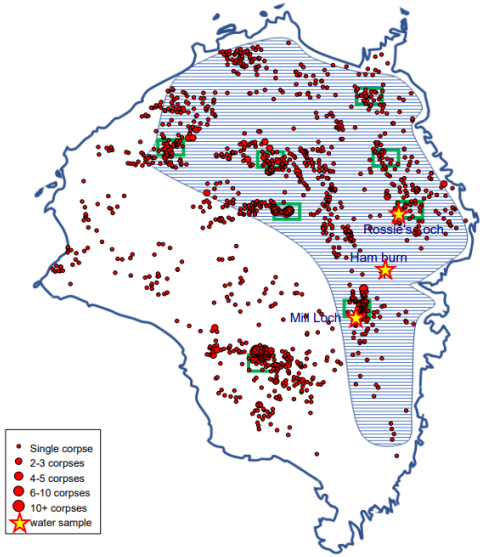
Environmental Samples Test Negative for Avian Influenza Virus H5N1 Four Months after Mass Mortality at A Seabird Colony

Robert W. Furness [1,2,*], Sheila C. Gear [3], Kees C. J. Camphuysen [4], Glen Tyler [5], Dilhani de Silva [6], Caroline J. Warren [6], Joe James [6], Scott M. Reid [6] and Ashley C. Banyard [6,*]

University of Glasgow

NatureScot

NIOZ Royal Netherlands Institute for Sea Research



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Evolved H5N1 clade 2.3.4.4b' viruses
Current threat

Changes resulting in 'fitness gains' in the H5N1 virus likely strongly influenced the size and scale of the 2021-2023 poultry epidemic and global spread

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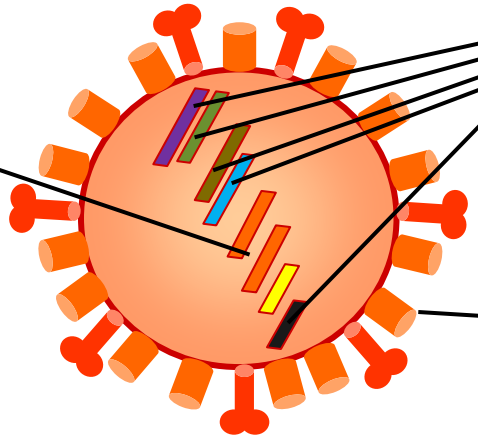
FLU MAP

Virological explanations for the unprecedented 2021-present H5N1 epidemic

1. Acquisition of N1 NA conferred fitness in ducks and wild birds

but possibly not fitness in chickens due to long stalk



2. Increased fitness in wild birds enabled multiple reassortment events to acquire optimized internal gene constellation

3. Mutations in H5 HA restored thermostability but it remains specific for α2,3 sialic acid

Contemporary H5N1 viruses have enhanced fitness to infect, transmit and persist in birds, but remain un-adapted to humans.

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Current UK/GB Risk Levels for H5 HPAI

- Surveillance and outbreak data inform continuous review of risk levels
- The risk of incursion of highly pathogenic (HPAI) avian influenza H5 in wild birds in Great Britain has decreased from high (i.e. event occurs very often) to **medium** (i.e. event occurs almost certainly).
- The risk of **poultry** exposure to HPAI H5 in Great Britain is remains assessed as **low** (with medium uncertainty) where there are substantial biosecurity breaches and poor biosecurity and **low** (i.e. event occurs occasionally) (with low uncertainty) where good biosecurity is applied.
- The latest risk and outbreak assessments by Defra and the Animal and Plant Health Agency (APHA) are published and available on GOV.UK at https://www.gov.uk/government/publications/avian-influenza-bird-flu-in-europe
- **CAUTION : WE ARE IN PERIOD OF UNCERTAINTY SO GOOD BIOSECURITY STANDARDS ARE REQUIRED- NO ROOM FOR COMPLACENCY**

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Immune pressure in an exposed recovered population will shape virus selection

Immune escape variants of the virus which carry a ‘fitness’ for host population and persist and spread

In time will carry a selection advantage of previous epizootic strains

The contribution of prior immunity to all influenza A viruses is not understood

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Could vaccination solve the problem?

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Vaccination will only work when applied in combination with other measures

Vaccination is not a substitute for weak farm biosecurity

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Criteria for vaccine suitability

Swayne and Sims (2020) proposed 8 criteria

- Inexpensive
- usable in multiple avian species
- provide protection after a single dose
- can be applied by low-cost mass application methods
- allow easy identification of infected birds within the vaccinated population
- produce a protective humoral response in the presence of maternal antibodies
- be applied at one day of age in hatchery or *in ovo*;
- antigenically close to field virus.

No current vaccine or vaccine technology meets all eight criteria so the user must select the licensed vaccine that best meets their needs.

Swayne D.E. & Sims L. (2020). Avian influenza. In: Veterinary Vaccines: Principles and Applications, Metwally S, El Idrissi M., Viljoen G., eds. Wiley, Chichester, United Kingdom, 229–251

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Framework considerations for harmonised use of vaccination against HPAI in the EU

- Continual risk with epizootic waves
- Vaccination permitted but with strict controls
- Programme scope and integration in overarching disease control and threat mitigation
  - Targeted/non targeted; preventative or emergency; species; geography inc DPPA
- Programme duration
- Vaccine type
- Surveillance requirements including DIVA approach
- Safeguards for movements of birds and products
- **Trade impacts (as applicable)**

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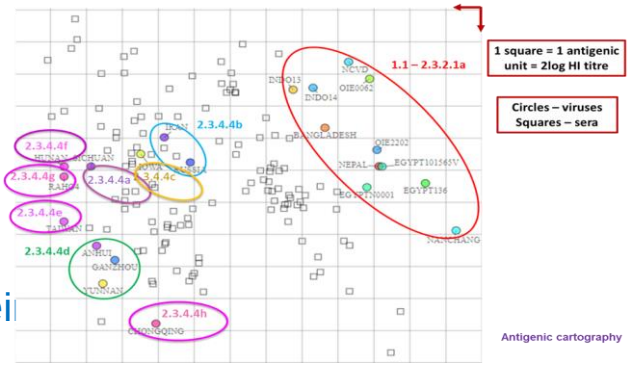
EU vaccine studies

- Studies in three EU MS: NL,FR, IT
- Chickens, Turkeys and Ducks
- Different vaccines: inactivated, vector based, recombinant protei



- Design to assess immunogenicity, clinical protection, virus shedding in challenged birds and transmission

- Effectiveness Vector/RNA>DNA or Recombinant protein> Inactivated
- Variability between hosts and two doses required; turkeys prime boost better
- Closer match between field and vaccine strains increased effectiveness
- Duration of immunity uncertain; revaccination??

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EU SPECIFIC CONDITIONS FOR PREVENTIVE VACCINATION OF HPAI

Costs to industry

Vaccine £??
Vaccination £??
Veterinary costs for inspection

Surveillance (DIVA): £2500 /month/epi group or farm

Weekly mortality: c £200/week/epi group

1. **Type of vaccine to be used:** live attenuated avian influenza virus prohibited

2. **Reinforced surveillance to be implemented**

2.1 enhanced passive surveillance shall be implemented in the vaccinated establishments by weekly virological testing of a representative sample of dead birds collected within one week;

2.2 after the start of vaccination, the following active surveillance has to be carried out by an official veterinarian in vaccinated establishments at least every 30 days to detect occurrence of infection with HPAI field virus:

a) a clinical examination that shall include a check of the production records and health records of the establishment in each epidemiological unit, including an evaluation of its clinical history and clinical examinations of the poultry or captive birds;

b) a collection of representative samples for serological or virological surveillance to enable detection of a prevalence of HPAI virus infection in the epidemiological unit of 5% with a confidence level of 95%, using appropriate methods and protocols that allow early detection of the virus and taking into account the specific characteristics of the vaccine used;

- 4.1 **Conditions for granting a derogation for movements of vaccinated poultry or captive birds including day-old chicks and hatching eggs derived from such poultry or captive birds:**

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Application to field use EU

France has started vaccinating all fattener ducks in the Foie Gras sector wef 1/10/23 compulsory for those on home market only.

As a result USA, Canada, Japan blocked trade in poultry and product from European Poultry Area (all excluding GB)

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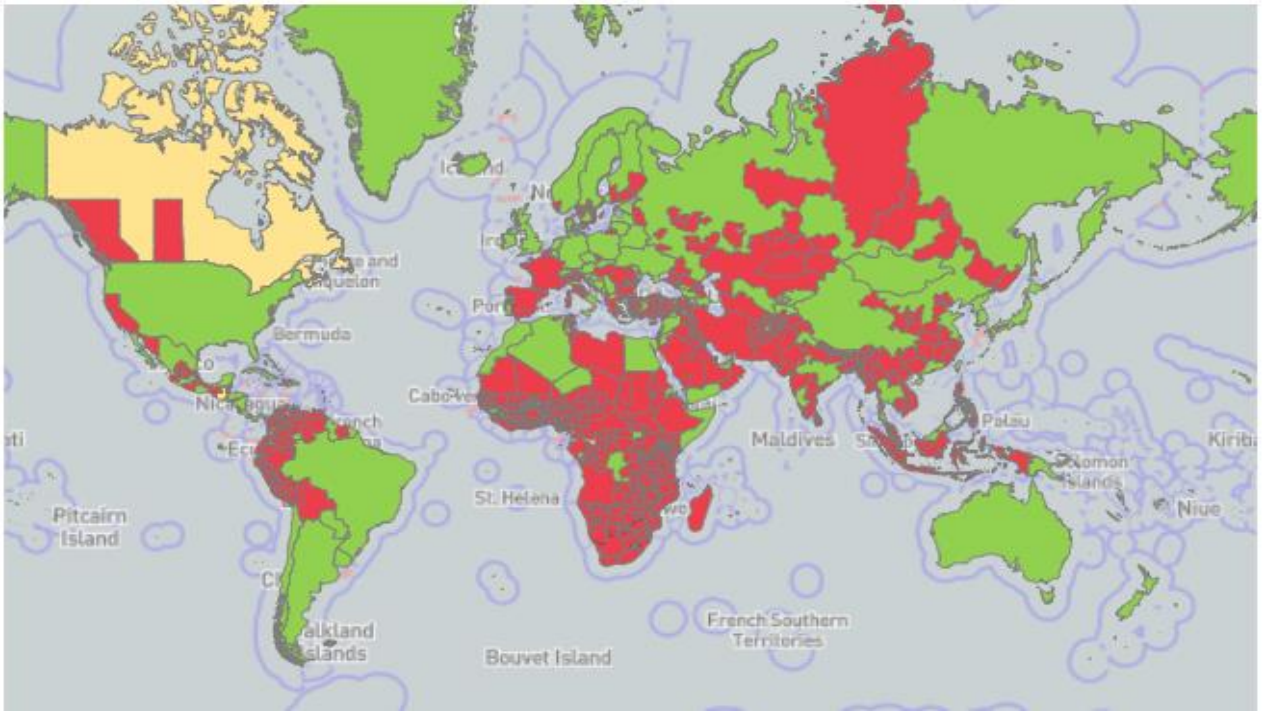
Newcastle Disease Virus/Avian Paramyxovirus-1 Background



Absent

Suspected

Present

NDV 2013 - 2023

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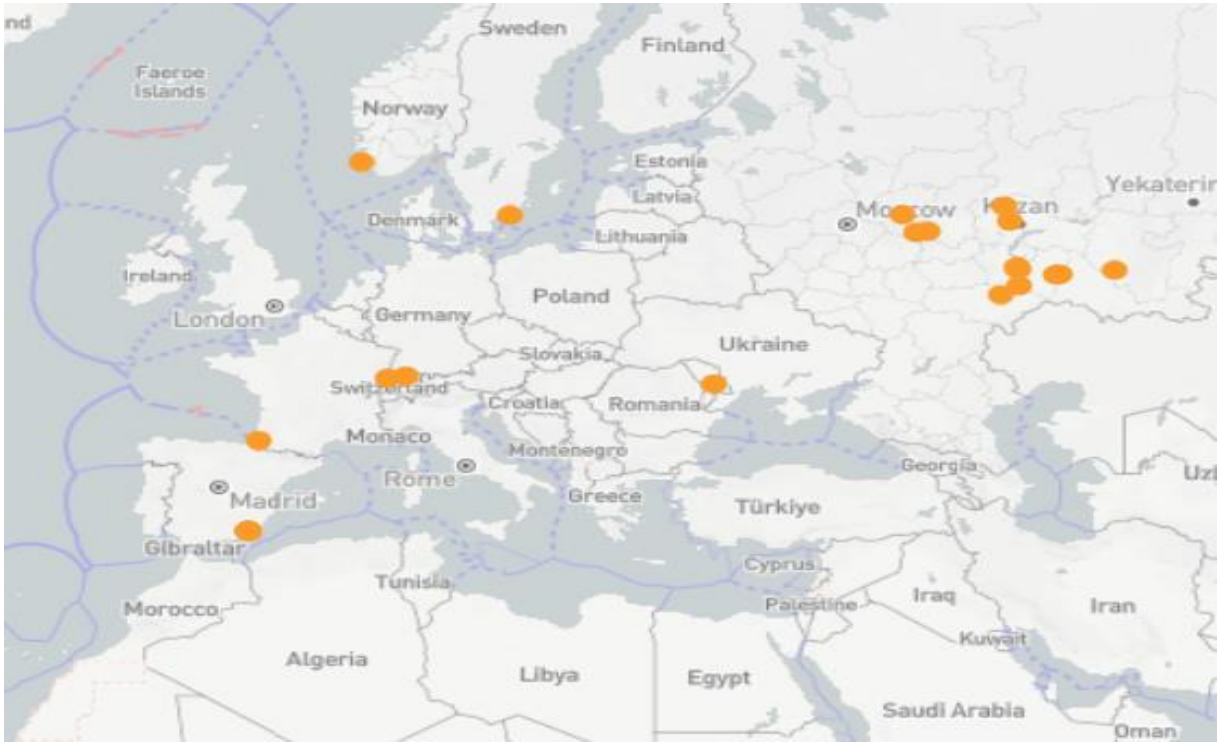
Newcastle Disease Virus/Avian Paramyxovirus-1 in Europe



2021-2023

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Key messages- HPAI

- Continued unprecedented threat: when will epidemic peak??
- Biosecurity standards in some farms insufficient and if not addressed could face an even bigger disaster
- Virus is presently phenotypically stable but we need to monitor these genetic variations
- No evidence yet of virus incoming with migratory birds not that is has changed but early!
- Infection pressure has been high; demographic in wild birds and picture across Europe
- Insights to virus giving clues as to why causing such a large panzootic
- Vaccination as a tool: plans developing fast in EU; UK tracking/monitoring
- There is still risk on the horizon and longevity of this threat we should plan for !

Animal & Plant Health

Biotechnology and Biological Sciences Research Council

FLU MAP

The Scottish Government
Riaghaltas na h-Alba

Llywodraeth Cymru
Welsh Government

NATURAL ENGLAND

Department for Environment Food & Rural Affairs

Questions?

World Organisation for Animal Health
Founded as OIE

STATENS SERUM INSTITUT

afbi Agri-Food and Biosciences Institute

Prof. Ash Banyard
Avian Virology Lead

Dep Director of IRL

Dr. Marco Falchieri
Veterinary lead

Dr Joe James
Head of Research

Royal Netherlands Institute for Sea Research

UK Health Security Agency

Dr. Scott Reid
Reference Laboratory

Dr. Josh Lynton-Jenkins
International Reference Laboratory

Dr. Marek Slomka
Avian Influenza Team

Dr. Helen Everett
Influenza Team

Dr. Craig Ross
Newcastle Disease Team

Dr. Alex Byrne
and Bioinformatics Team

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ROSLIN

The Pirbright Institute

NIH National Institute of Allergy and Infectious Diseases

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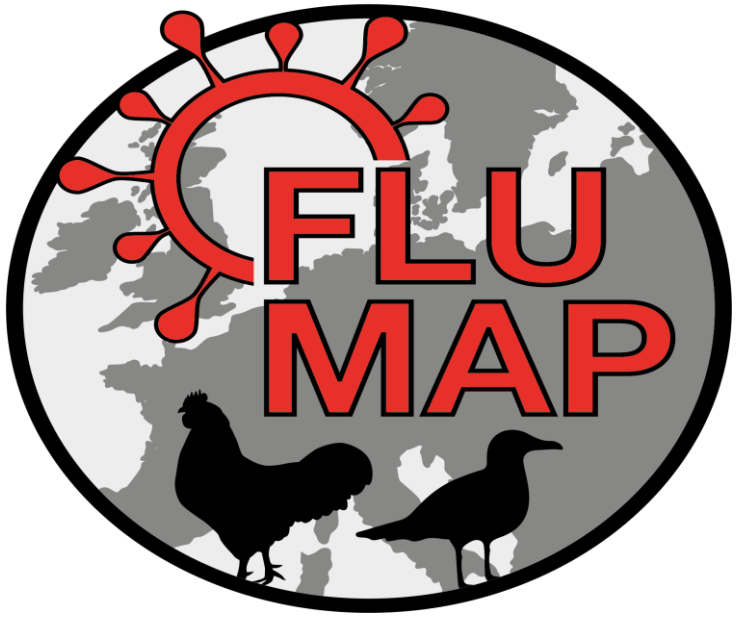
Insights to biological markers



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Imperial College London

THE Pirbright INSTITUTE

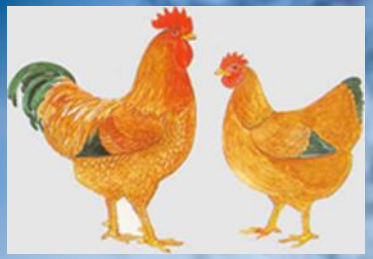
UNIVERSITY OF LEEDS

RVC Royal Veterinary College University of London

UNIVERSITY OF CAMBRIDGE

ROSLIN

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA



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