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UPDATE ON BEAK TRIMMING AND ALTERNATIVES

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TOPICS

- ✓ Cannibalism and feather pecking
- ✓ Solutions for cannibalism
- ✓ Welfare assessment of beak trimming methods
- ✓ Alternatives to beak trimming
- ✓ Implications

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CANNABALISM AND FEATHER PECKING

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POULTRY INDUSTRY PROBLEM

- ✓ Feather pecking
- ✓ Cannibalism
  - o Mortality up to 30% of the flock

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PECKING

Pecking in laying hens is a major welfare concern

It can spread through flocks and results in pain and high mortality

Includes feather pecking and vent pecking

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FEATHER PECKING

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Genetic Effect: Feather Pecking

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CANNIBALISM

Cannibalism occurs when the flesh is eaten

It is a common problem in poultry particularly laying hens

Cannibalistic behaviour may be learned by hens and spreads rapidly throughout a flock.

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CANNIBALISM

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SOLUTIONS FOR CANNIBALISM

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SOLUTIONS FOR CANNIBALISM

- ✓ BEAK TRIMMING
- ✓ ALTERNATIVES
  - o Genetic
  - o Environmental enrichment
  - o Nutrition, body weight management*
  - o Lighting, deterrents
  - o Beak abrasives, fitted devices

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BEAK TRIMMING

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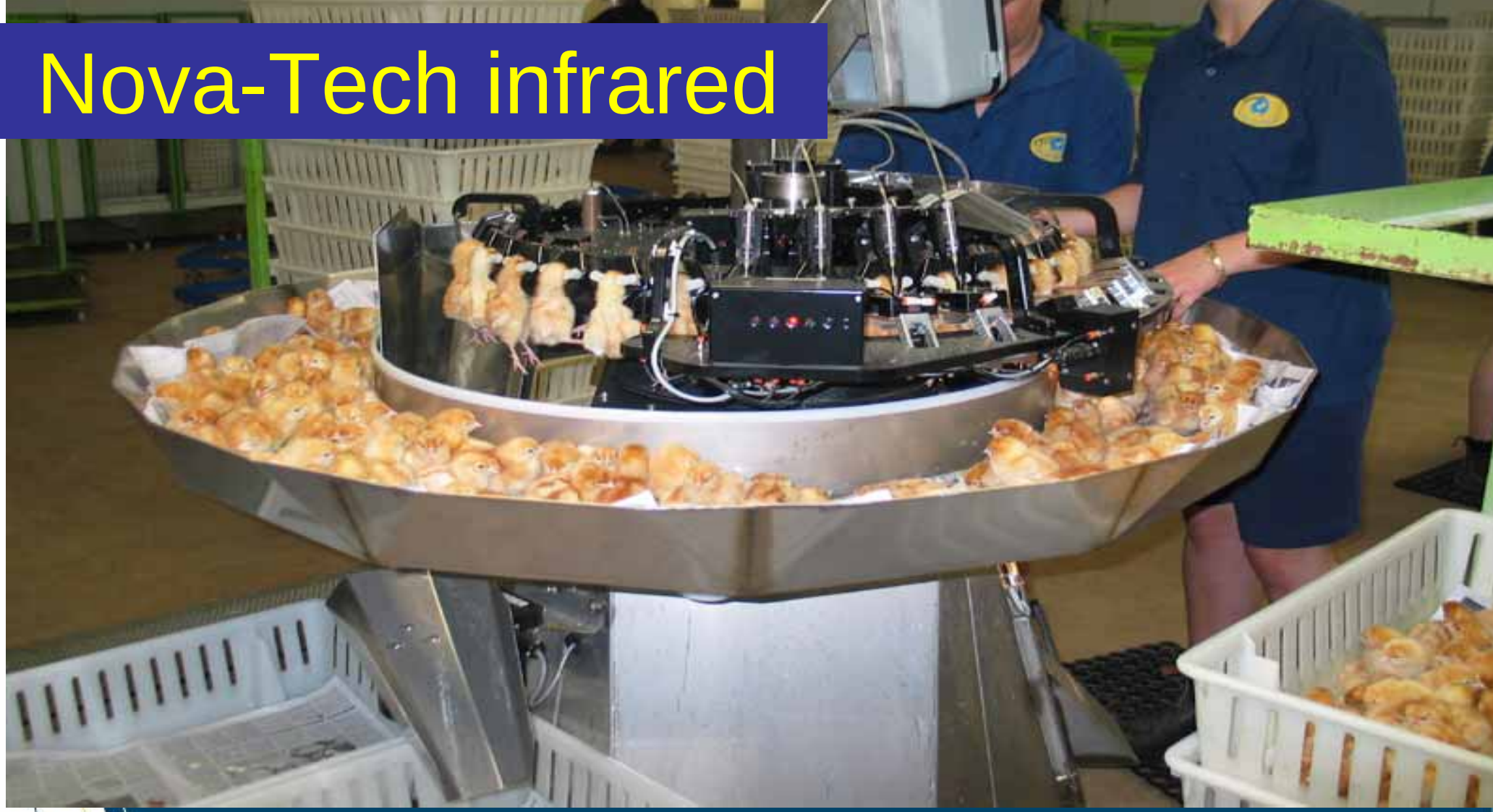
HOT BLADE BEAK TRIMMING

Nova-Tech infrared



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BEAK TRIMMED BIRD

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BEAK TRIMMING AND WELFARE CONCERNS

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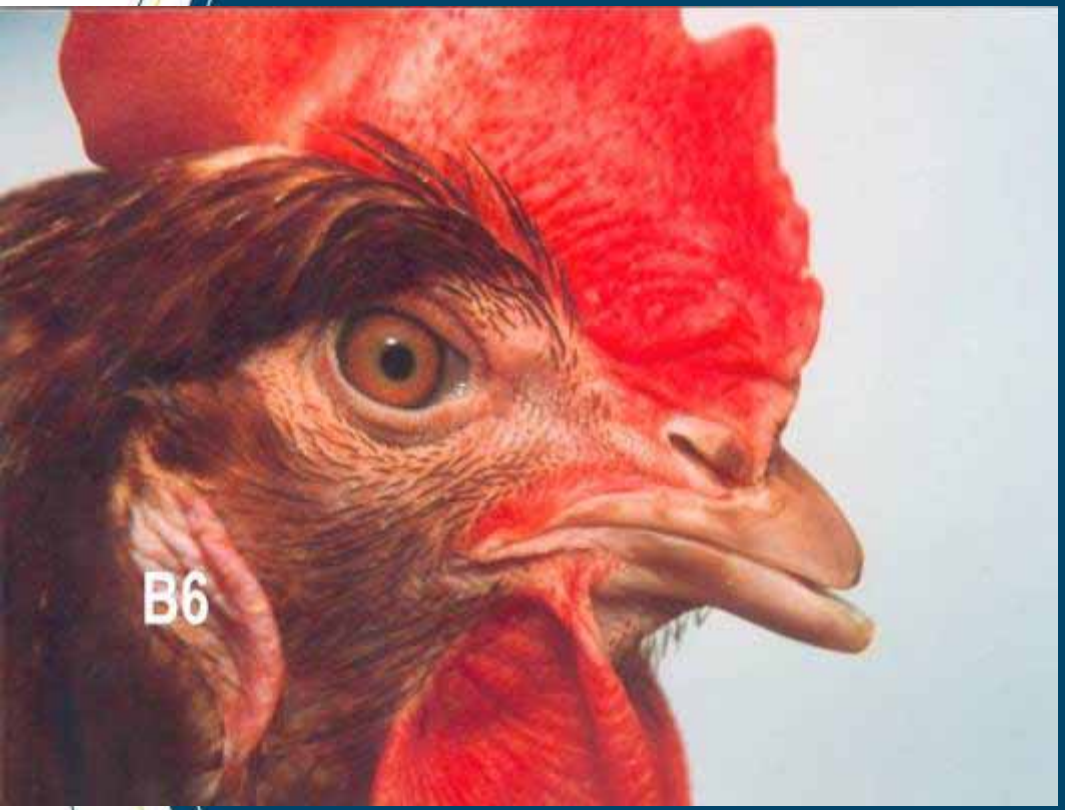
BEAK TRIMMING CONSISTENCY



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BEAK TRIMMING WELFARE ISSUES

1. Loss of sensory input from due to removal of receptors
2. Acute and chronic pain from severing nerves

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REMOVAL OF RECEPTORS

- ✓ Receptors are concentrated at the beak tip
- ✓ Removal can result in a reduction of
  - o Feed intake
  - o Pecking efficiency
  - o Temperature and touch responses

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EFFECT OF TRIMMING ON RECEPTORS

Trimming 1/3rd of beak at 5 weeks results in dermis without receptors

However trimming at a younger age results in regeneration of nerves which target the receptors

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NEUROMAS

- ✓ **Traumatic neuromas can develop from regenerating fibres and cause chronic pain**
- ✓ **After severing, sprouting of axons can form disorganised tangles of nerves (neuromas)**
- ✓ **Excess sprouts can degenerate and neuroma regresses**
- ✓ **Neuromas may persist and discharge ectopic action potential perceived as pain**

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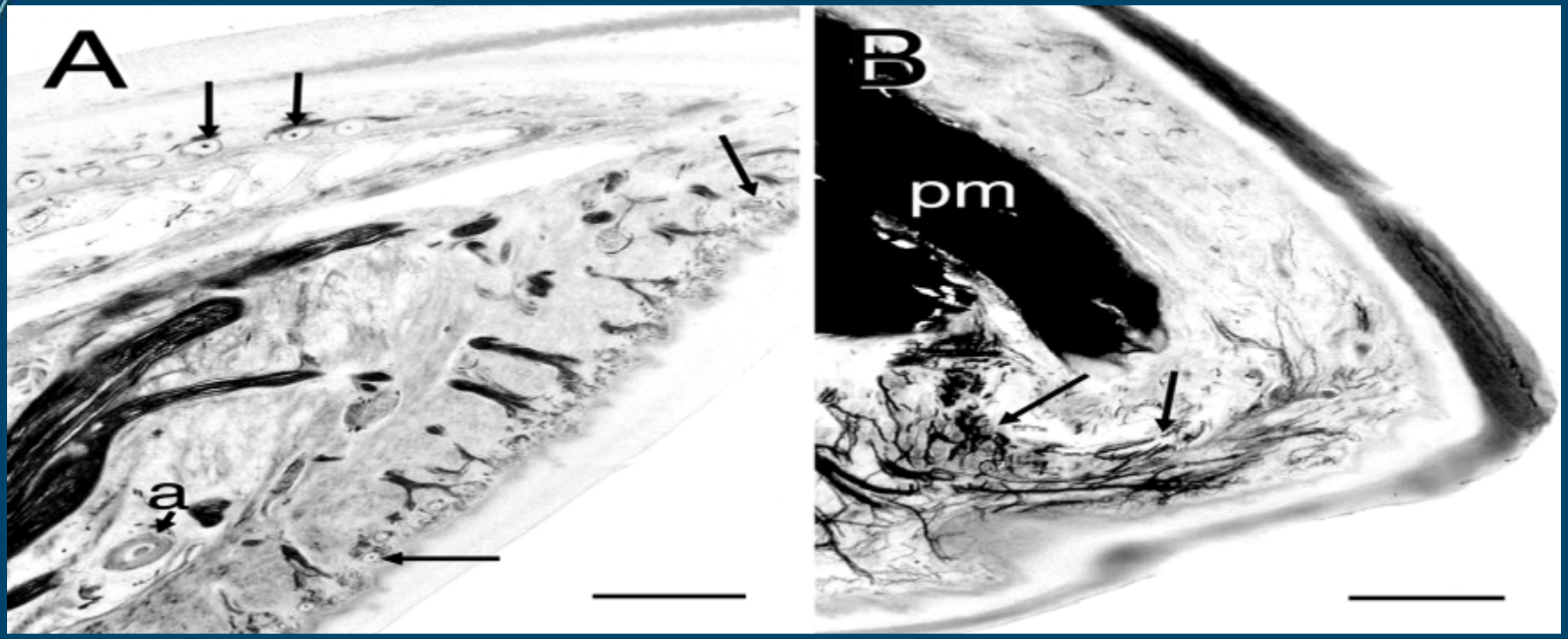
NEUROMAS



(A) *Nerve fibres (stained black).*

(B) *Extensive neuroma (arrows) in the beak of an adult hen*

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NEUROMAS RISK FACTORS

- ✓ Age of trimming
- ✓ Severity of trimming
- ✓ Re-trimming

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ASSESSMENT OF BEAK TRIMMING METHODS

MORTALITY OF LAYERS TRIMMED WITH THE INFRA RED METHOD

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MORTALITY

- ✓ IR beak treatment assessed for about 1m layers; 32 flocks
- ✓ 18 cage systems (Hi-rise, multi-tier and conventional) with natural ventilation or controlled environment
- ✓ 14 free range barn systems (slats or slats/litter) with natural ventilation

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MORTALITY

- The flocks had an age range from 20-80 weeks and mortality of birds from each flock was corrected to 50 weeks
- Free-range/barn systems had higher ($P<0.05$) mortality (2.58%) compared to birds housed in cages (1.81%).

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MORTALITY

- ✓ There was no significant difference in bird mortality for birds housed in cage systems or provided with different ventilation methods.
- ✓ For the free-range/barn system there was no difference in layer mortality when comparing slats with the slats/litter flooring system.
- ✓ The relatively low mortality of birds in all production systems indicates the IR method is a suitable method of beak trimming despite higher levels of mortality in free range barn systems.

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Layer mortality (%) in different production systems

Treatment	Mortality at 50 weeks of age
Cage	1.811
Free-range/Barn	2.508
P	0.024

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Layer mortality in different cage systems

Treatment	Mortality at 50 weeks of age
Conventional	1.852
Hi-rise	1.792
Multi-tier	1.793
P	0.982

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Layer mortality for different ventilation systems in cage systems

Treatment	Mortality at 50 weeks of age
CE	1.793
Natural	1.827
P	0.905

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Layer mortality for different floor types in free-range/barn production systems

Treatment	Mortality at 50 weeks of age
Slats	2.773
Slats/litter	2.456
P	0.635

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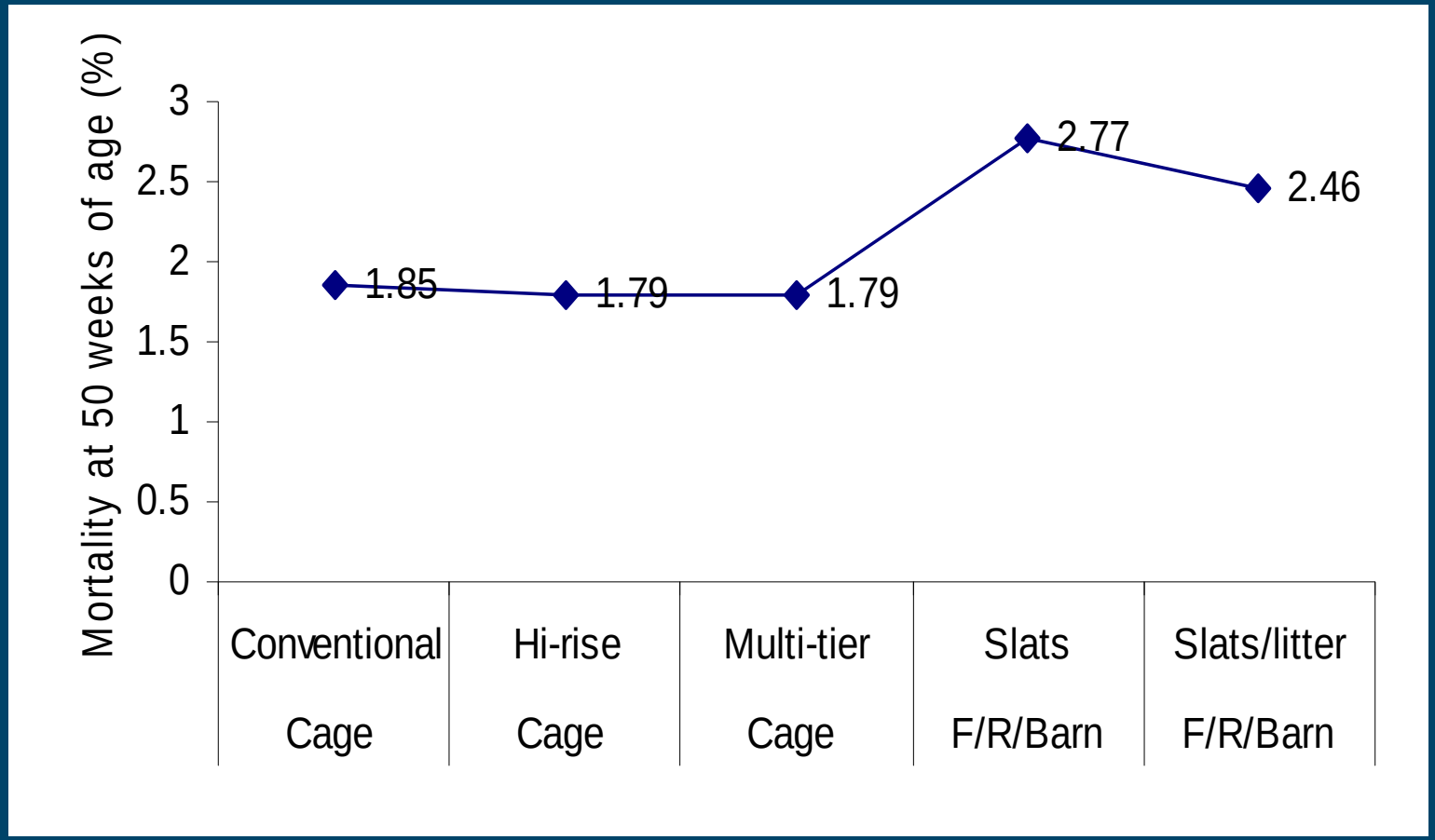
Bird mortality in different housing systems



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BEAK REGROWTH

The power settings on the IR trimming machine have an important bearing on whether extensive beak regrowth occurs.

In this study it is likely that the settings on IR machine were appropriate and prevented beak regrowth and subsequent cannibalism.

COMPARISON OF HOT BLADE BEAK TRIMMING AND INFRARED TREATMENT IN LAYING HENS

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HOT BLADE VS INFRARED

- **Hot blade beak trimming involves the partial removal of the upper and lower beak by using an electrically heated blade that cuts and cauterises the beak**

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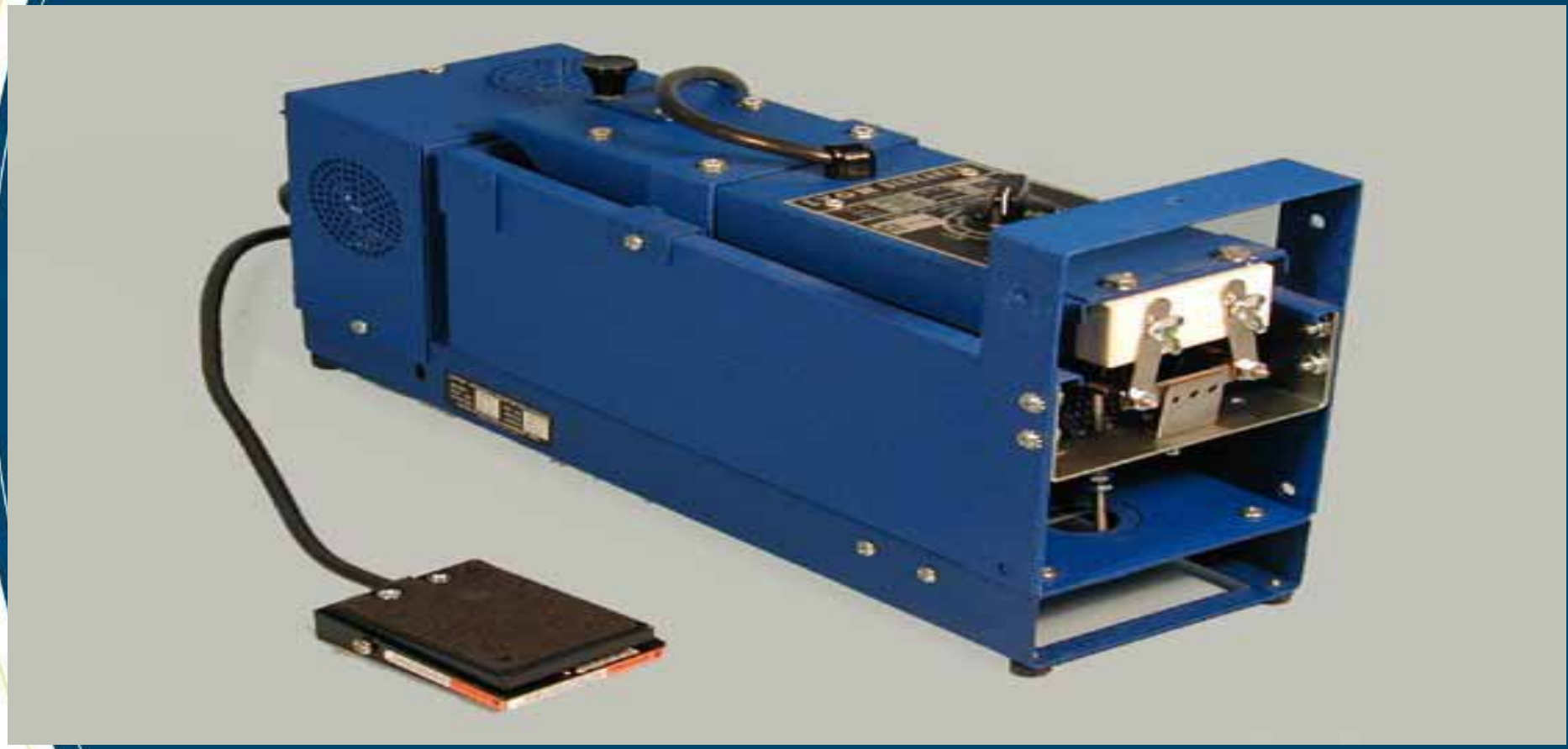
HOT BLADE BEAK TRIMMING



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INFRARED METHOD

- ✓ The infrared method kills the underlying beak tissue.
- ✓ The treated tissue erodes after a few weeks resulting in a partially trimmed beak.


Nova-Tech infrared

Nova-Tech infrared


Nova-Tech infrared

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CONTROL VS INFRARED

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AIM

- ✓ Compare production and beak condition of bird's trimmed using the hot blade and infrared method.

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MATERIALS AND METHODS

- ✓ **50 Hyline Brown layers were trimmed at day old using the infrared and hot blade method.**
- ✓ **Birds were housed in growing cages until 16 weeks; then at 4 per cage (550 cm2) in a controlled environment layer shed**
- ✓ **A standard starter, grower, and layer diet was fed and water was available *ad libitum* throughout the trial. Birds were monitored from 0-60 weeks.**

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MATERIALS AND METHODS

- Beak length, beak step, beak growth and beak condition, body weight and weight gain were determined at regular intervals.

- Beak length was measured using a digital vernier calliper. Beak condition was assessed using a scoring system (1=…; 2 =…; 3=….).

- Hyline layers housed in cages were monitored for the same variables at 45 and 60 weeks on 3 commercial egg farms in South Australia.

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LAYER FACILITY

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MEASURING BEAKS

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BEAK MEASUREMENT

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BEAK GRADE

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Minimise Cannibalism with Beak Trimming

Beak Grades Guide

Grade 1

- No imperfections, splitting, chapping or swelling;
- good keratin layer on beak;
- beak is not too short

Grade 2

- beak shows minor imperfections in appearance and beak is too short

Grade 3

- beak shows major imperfections and is very short

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HOT BLADE

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INFRARED

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INFRARED

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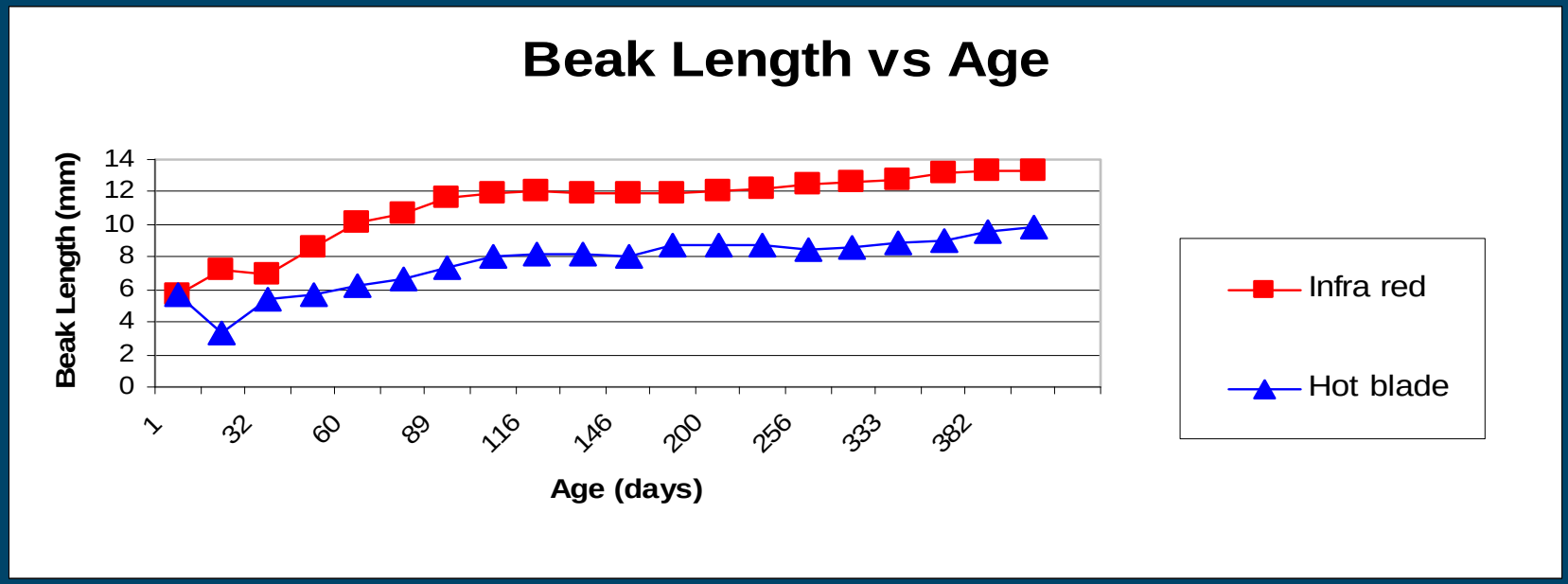
PPPI Trial
IR vs. Hot blade



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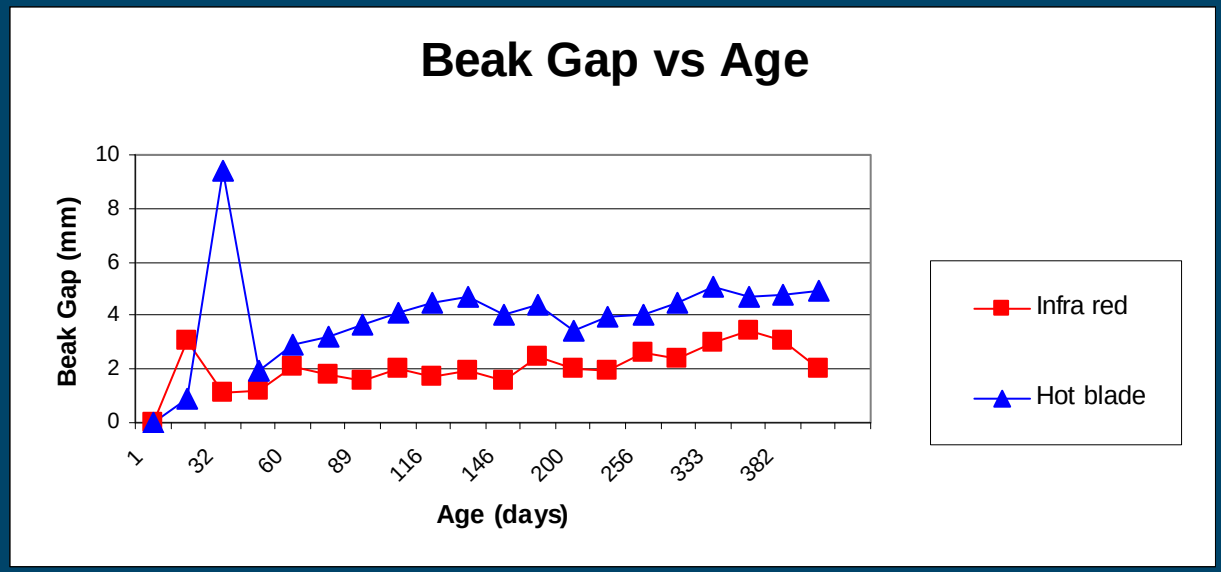
IR vs. Hot blade



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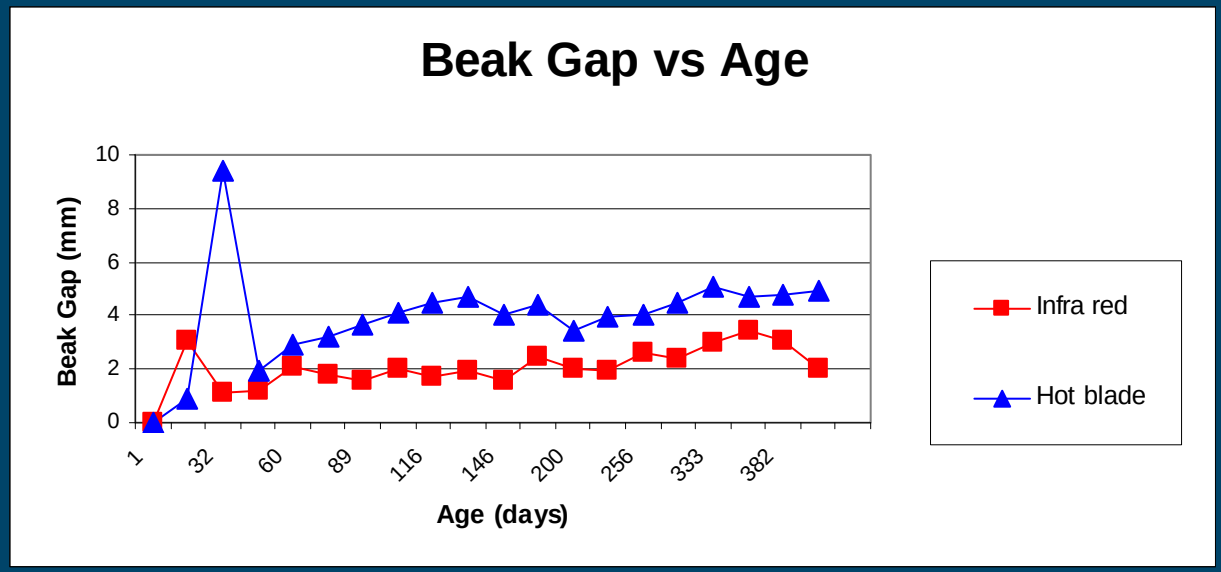
PPPI Trial
IR vs. Hot blade



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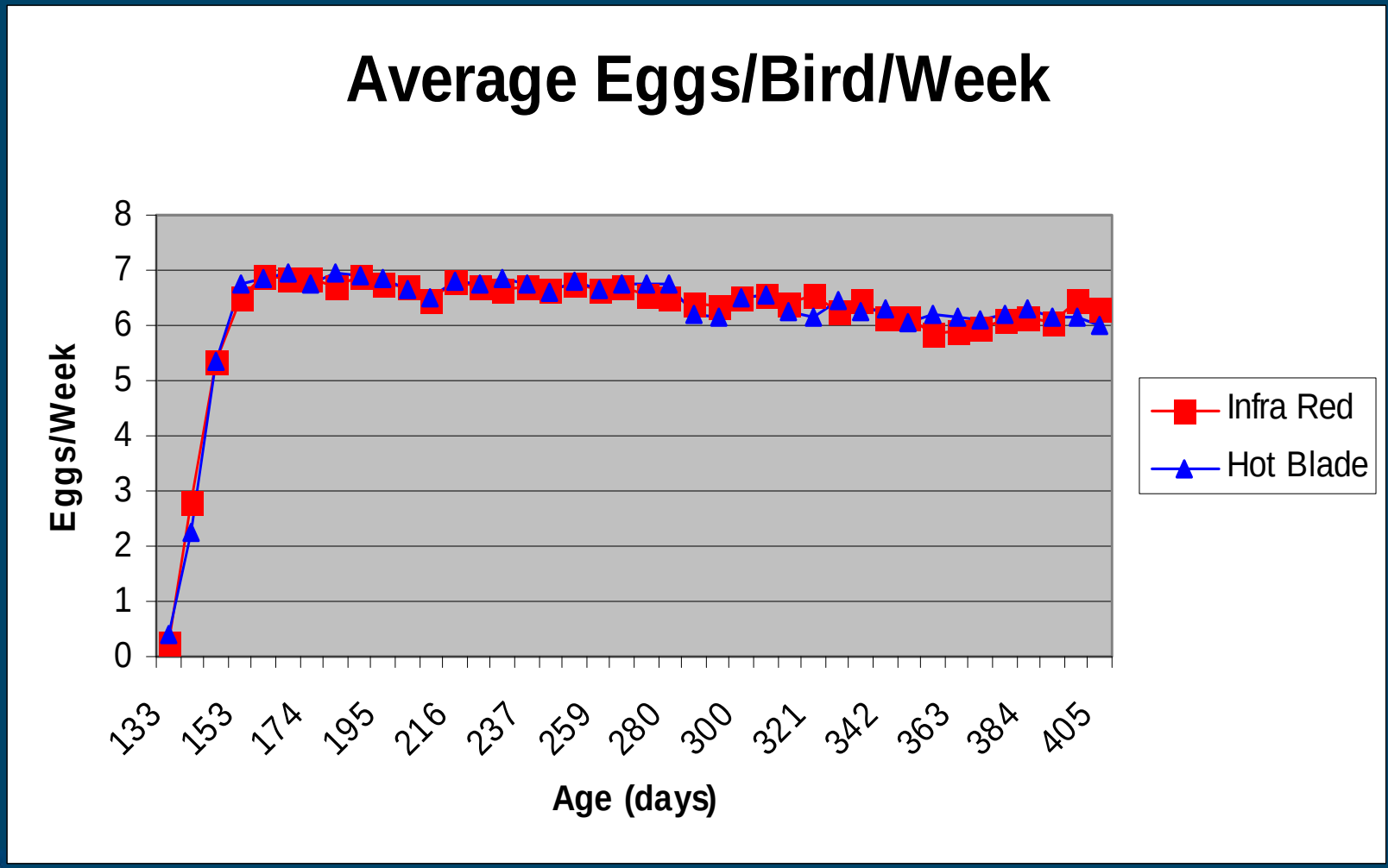
PPPI Trial
IR vs. Hot blade



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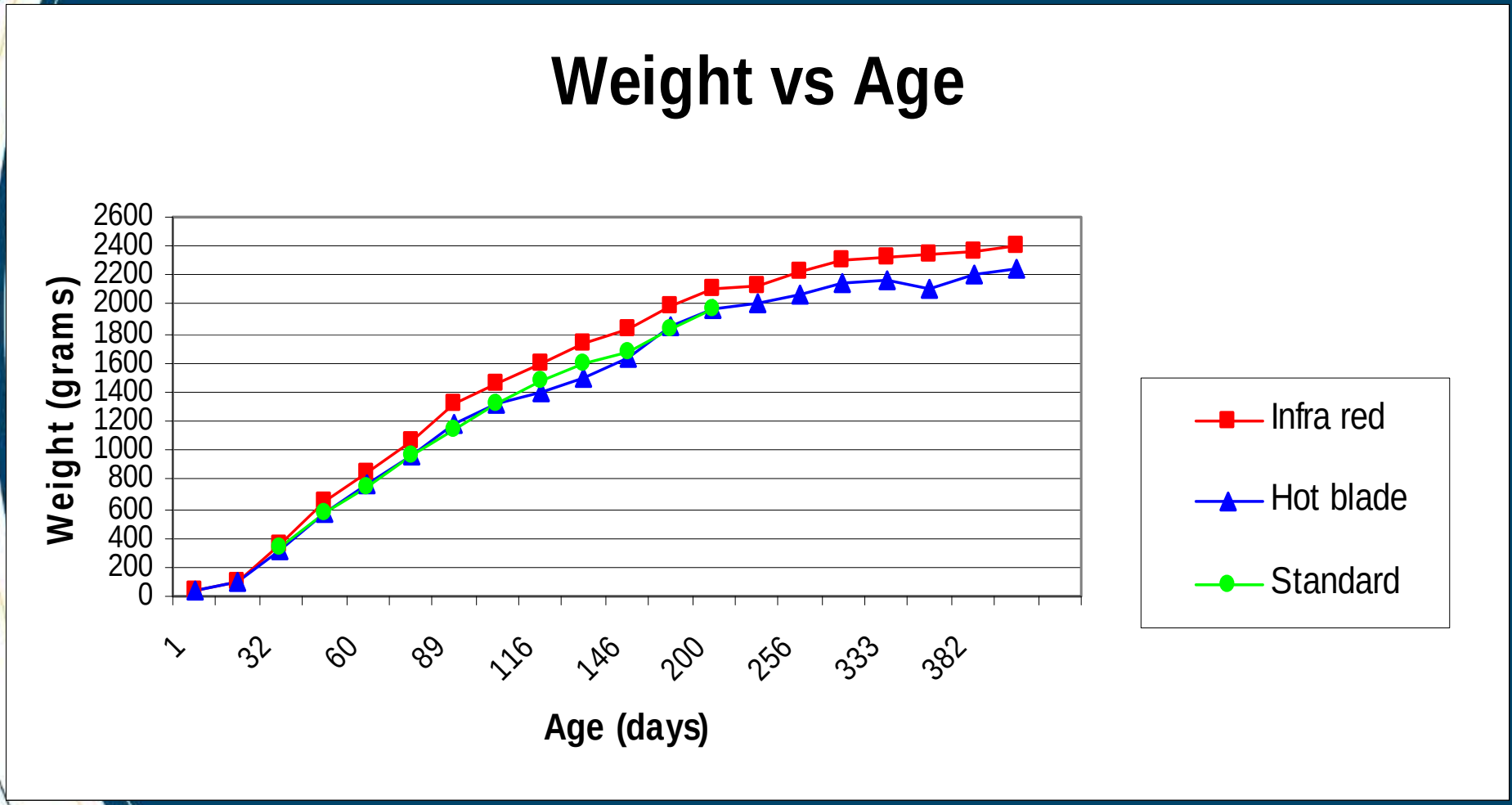
PPPI Trial
IR vs. Hot blade



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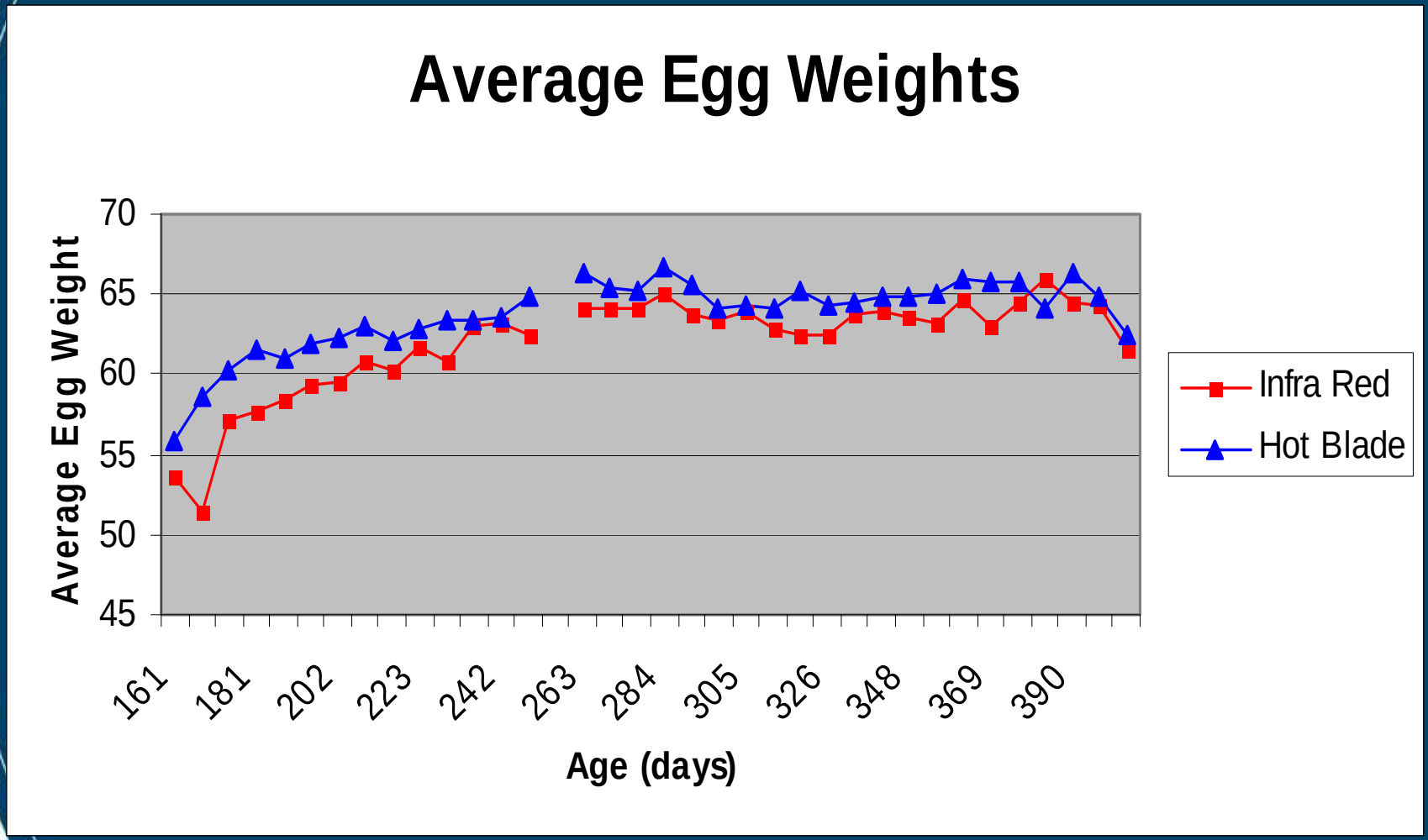
PPPI Trial
IR vs. Hot blade



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RESULTS

- ✓ Beak length was higher for infrared trimmed birds than hot blade trimmed birds.
- ✓ However, the beak step (gap between top and bottom beak) was larger for hot blade birds

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BEAK CONDITION

- ✓ Hot blade trimmed birds had poorer beak condition than infrared trimmed birds up to 40 weeks age
- ✓ Thereafter there was no difference in beak condition

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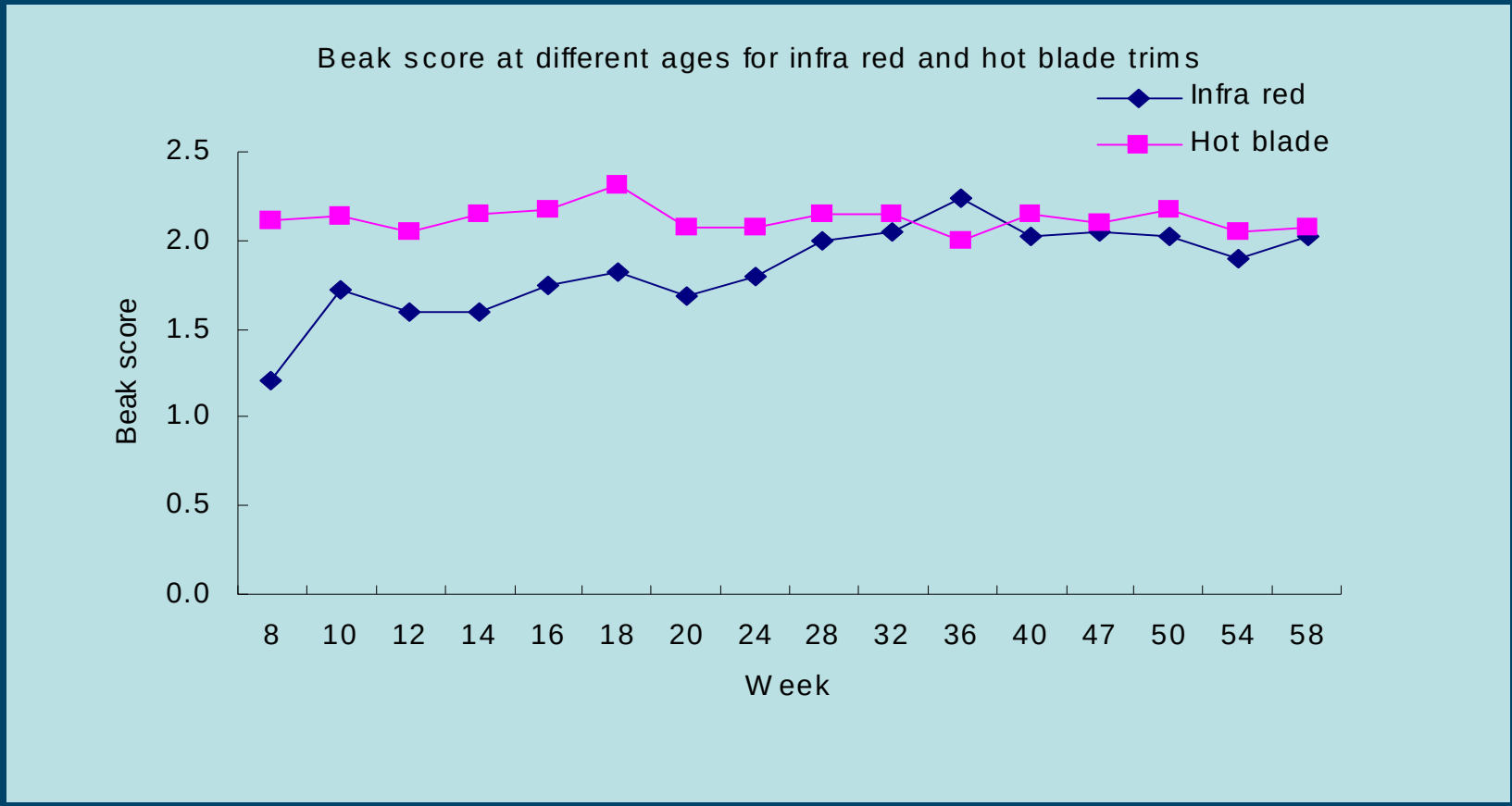
BEAK CONDITION



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DISCUSSION

- ✓ Hot blade trimmed birds had a shorter beak (9.82mm) compared to infrared trimming (13.29mm).
- ✓ Birds with longer beak may have a greater capacity to engage in feather pecking and cannibalism

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✓MONITORING INDUSTRY EGG FARMS

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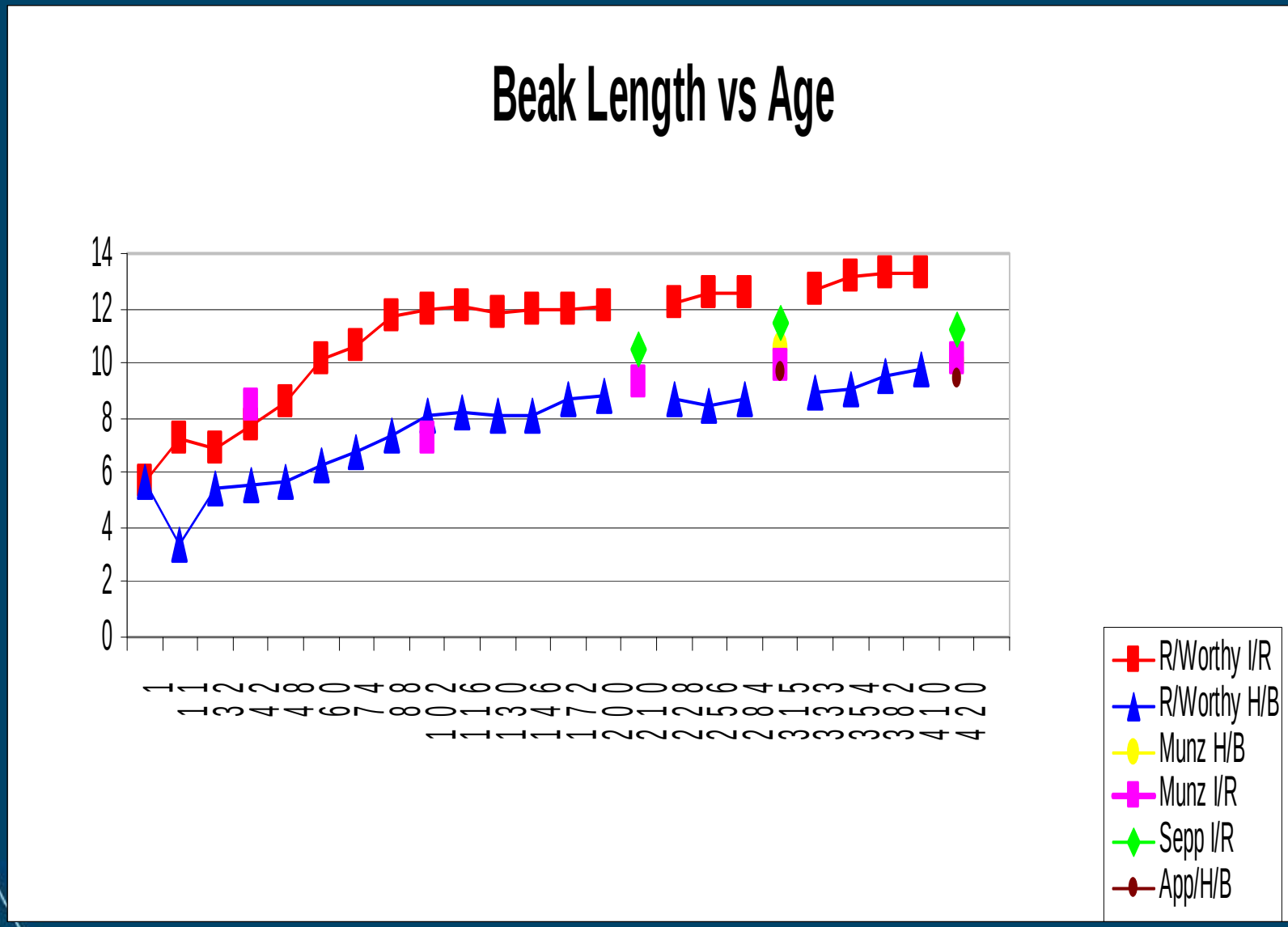
PPPI Data vs. Industry



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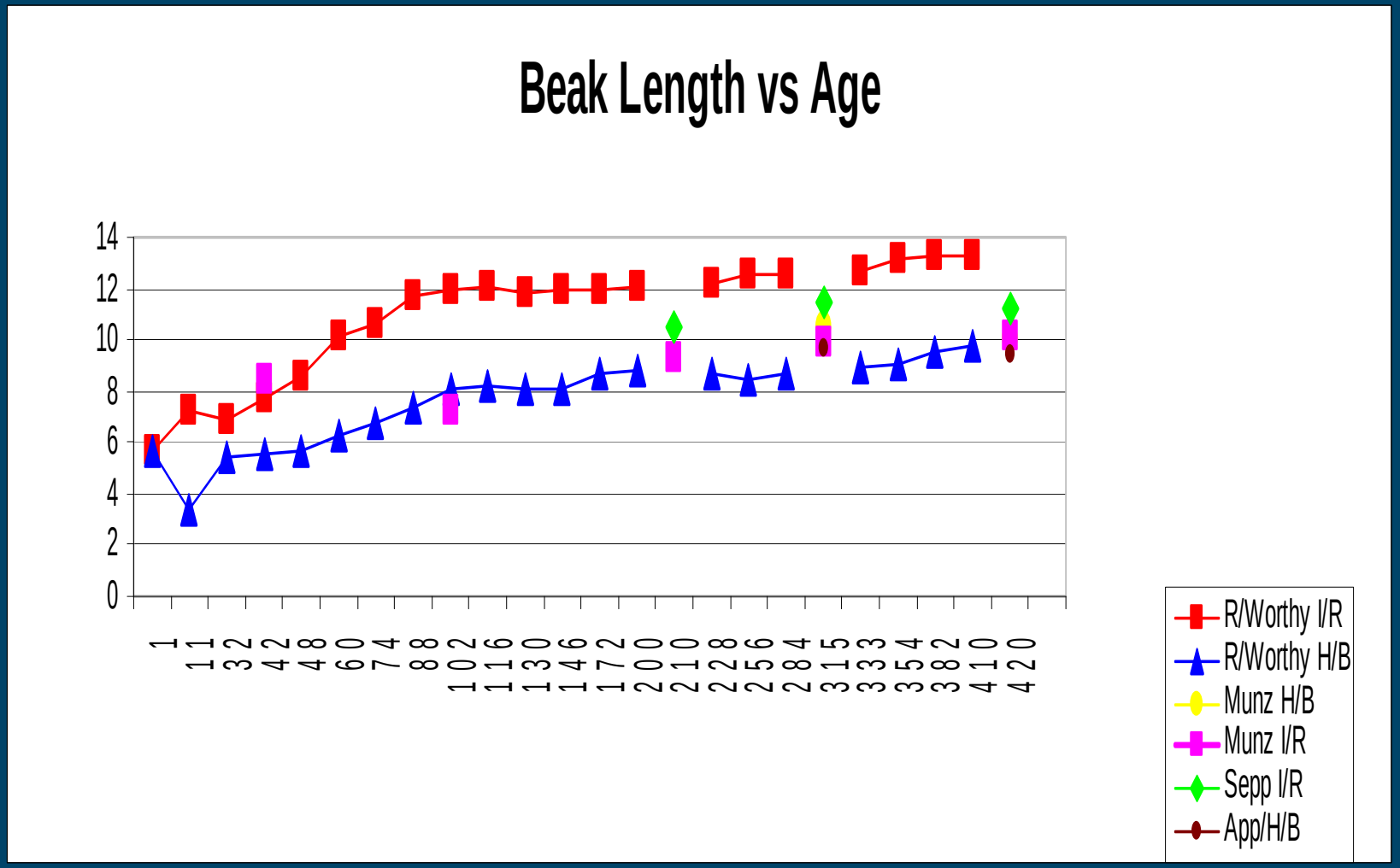
PPPI Data vs. Industry



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CONCLUSION

- ✓ **Beak condition (a measure of its appearance and shape) was superior for infra red treated birds in the rearing period but by mid lay was similar**

- ✓ **The upper beak length of infrared trimmed birds was consistently longer (4 mm) throughout lay**

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CONCLUSION

- ✓ **No difference in egg production was observed throughout the production**
- ✓ **Industry flocks were also monitored to provide a basis for comparison with the research trial**

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CONCLUSION

- ✓ **There was significant variation in beak condition and beak length of birds on industry farms between both beak-trimming methods for birds monitored on industry farms.**
- ✓ **There is a need for further consistency in the application of both trimming methods.**

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Histopathology of beaks trimmed with infrared method at day old and hot blade at 10 days

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IR BEAK TREATMENT

- The IR method of trimming developed by NovaTech is the most popular method world wide.
- From 2002-2009 IR treatment of
  - 2.4 billion turkeys
  - 596 million layers and broiler breeders
  - 104 million ducks

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IR BEAK TREATMENT

- The method uses an IR energy source to treat the beak.
- Immediately after treatment the beak looks the same as it did before treatment. The bird is able to continue to use its beak.

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IR BEAK TREATMENT

- The anatomy of the beak stump from IR and hot blade birds was examined to determine the incidence of neuromas

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Histopathology

- ✓ HB versus IR resulted in a similar histopathology of the upper beaks.
- ✓ Neuromas were present at 32 days of age and persisted to 420 days of age.
- ✓ Sensory receptors were not observed in beaks from either method of trimming at any age examined.

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Histopathology

- The histopathology suggests that excessive tissue was removed for the age at which the birds were HB trimmed.
- IR trimming has a significant impact on histopathology resulting in the formation of traumatic neuromas which persisted to adulthood.

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RECOMMENDATION

- ✓ There is a need to practice HB trimming at day old instead of 10 days to overcome neuroma formation and chronic pain
- ✓ Development of new technology methods of beak trimming (eg. laser and phyto agglutination) is required.

The behaviour of birds beak trimmed by different methods

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UNE TRIAL

- One thousand birds were purchased with 300 beak trimmed using a hot blade at the hatchery and 300 trimmed using infrared trimming. The remainder of the birds were left untrimmed.
- The chicks were reared in their trim treatment groups until 10 weeks of age. At this time half of the IR and HB birds were re-trimmed using the HB technique to remove at least one third of the upper and lower beak.

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UNE TRIAL

5 treatment groups

1. Control (untrimmed),
2. IR-Control (IR not re-trimmed),
3. HB-Control (HB not re-trimmed),
4. HB-HB (HB and re-trimmed) and
5. IR-HB (IR and re-trimmed).

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UNE TRIAL

Behavioural tests included four “test” procedures designed to allow assessment of fear (freeze behaviours) and aggression (pecking).

1. A foreign object test - pecks directed at a foreign object above the cage within a set time and the time to first peck
2. A food object test : pecks directed toward a food object and the time to first peck
3. A freeze response associated with the presence of another bird in an arena, the time to move within a set time period,
4. A freeze response associated with placement of the bird alone in the arena, the time taken to move within a set time period.

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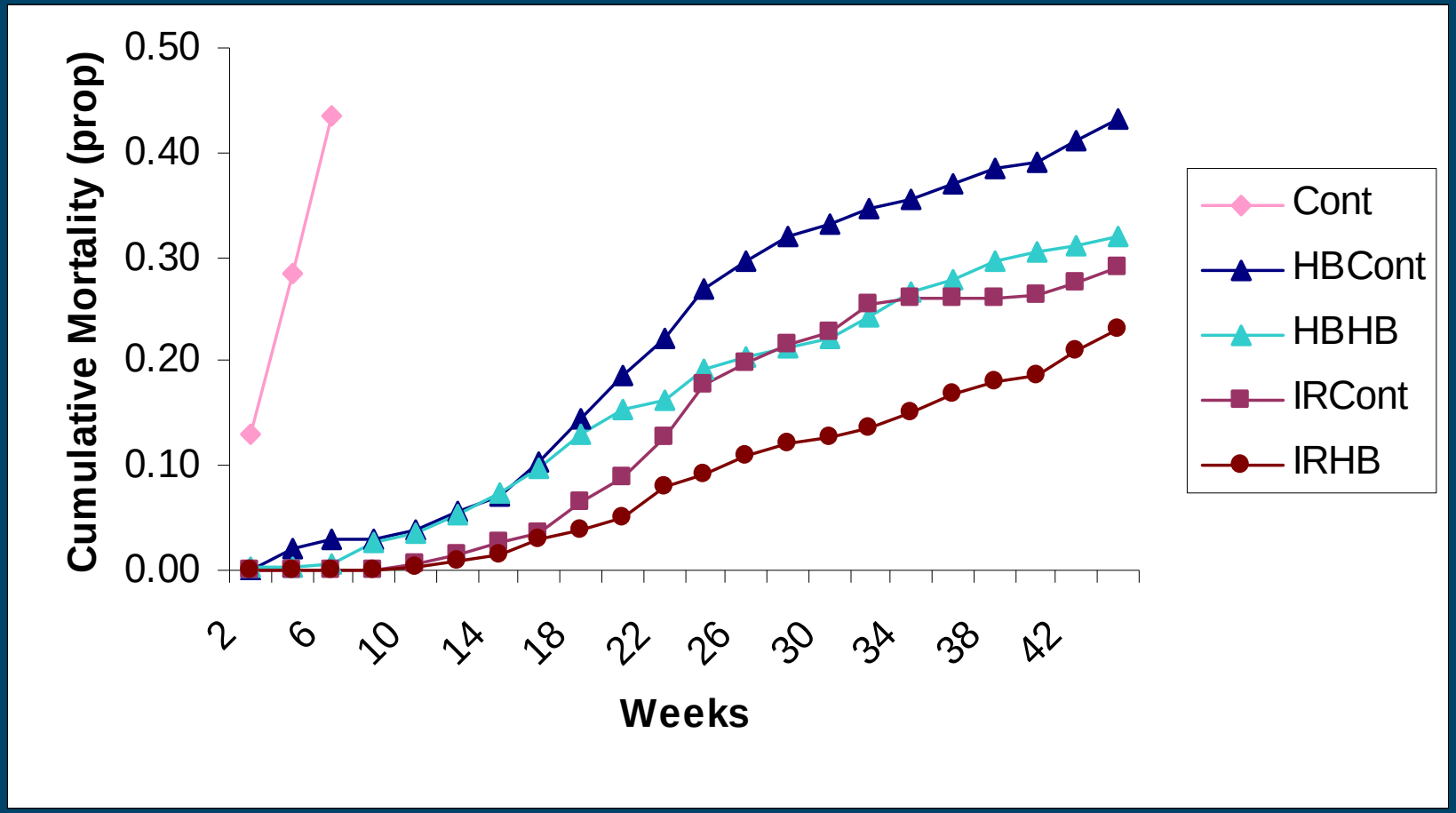
Mean cumulative mortality for all beak trim treatments



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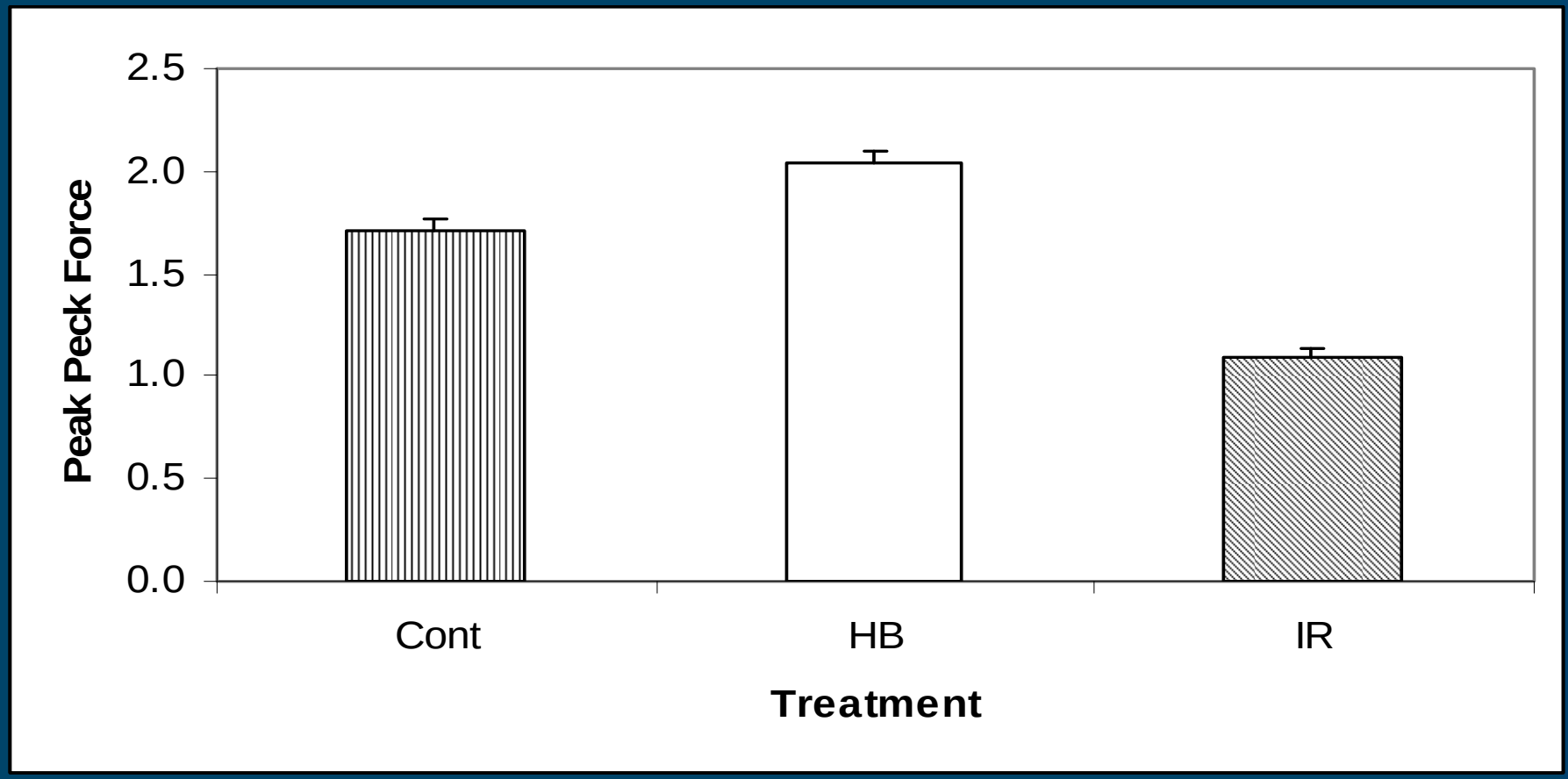
Mean peak force (N) of pecking for initial beak trim treatment groups



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Mean peak force (N) of pecking for initial beak trim treatment groups

- ✓ The differences between initial treatments in peck force were significant ($P<0.01$) with the IR group exhibiting significantly lower force than the control or HB birds.
- ✓ This may be due to a greater incidence of neuromas in IR trimmed birds compared to the lightly trimmed HB birds.
- ✓ HB birds also had a peck force greater than the controls. There were no significant differences between re-trim and control treatments applied at 10 weeks with mean force values of 1.59 vs1.64 newtons.

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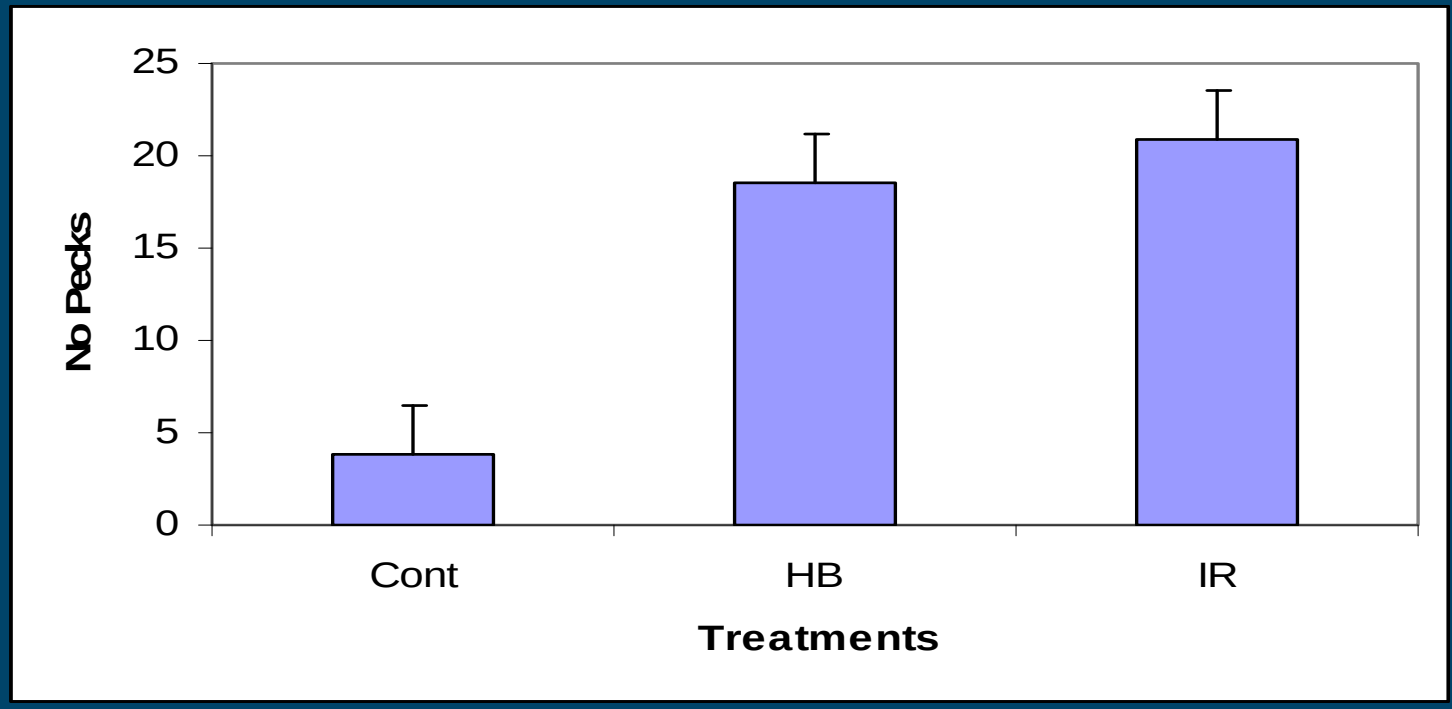
Mean number of pecks directed at a foreign object for birds trimmed at day old



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Mean number of pecks directed at a foreign object for birds trimmed at day old

- ✓ Pecks directed at a foreign object were significantly lower in the control birds vs other treatments conducted at day old

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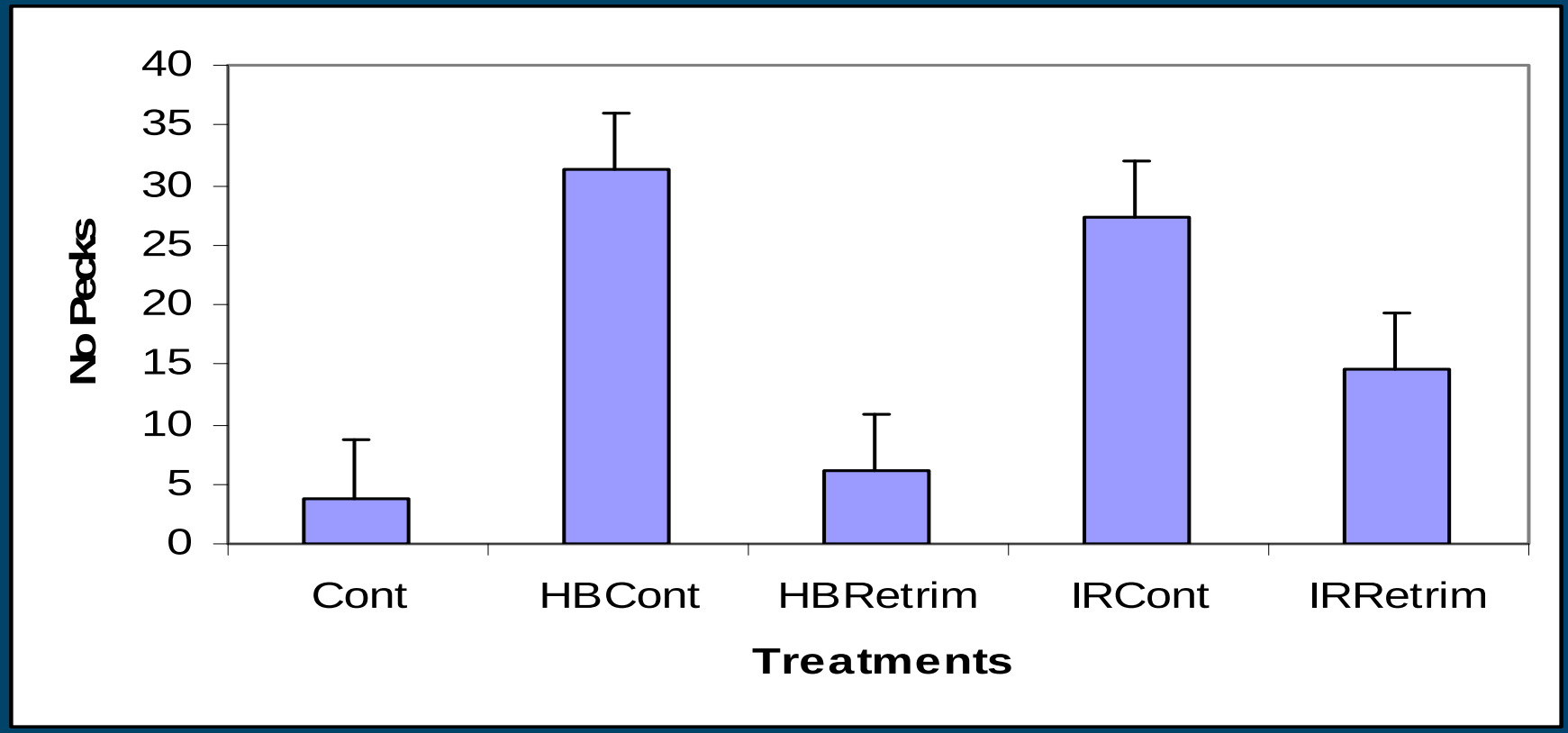
Number of pecks directed at a foreign object for the beak treatments.



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Number of pecks directed at a foreign object for the beak treatments.

- ✓ Significant difference ($P<0.001$) between beak treatments in the number of pecks directed at a foreign object.
- ✓ The one day trimmed bird (IR and HB) directed significantly more pecks than the control birds ($P<0.01$) at the foreign object.
- ✓ Birds re-trimmed at 10 weeks used significant fewer pecks than the birds only trimmed at day 1 ($P<0.05$).

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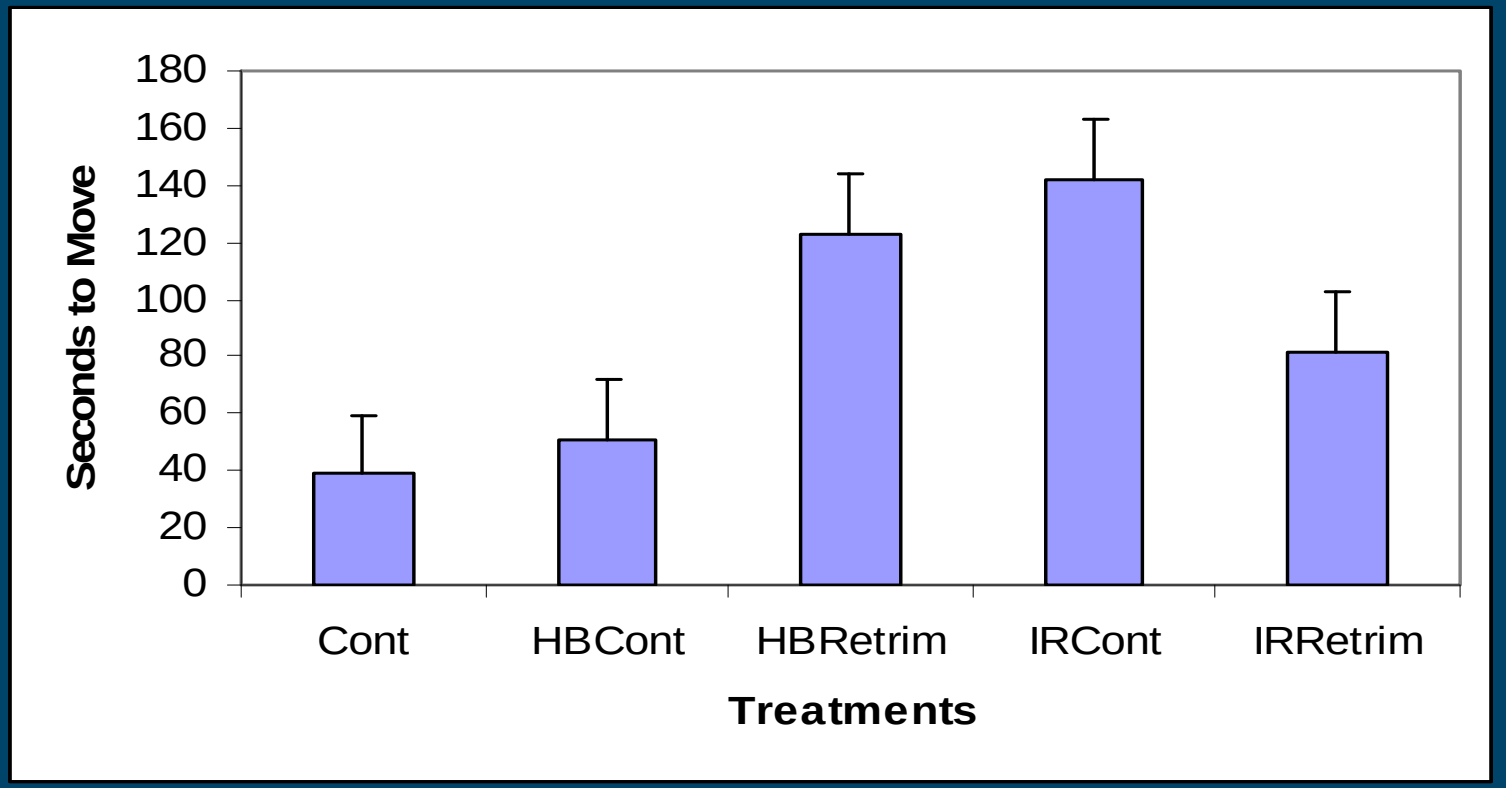
Mean time (sec) for first movement after placement of a strange bird into the arena for beak trim treatments, trimming at day 1 or 10 weeks.



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Mean time (sec) for first movement after placement of a strange bird into the arena for beak trim treatments, trimming at day 1 or 10 weeks.

- ✓ Large variation between birds within treatments for the time to move (fear) response to another bird and a significantly greater fearfulness of bird trimmed with IR at day 1 compared to HB or control birds ($P<0.05$).
- ✓ The IR trimmed birds may have been subject to greater pain during the beak treatment contributing to the response.
- ✓ The birds HB trimmed at 1 day and re-trimmed at 10 weeks were more fearful than birds trimmed for the first time at 10 weeks (HB10, $P<0.05$). There were no significant differences between treatments in the freeze response of birds when isolated in the arena.

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UNE TRIAL

- The large scale trial conducted at UNE showed clearly that when light intensity cannot be controlled in laying sheds cannibalism will occur.
- In the current trial mortality levels reached 40% before the birds were relocated to individual cages.
- It was also clear that the lightly trimmed HB layers had higher mortality suggesting that after beak regrowth birds engaged in damaging pecking.

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UNE TRIAL

- The IR mortality levels were lower than HB and control groups. It is possible that the presence of neuromas may have reduced the ability of birds to engage in cannibalism.
- However it is not clear whether the presence of neuromas indicates a higher level of pain in the beaks or poorer proprioception reducing the ability of birds to peck.
- The retrimming of birds had the desired effect of further limiting the ability of birds to engage in cannibalism, particularly for the IR treated birds.

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UNE TRIAL

- The assumption made here is that the light levels of HB trimming practiced at UNE probably lead to recovery of neuromas in the beaks of these birds) contributing to the higher peck force of the HB birds.
- The peck force exhibited by the IR birds, however was lower adding further evidence to the suggestion that IR treatment leads to higher levels of pain in the beak or poorer proprioception compared to the HB trimming.
- The retrimming of birds had the desired effect of further limiting the ability of birds to engage in cannibalism, particularly for the IR treated birds.
-

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UNE TRIAL

- The UNE trial also showed that one day old trimmed birds (IR and HB) directed more pecks than the controls at foreign objects perhaps due to investigative pecking behaviour.
- Alternatively beak trimming may only result in a mild irritation or the persistent pecking may be used by the bird to mask the pain sensation

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Conclusions from UNE trial

- Overall the behavioural measures suggest that there are differences in behavioural responses resulting from beak trimming treatments.
- It is apparent that IR and HB treatment at 1 day old increases the level of aggression/pecking activity relative to other treatments and that fearfulness appears significantly higher in the birds treated by IR at day 1 than other trim treatments except the double HB trim.
-

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FUTURE OF BEAK TRIMMING

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EU DIRECTIVE ON BEAK TRIMMING

Currently a number of European countries are working towards the EU Welfare Directive by legislating for a ban on beak trimming by January 1, 2011.

This has resulted in the search for alternatives to beak trimming to reduce the incidence of severe feather pecking and cannibalism especially as free range systems continue to become a more common production system.

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UK UPDATE ON THE BAN OF BEAK TRIMMING

- ✓ UK Farm Animal Welfare Council and the UK beak trimming action group decided to extend derogation allowing beak trimming beyond 1/1/11 but only for Infrared trimming until 1/1/15
- ✓ DEFRA; UK government department responsible for policy and regulations on the environment, food and rural affairs wish to ban all mutilations including beak trimming before 2015

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FUTURE OF BEAK TRIMMING

- ✓ Welfare-friendly production schemes, e.g., ‘Freedom Foods’, will allow infrared beak treatment for a few more years but not hot blade trimming.
- ✓ There is a need to develop alternatives to beak trimming especially for free range

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ENVIRONMENTAL ENRICHMENT

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ENVIRONMENTAL ENRICHMENT- ENCOURAGES BIRDS TO RANGE OUTSIDE

- ✓ Lowers density of birds within the house
- ✓ Allows expression of a wider range of natural behaviours
- ✓ Reduces feather pecking and improves plumage condition

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ENVIRONMENTAL ENRICHMENT

This trial examined the role of shade, forage and shelter belts in attracting laying hens into the range to determine if feather pecking was reduced

Does enrichment reduce the need to beak trim birds?

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ROLE OF SHADE, SHELTERBELTS AND FORAGE

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FACILITIES

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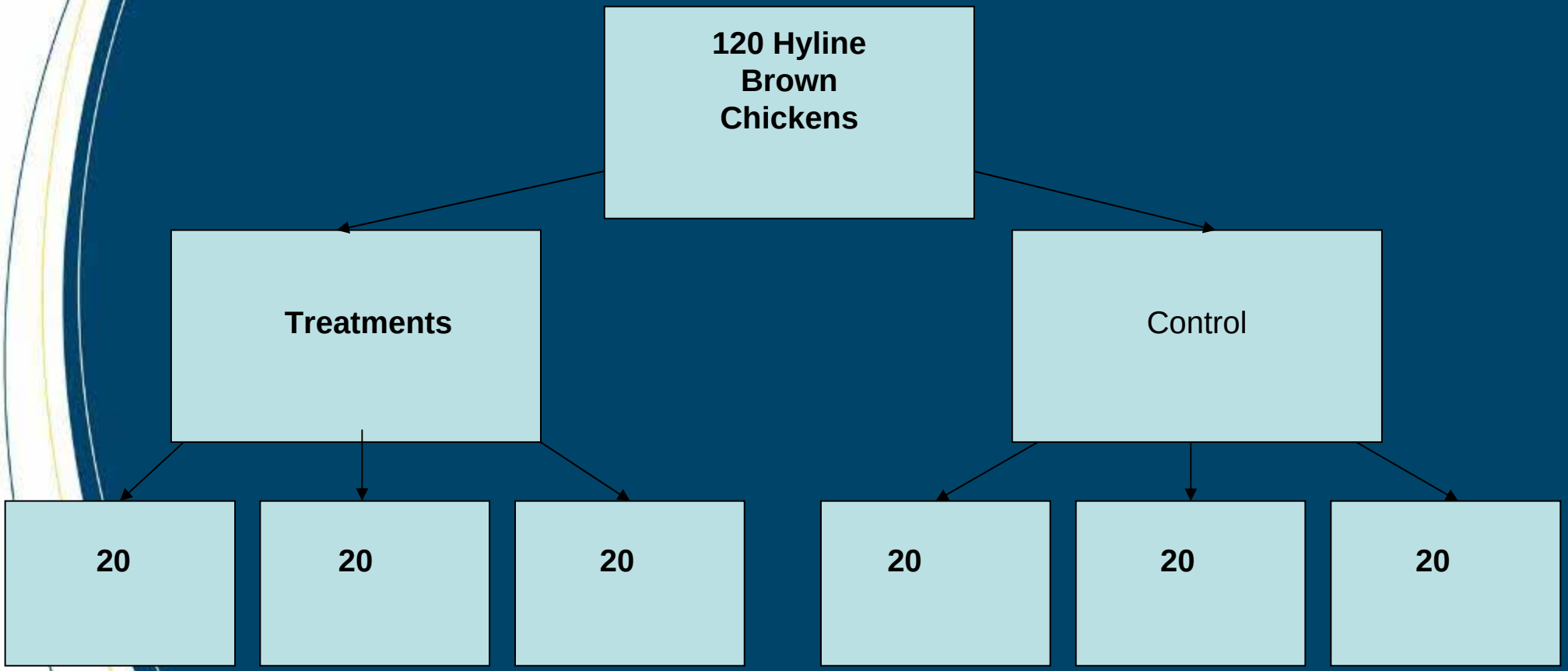
EXPERIMENTAL DESIGN



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SHADE AREAS

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SHELTERBELTS

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FORAGING ON VETCH

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METHODOLOGY

- ✓ Birds were allowed access to the range for 12 weeks
- ✓ Production measurements included egg production, egg weight, body weight.
- ✓ Video records were made of birds. No & distribution of birds(<10m/>10m)
  - Feather pecking & feather score
  - Aggressive behaviour
  - Dust-bathing
  - Foraging
  - Running
  - Comfort behaviours (eg. Preening)
- ✓ Corticosterone
  - Plasma
  - Egg (albumen)
- ✓ Heterophil: Lymphocyte ratio

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DOES ENVIRONMENTAL ENRICHMENT REDUCE FEATHER PECKING?

- ✓ There was no significant effect on production and feather score of hens with all enrichments used
- ✓ Aggressive feather pecking was only observed on a few occasions in all of the trials possibly due to low stocking density

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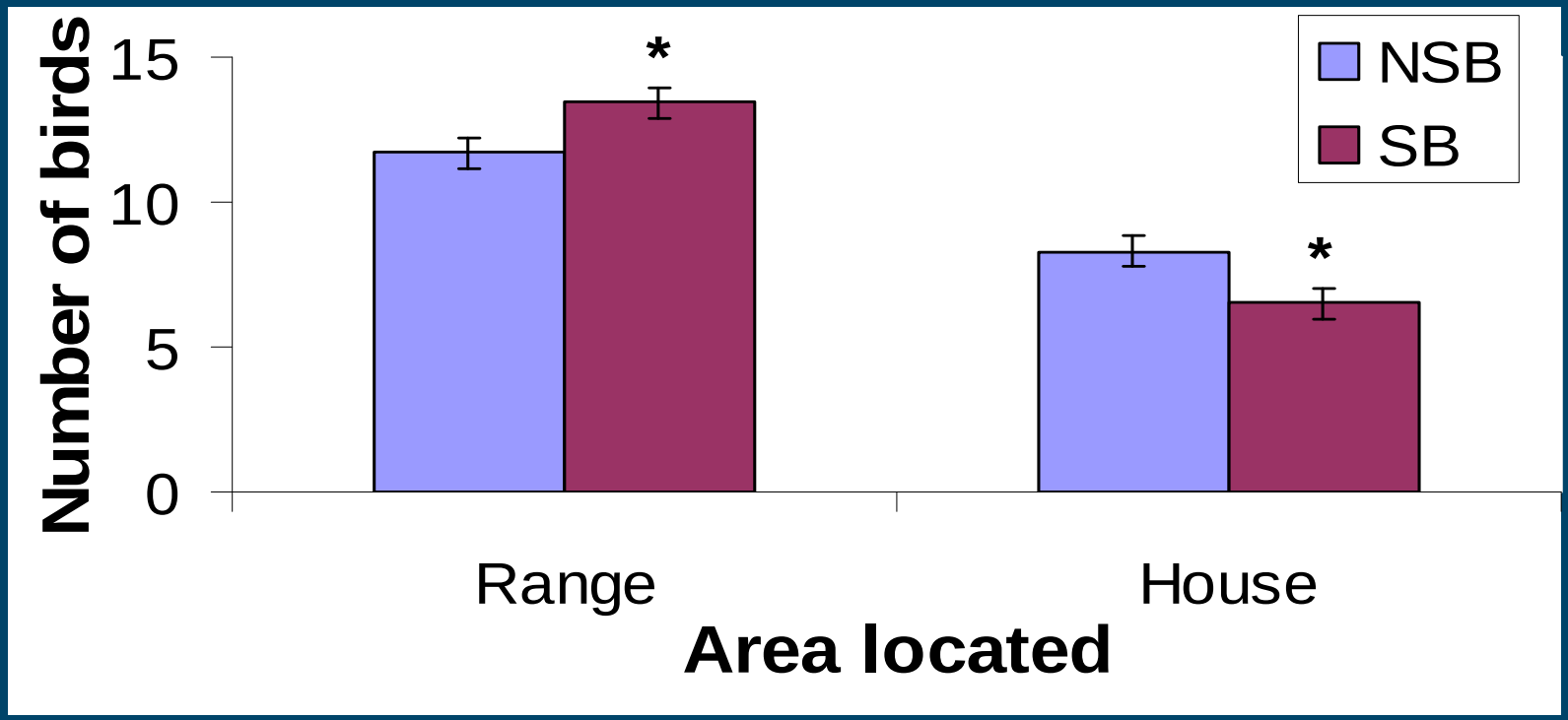
NUMBER OF HENS RANGING WHEN SHELTER BELT PROVIDED



Values with * are significantly (P<0.05) different.

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SHELTERBELT

- ✓ Significant increase in % of birds using range during the day
- ✓ Increased foraging behaviour in the range
- ✓ Prefer to range near sheltered areas (i.e. trees, and fence lines)

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SHADE

Shaded areas were visited by 18% of the hens

Tendency (P=0.07) for more hens to be in the paddock;

- 43% for paddocks with shade
- 25% for the paddocks with no shade

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FORAGE

- ✓ Significant interaction; treatment x time of day. % of control birds in range greater in morning than afternoon

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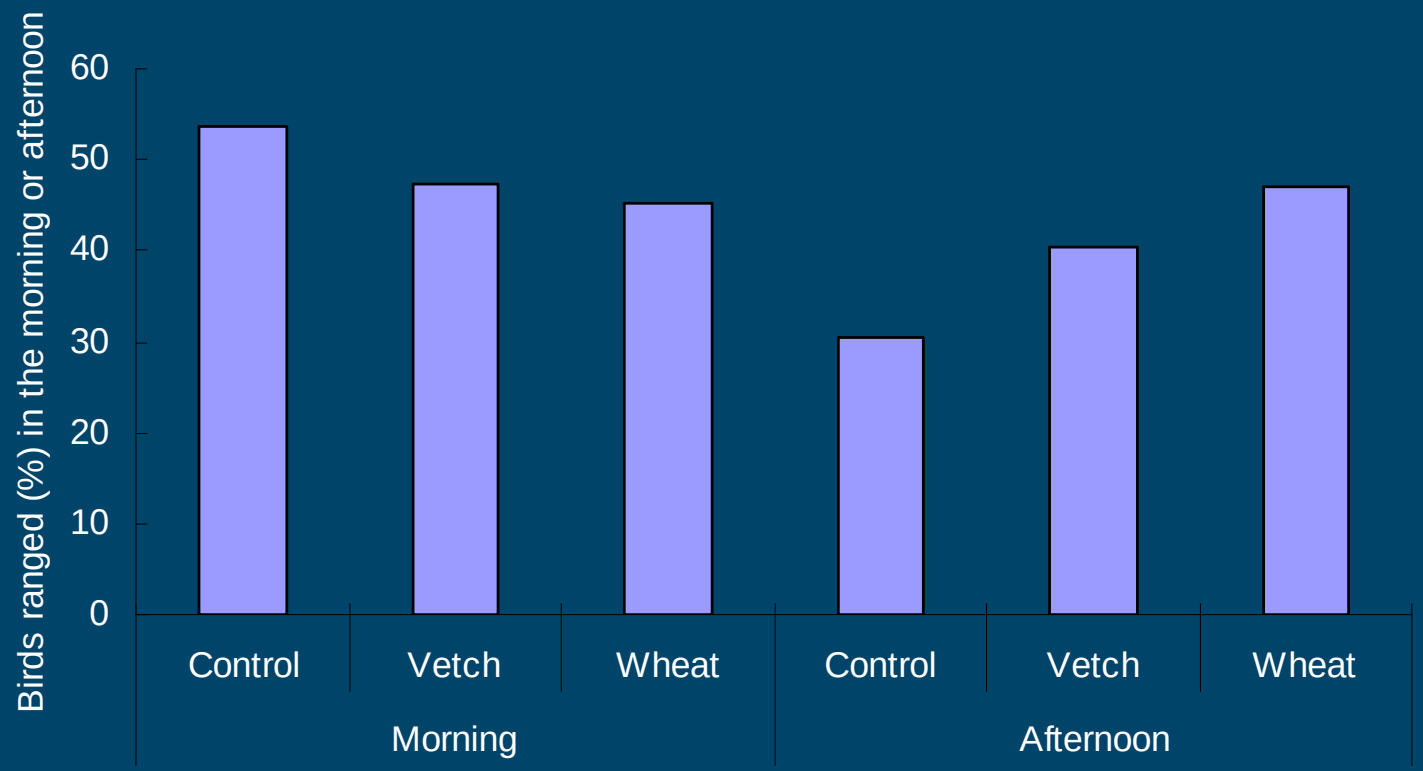
BIRDS IN RANGE WITH FORAGE AVAILABLE



Repellent Work undertaken at UNE

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THE UNIVERSITY OF MELBOURNE

UNE THE UNIVERSITY OF NEW ENGLAND

CRC AUSTRALIA

Australian Government
Rural Industries Research and Development Corporation

AUSTRALIAN EGG® CORPORATION LIMITED

BIOPROPERTIES
The Vaccine Innovators

Australian
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Repellents

Aim: To identify potential repellents that can be used to train birds to avoid blood or feathers

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Experimental methodology

- ✓ Based on choice feeding (2 trough choices) using mature laying hens.
- ✓ Create clear link between food and consequences ~ colour food cues used
- ✓ Alternate position to avoid bias
- ✓ Colour cues (red and green) tested to ensure no bias based on colour

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Screening of potential repellents

- ✓ Literature search of “bird repellent”: possibilities
- ✓ Dosages not listed for poultry with exception of LiCl
- ✓ Repellent effects based on **smell** or **nausea** associated with ingestion (Identified 5 of each)

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Agents – irritant smell

Agent	Effects	Dose /comment
Cabbage extract /“sulphur” volatiles	Irritant/smell	Spray – without saturation (very volatile and requires renewal or carrier!
BHPM - D-Ter® Animal and Bird Repellent Aluminium (ammonium sulphate +)	Irritant/smell	0.05% in food- non toxic
Methyl anthrailate (MA) – grape flavor	Irritant /smell	1000ppm in food – non toxic
2 Ethyl- athraquinone - “Flight Control”	Causes nausea for about 20 minute	Registered as a goose repellent (USA) – low toxicity
Multicrop- Scat Aluminium ammonium	Irritant/smell	0.05% in food –non toxic

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Agents - nausea

Agent	Effects	Dose/comments
Lithium Chloride	Nausea	Max 40mg/kg in food - toxic ~ 400mg /kg
Monsensin sodium	Reduces food intake – possibly nausea	50ppm in food - toxic ~ 600ppm
Thiram (tetramethylthiuram disulphide) used as seed treatment fungicide	Reduces food intake – irritant on mucus membrane	100mg/kg -Toxic ~ 800mg/kg
Azadirachtin - biopesticide	Bitter compound-reduces feed intake of birds	1000mg/kg – low toxicity
Strawberry food flavor (high Conc)	Reduced intake – possibly nausea	>1000ppm- non toxic

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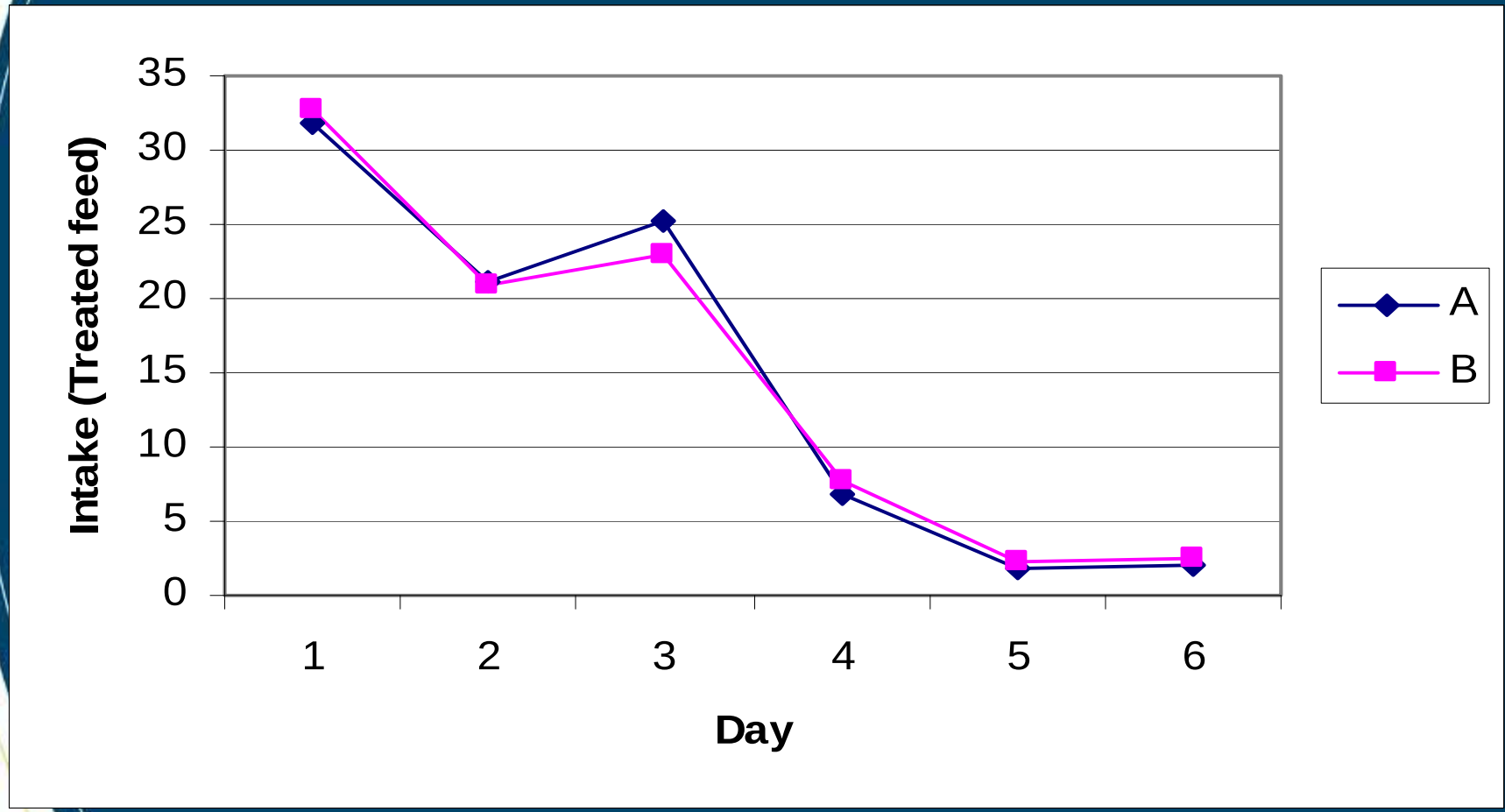
Multicrop (smell)



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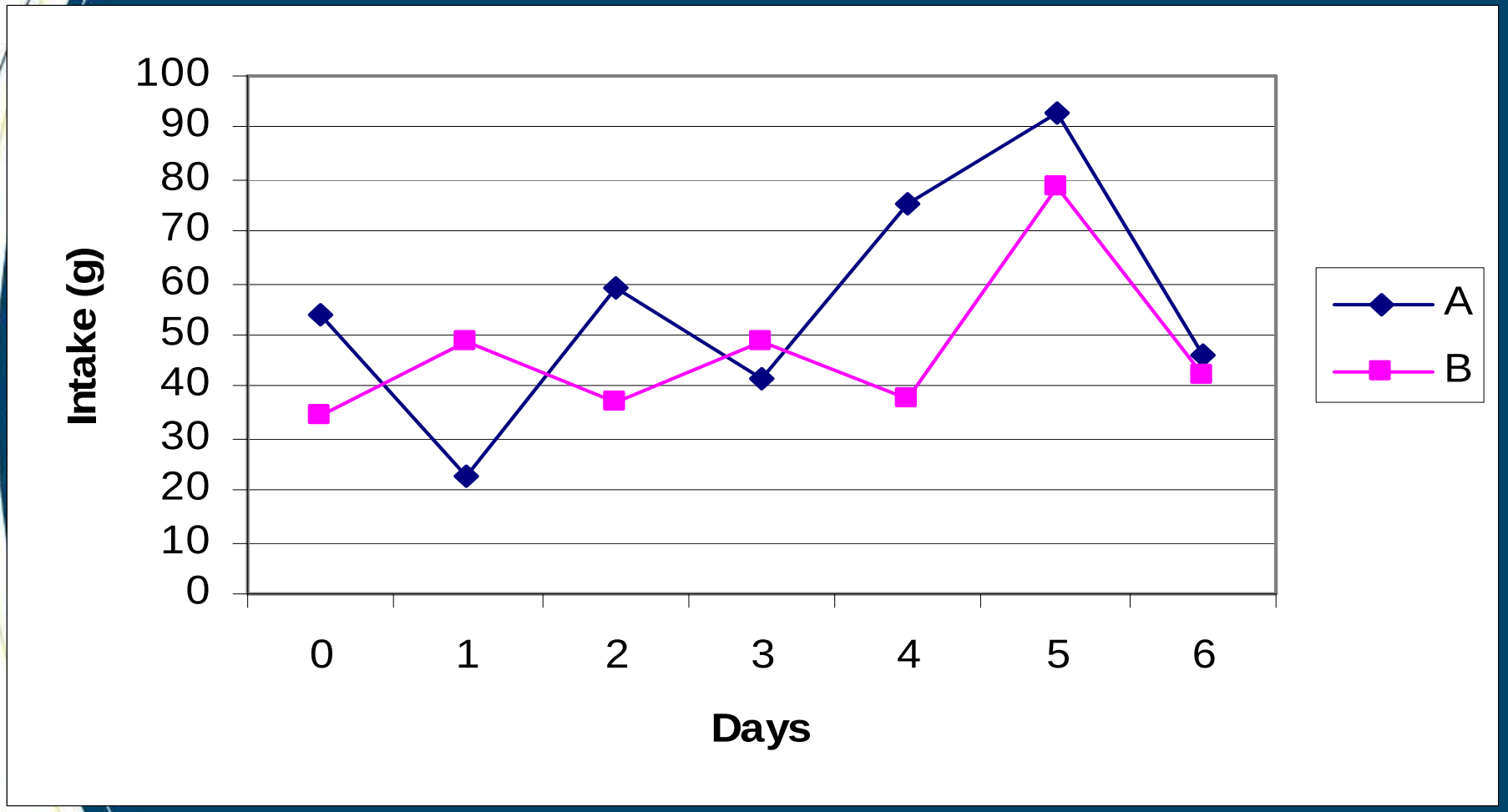
Monensin (nausea)



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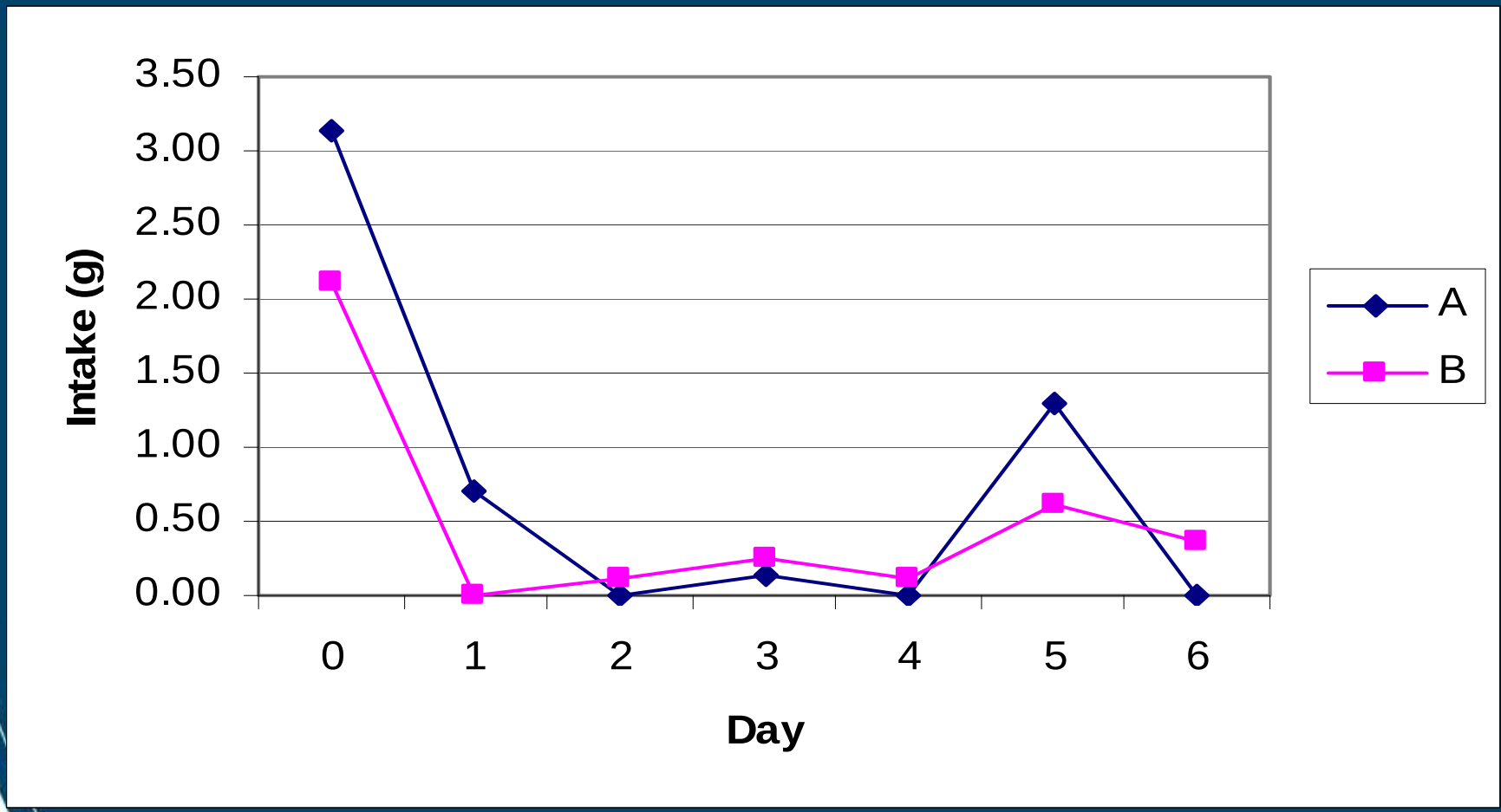
Li Cl (nausea)



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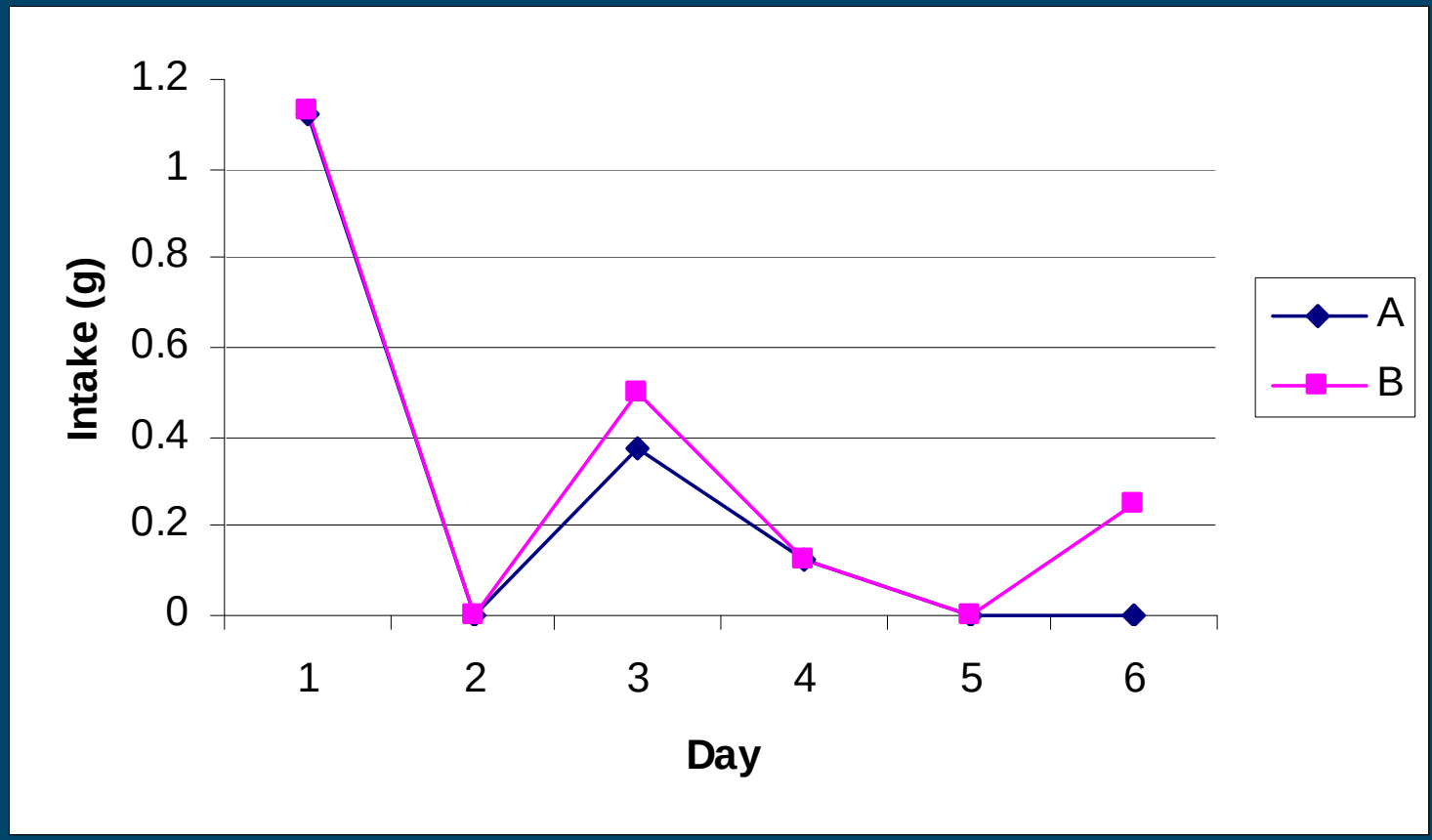
Thiram powder (nausea)



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REPELLENT CONCLUSIONS

- ✓ Nausea producing substances are more effective in reducing intake.
- ✓ LiCl and Thiram had lasting effects.
- ✓ Multicrop appeared to have potential as a repellent but the aversion took considerable time to develop.

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IMPLICATIONS OF BEAK TRIMMING AND ALTERNATIVES

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IMPLICATIONS

- ✓ There was significant variation in beak condition and beak length of birds on industry farms between both beak-trimming methods for birds monitored on industry farms.
- ✓ There is a need for further consistency in the application of both trimming methods.

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IMPLICATIONS

- ✓ IR trimming has a significant impact on histopathology resulting in the formation of traumatic neuromas
- ✓ Development of new technology methods of beak trimming (eg. laser and phyto agglutination) is required.

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IMPLICATIONS

- ✓ Environmental enrichment of range areas using shade, forage and shelter attracted more birds into the range.
- ✓ However aggressive feather pecking was only observed on a few occasions in all of the trials conducted at SARDI.
- ✓ It is likely the small flock size contributed to the flock being docile.
- ✓ However in larger operations there is no guarantee that there would not be an outbreak of feather pecking and cannibalism even when the environment is enriched.

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IMPLICATIONS

- ✓ Repellents working through aversion may be a method to reduce the incidence of cannibalism in caged birds.
- ✓ There is still much to be done in optimising dose levels and the timing of treatments.
- ✓ The approach could be a very useful addition to the array of methods already used to reduce cannibalism in layer hens.

Nest boxes for laying hens and their effects on hen behaviour and stress physiology.

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Background Literature

Most hens use a nest box if provided.

Most hens are motivated to lay in a nest box:

- work
- nest-searching behaviour
- ‘gakel’ call

If nest site access is blocked, the hen will be frustrated

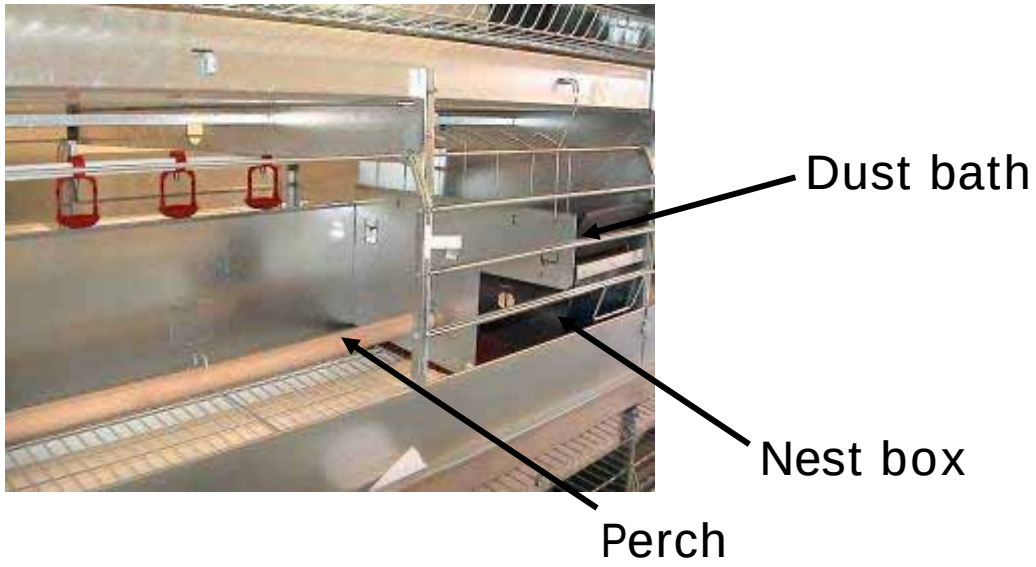
- **manifest as 'pacing' (stereotyped escape behaviour), restlessness or increased activity**

“*It is important for hens to be able to lay their egg in a suitable nest* (Keeling 2004).

“*In general, nests fulfill some needs of hens* (Sherwin and Nicol 1994).

Factorial experiment on furnished cages

3 (nest box) x 3 (dust bath) x 2 (perch) with 8 hens/cage



Barnett JL, Tauson R, Downing JA, Janardhana V, Lowenthal JW, Butler KL, Cronin GM (2009) The effects of a perch, dust bath and nest box, either alone or in combination as used in furnished cages, on the welfare of laying hens. *Poultry Science* **88**, 456-470.

Furnished cages experiment - Werribee

8 birds/cage; 1 nest box/cage

Egg laying in nest boxes

- About two-thirds of eggs were laid in the nest boxes

- 80-90% of eggs were oviposited at the lower end of the nest box (i.e. towards the cage front)

- More nest box eggs if a perch was present (44% to 65%)

Barnett et al (2009) *Poultry Science* **88**, 456-470.

Furnished cages experiment - Werribee

8 birds/cage; 1 nest box/cage

Hen behaviour and nest box occupancy

	29-33 wks		59-63 wks	
Ave visits to NB/hen/24 h	14.6		31.0	
Total time NB occupied (min/cage/24 h)	245.6	(17%)	323.6	(22%)
Visit time in NB if egg laid (min)				
• Pre-oviposition	30.7		22.6	
• Post-oviposition	5.9		4.8	
Total time of visit	**36.6**		**27.4**	
• Hen sitting	24.9	(68%)	20.3	(78%)
Visit time in NB if no egg laid (min)	6.5		9.8	
• Hen sitting	3.8	(58%)	7.0	(71%)

Barnett et al (2009) *Poultry Science* **88**, 456-470.

Furnished cages experiment - Werribee

8 birds/cage; 1 nest box/cage

Nest boxes and stress physiology

- **No effects of nest box on any physiological measures of stress**

Barnett et al (2009) *Poultry Science* **88**, 456-470.

Questions regarding the importance of nest boxes

- What do hens perceive as a suitable nest site?
- What is the significance of pre-laying behaviour?
- What if hens choose not to lay in a nest box?
- What if access to the nest site is blocked?
- What does this all mean for our understanding of the importance of nest boxes for hen welfare?

Importance of nest boxes for hen welfare

Experimental approach

Presence versus absence of a nest box

- blocking access to nest box for consistent NB layers

Group size

- 2, 4 and 8 birds / nest box
- 1 versus 8 birds per nest box

Manipulation of photoperiod (light schedules)

4 experiments completed

Biological functioning approach to investigate the impact of the environmental and social factors on welfare

Importance of nest boxes for hen welfare

Experimental approach

Measurements on individual hens:

- egg laying characteristics
  - date and time of oviposition
- consistency of nest site selection
  - location of oviposition
- pre-laying behaviour (2 h before oviposition)
- physiological stress response / immune capability
  - corticosterone
    - spot samples (in plasma)
    - egg albumen
    - maximum response to ACTH challenge
  - heterophil to lymphocyte (H:L) ratio

Materials and Methods

Video observation and identification of hens in cages

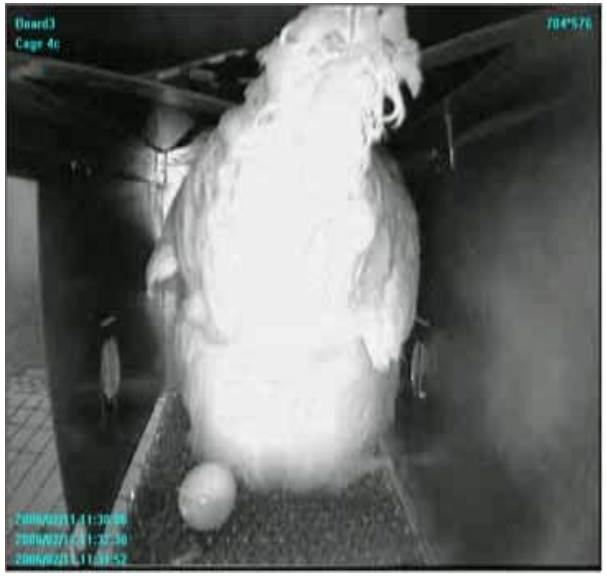
Materials and Methods

The visible spectrum (white light)

Under infra-red light

Materials and Methods

Video observation of egg laying inside the nest box and cages



Results

Consistency of egg-laying site / nest box use

Stress physiology

- **without manipulation**
- **with manipulation (block access to nest box)**

Pre-laying behaviour

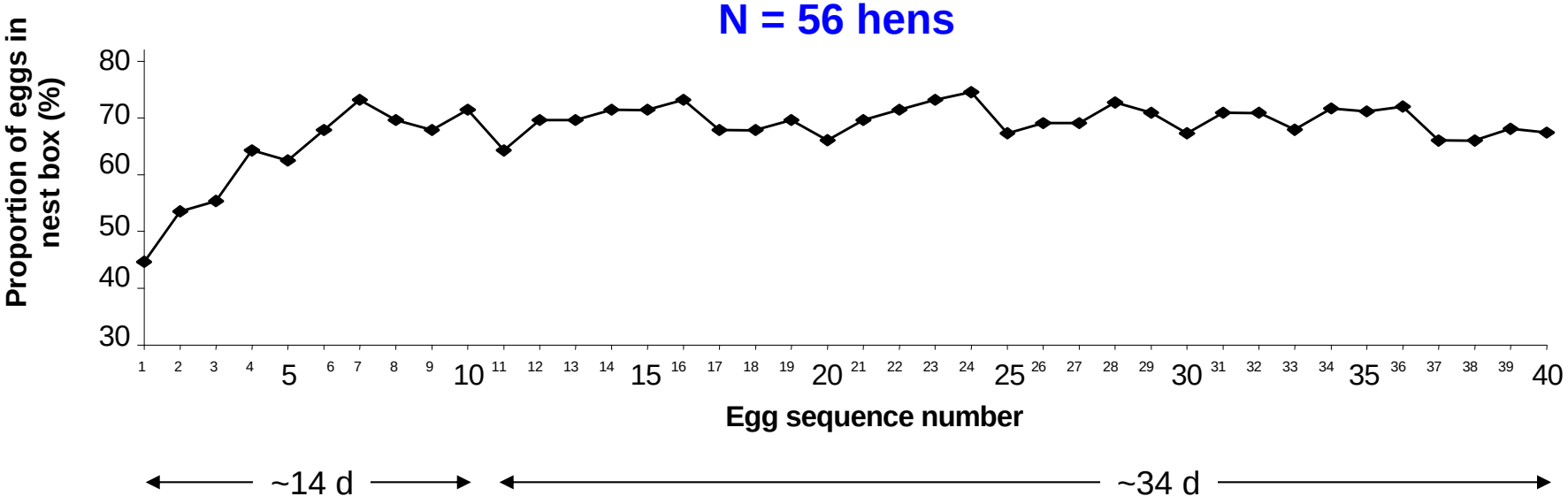
Relationships between behavioural and physiological variables

Measuring the consistency of nest box eggs

First 40 eggs laid per bird - Flock or cage basis

Cages with a nest box

Proportion of eggs laid in the nest box over the first 40 eggs laid per hen.
N = 56 hens



First egg = 44.6% in nest box

From egg 8 to 40 = 70.1% (± 2.26)

By about the 8th egg, the proportion of nest box eggs was relatively constant.

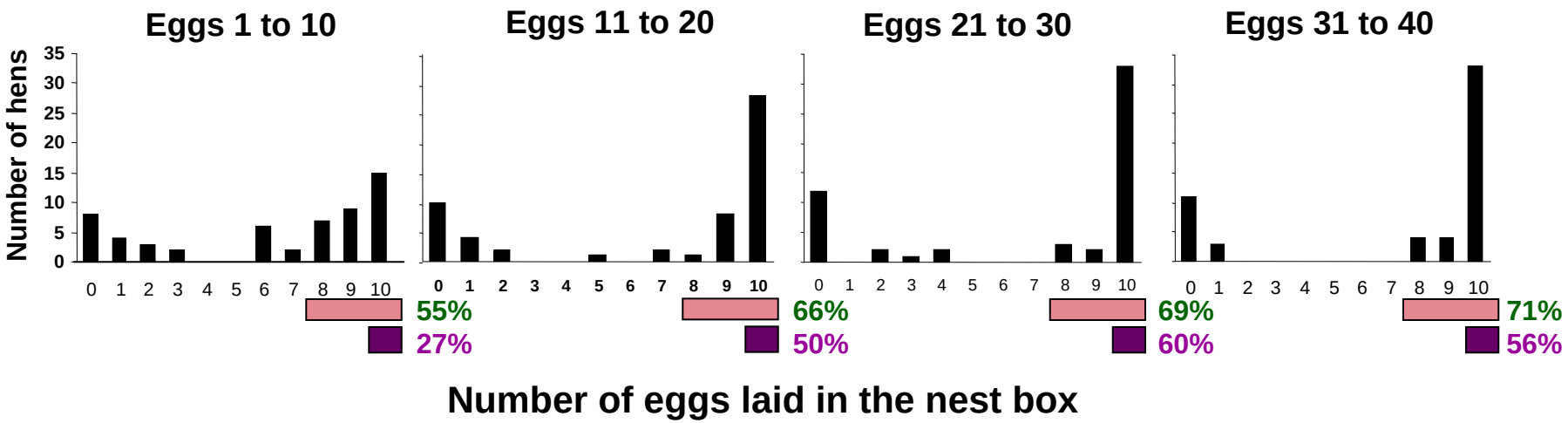
No effect of group size on % nest box eggs

Consistency of laying in the nest box (NB)

Individual bird basis

Cages with a nest box

Measuring consistency of egg lay site



Measures of consistency	
	80% of eggs laid in NB
	100% of eggs laid in NB

From the eleventh egg, the majority of hens consistently laid in the nest box

Summary

Consistency of laying in the nest box (NB)

Cages with a nest box

From the 11th to 40th egg…….

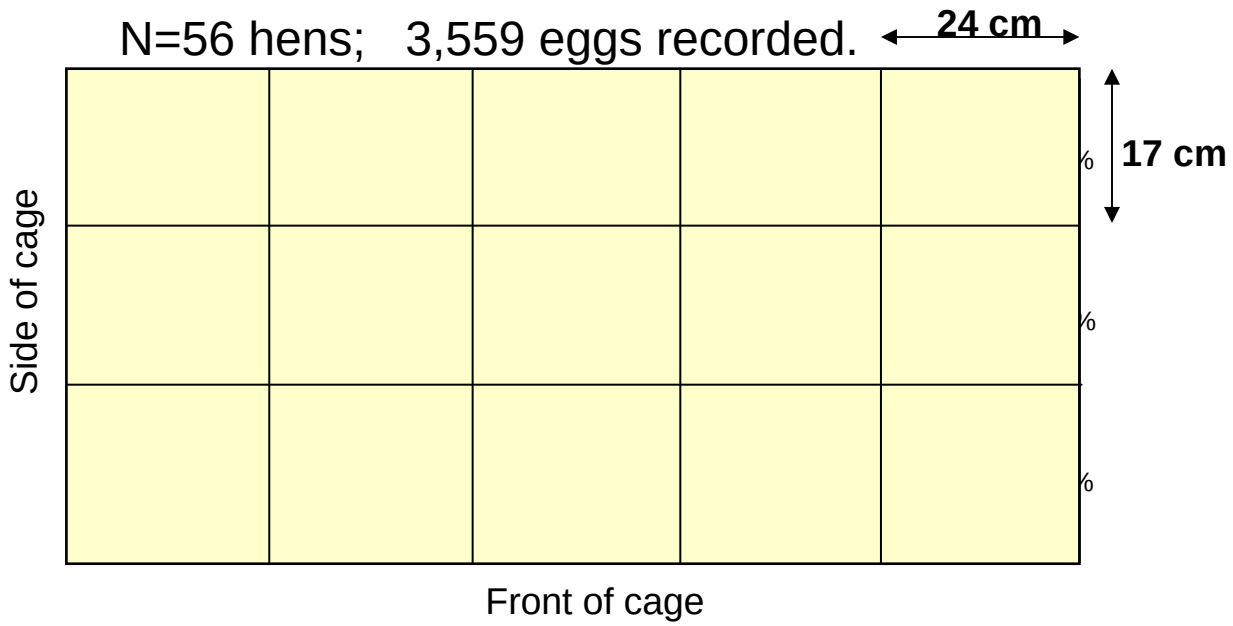
- 66% of hens consistently laid in the nest box
  - i.e. 80%+ of their eggs
- 23% of hens consistently laid on the wire floor, even though a NB was available
- 11% of hens were inconsistent nest box users

Consistency of laying at a specified site

Individual bird basis

Cages without a nest box

Proportion of eggs laid in different areas of the cage



The size of the circles is representative of the relative proportion of eggs laid at each of the 15 different areas in the cages.

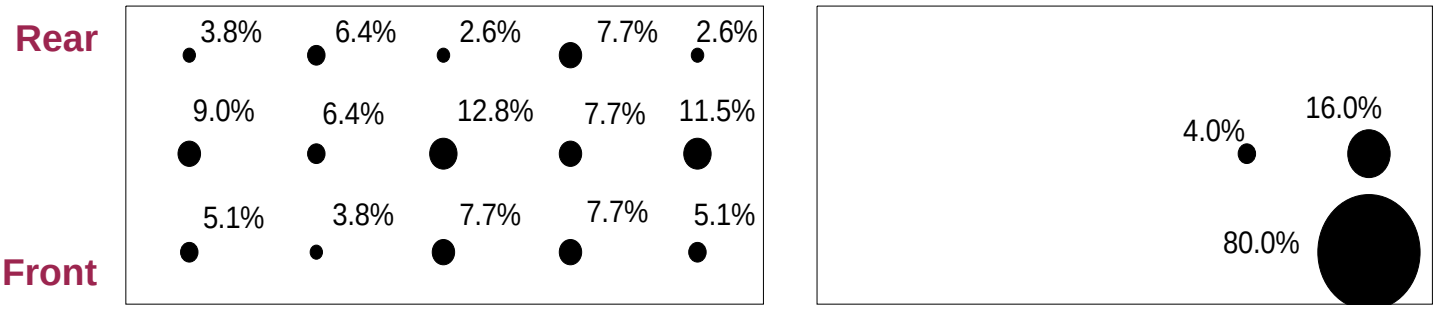
52% of eggs were laid at the sides of cages

Consistency of laying at a specified site

Individual bird basis

Cages without a nest box

Proportion of eggs laid in 15 areas of the cage by 2 hens in cages



Hen number	R131	R229
Birds per cage	2	2
Eggs recorded	78	69
Time period	4 months	4 months
Consistency Index Score (Pearson's Goodness of Fit)	**P>0.05**	**P<0.001**

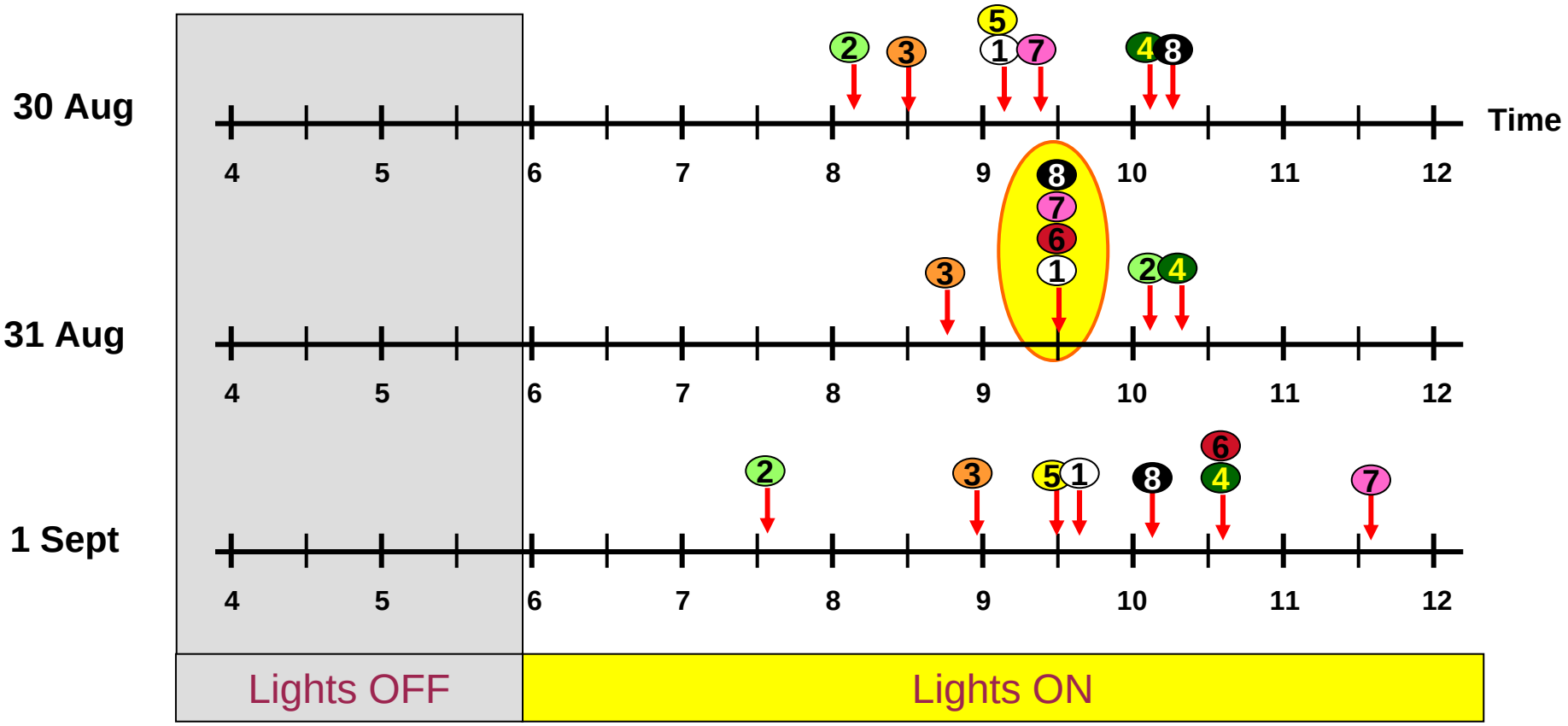
Most floor layers (92.8%) were consistent in their egg-laying site

Consistency of laying at a specified site

Individual bird basis

Cages without a nest box

Cage 4 (8 birds) without a nest box. Eggs laid on 3 days; birds were ~226 days old.



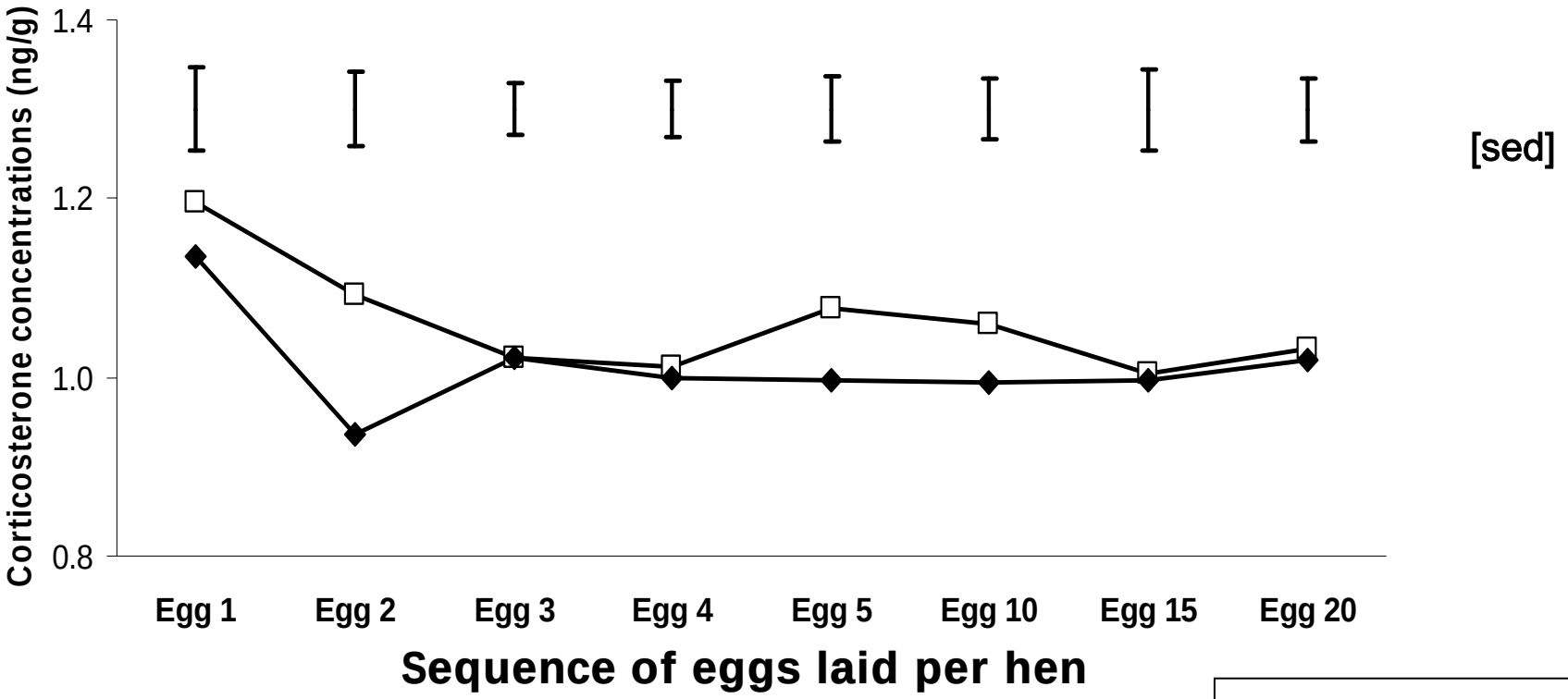
4 eggs laid within 5 minutes in one cage

Physiological stress measures

Corticosterone in the first 20 eggs / hen

No effect of having a nest box (NB) on egg corticosterone.

Based on cage means.

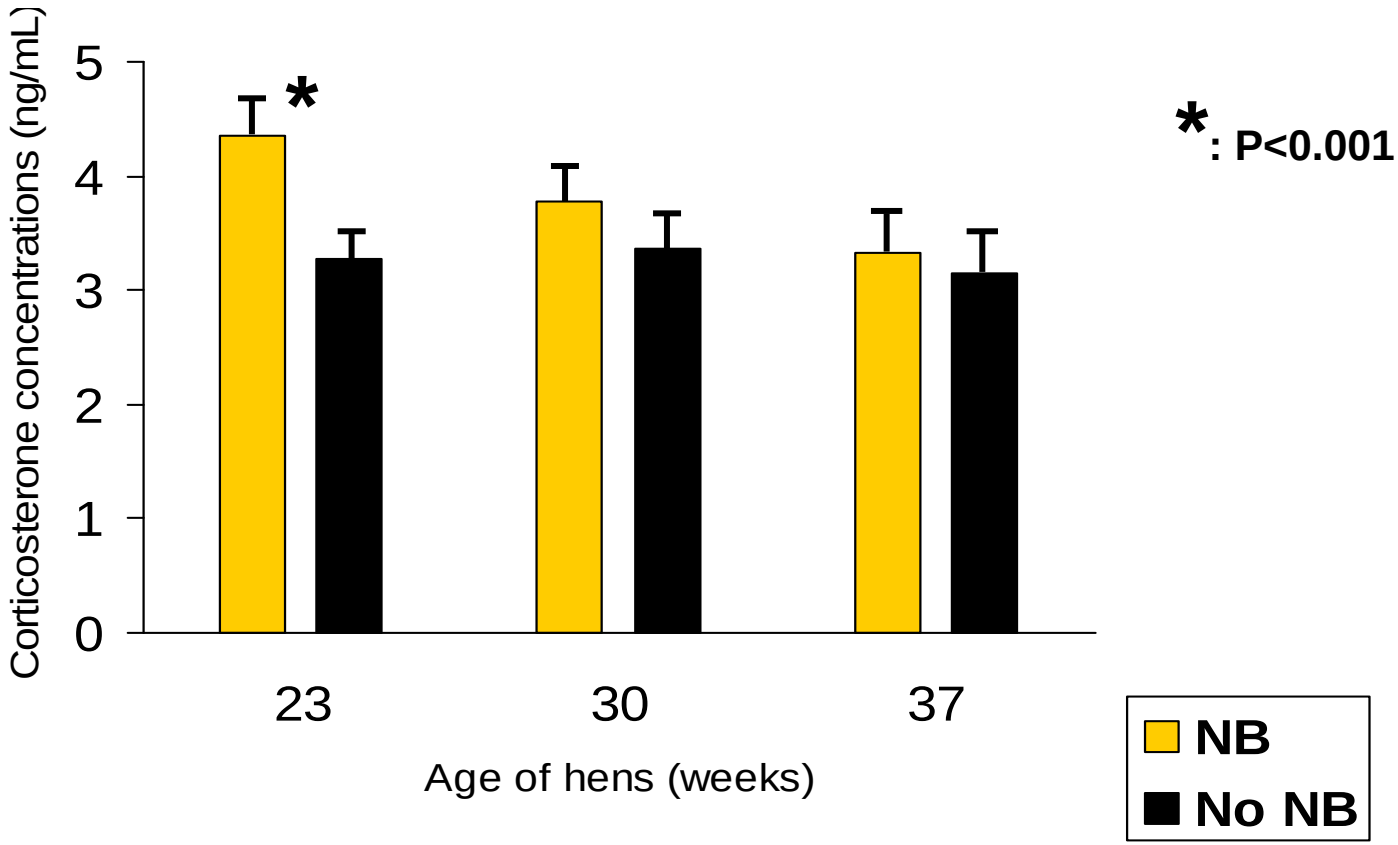


Physiological stress measures

Plasma corticosterone

The nest box increased plasma corticosterone concentrations at 23 wks

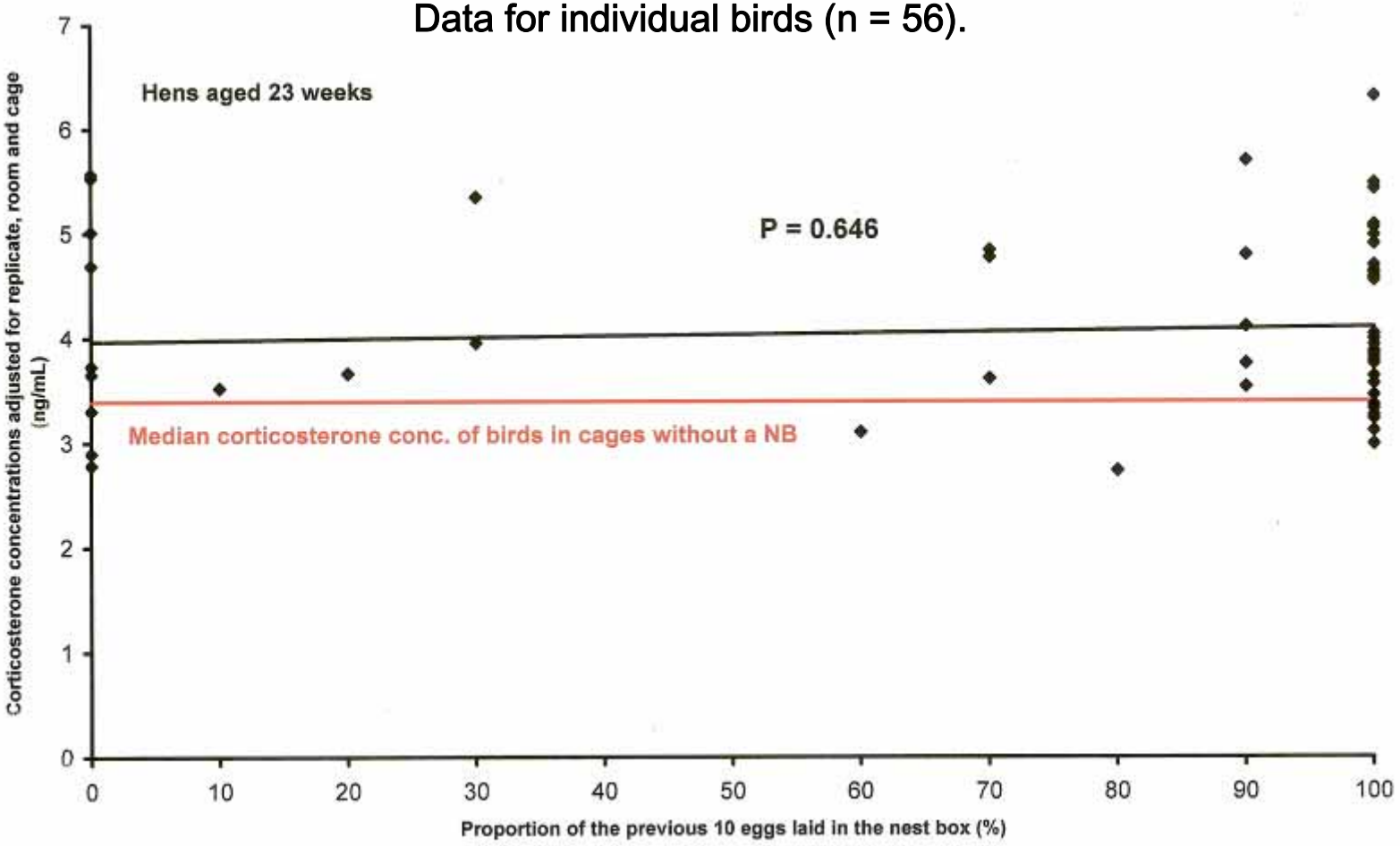
Values shown are cage means.



Consistency of nest box use and plasma corticosterone concentrations

No relationship

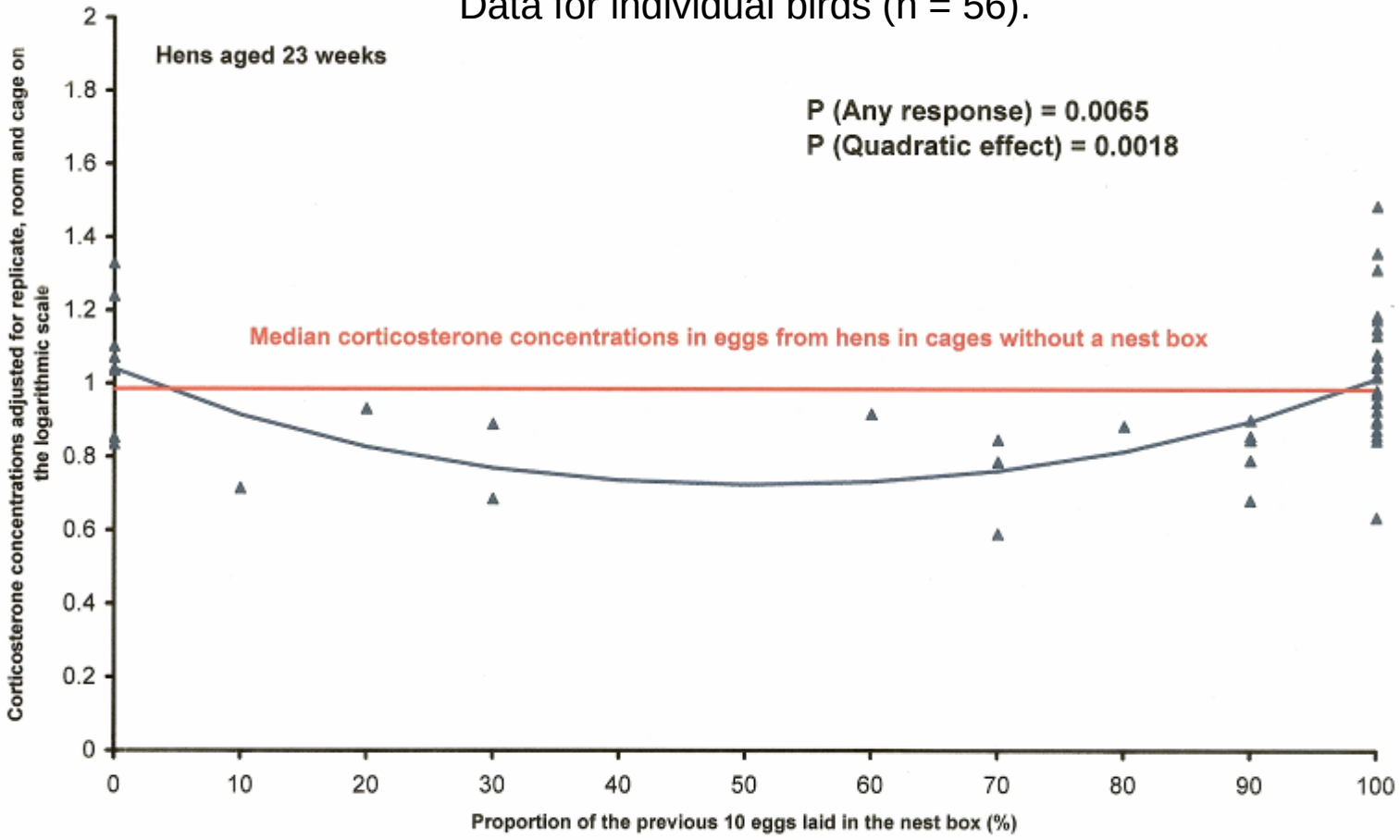
Data for individual birds (n = 56).



Consistency of nest box use and egg corticosterone concentrations

Quadratic relationship

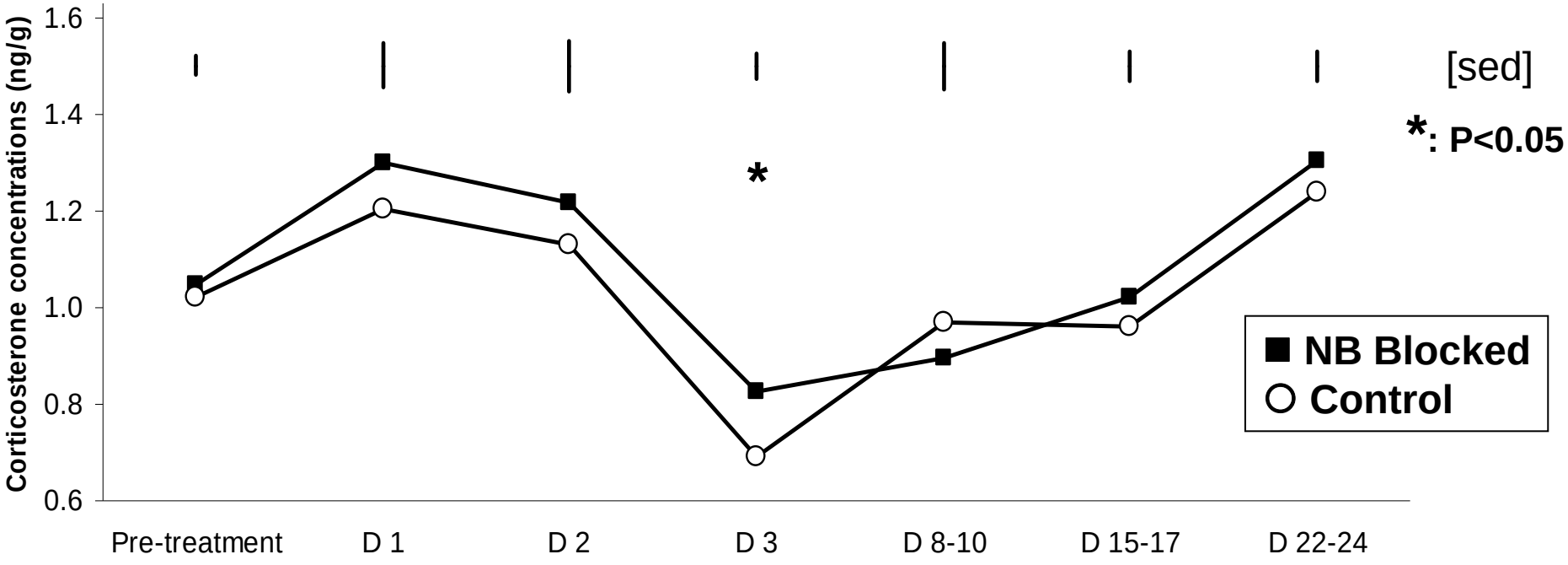
Data for individual birds (n = 56).



Blocking the nest box for consistent nest box layers

Minor effect on increasing egg albumen corticosterone concentrations

Values shown are cage means.



Hen behaviour before oviposition

Two phases of pre-laying behaviour by hens

1) Searching phase

- increased locomotion
- increased visual inspections of potential nests

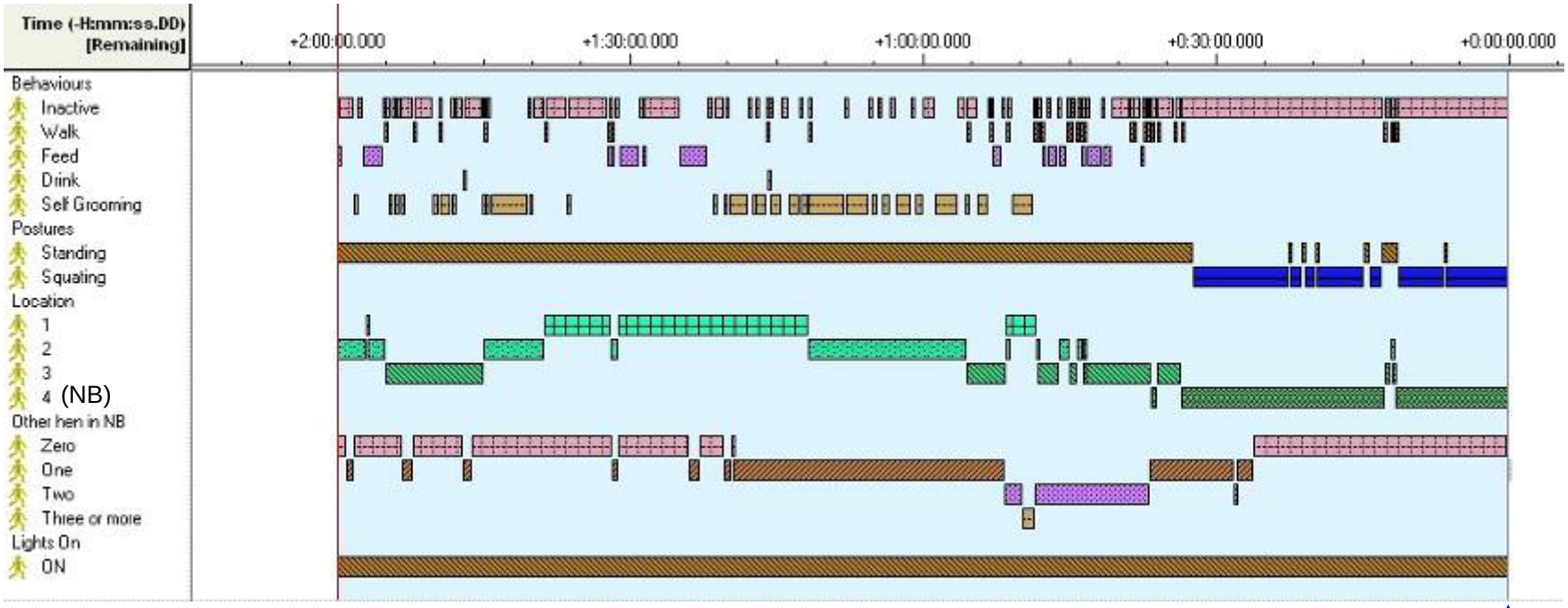
2) Sitting phase

- sit/squat posture
- interspersed with nest-building activities
- scratch the floor/litter
- rotate the body
- may collect litter if available

Hen behaviour 2 h before oviposition

Hen R221 at 30 weeks of age; Rep 2, Cage 2, 8 birds

Visualized sequence of behaviour, posture and location before laying.



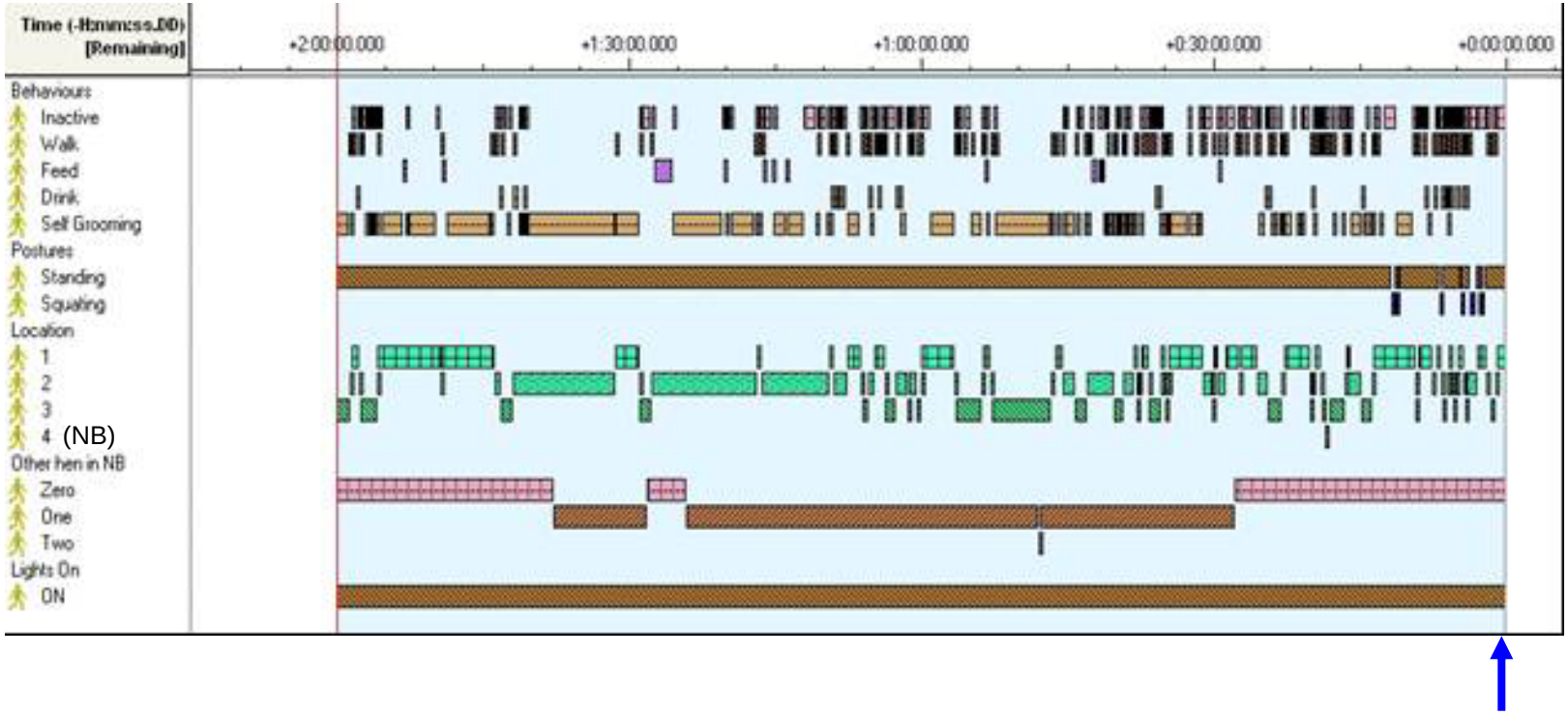
Nest box layer

Oviposition

Hen behaviour 2 h before oviposition

Hen R108 at 22 weeks of age; Rep 1, Cage 5, 4 birds

Visualized sequence of behaviour, posture and location before laying.



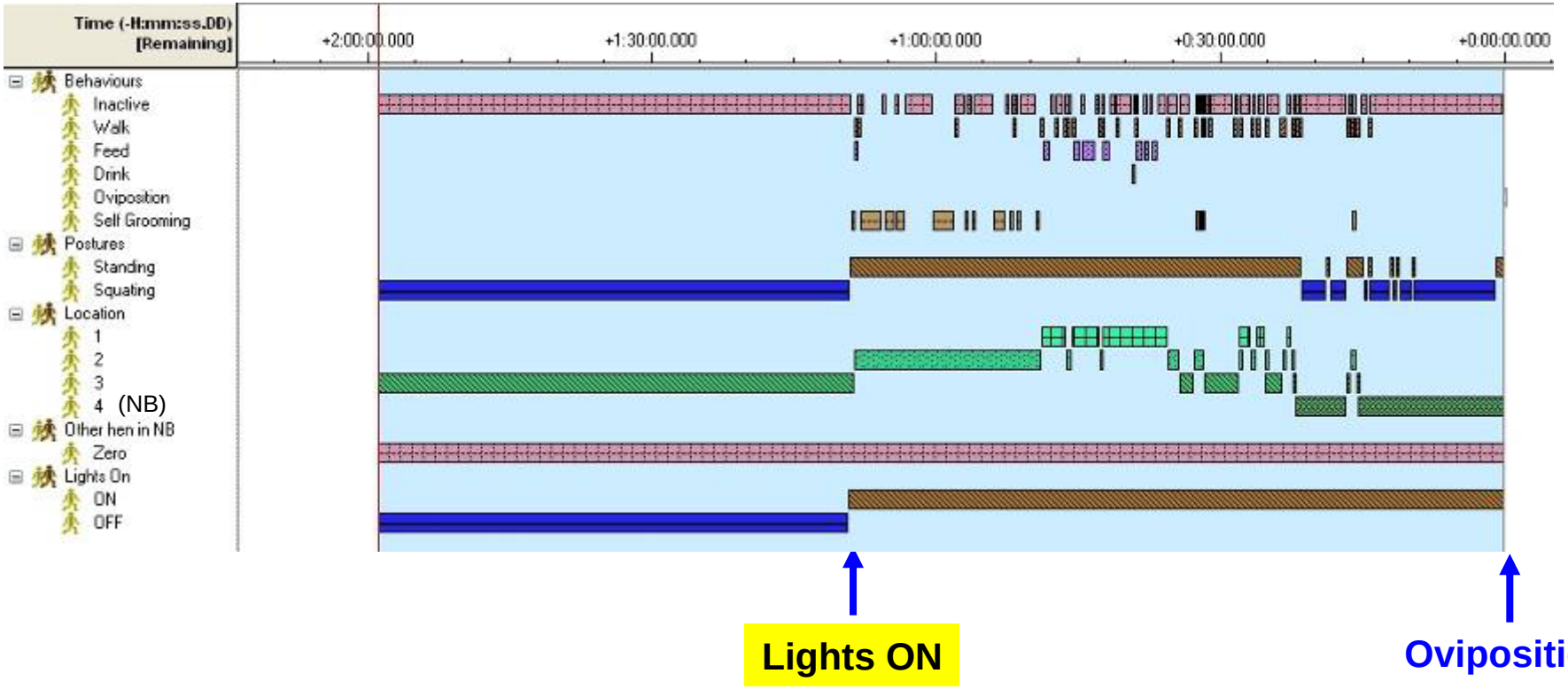
Floor layer (nest box in cage)

Oviposition

Hen behaviour 2 h before oviposition

Hen R130 at 30 weeks of age; Rep 1, Cage 9, 2 birds

Visualized sequence of behaviour, posture and location before laying.

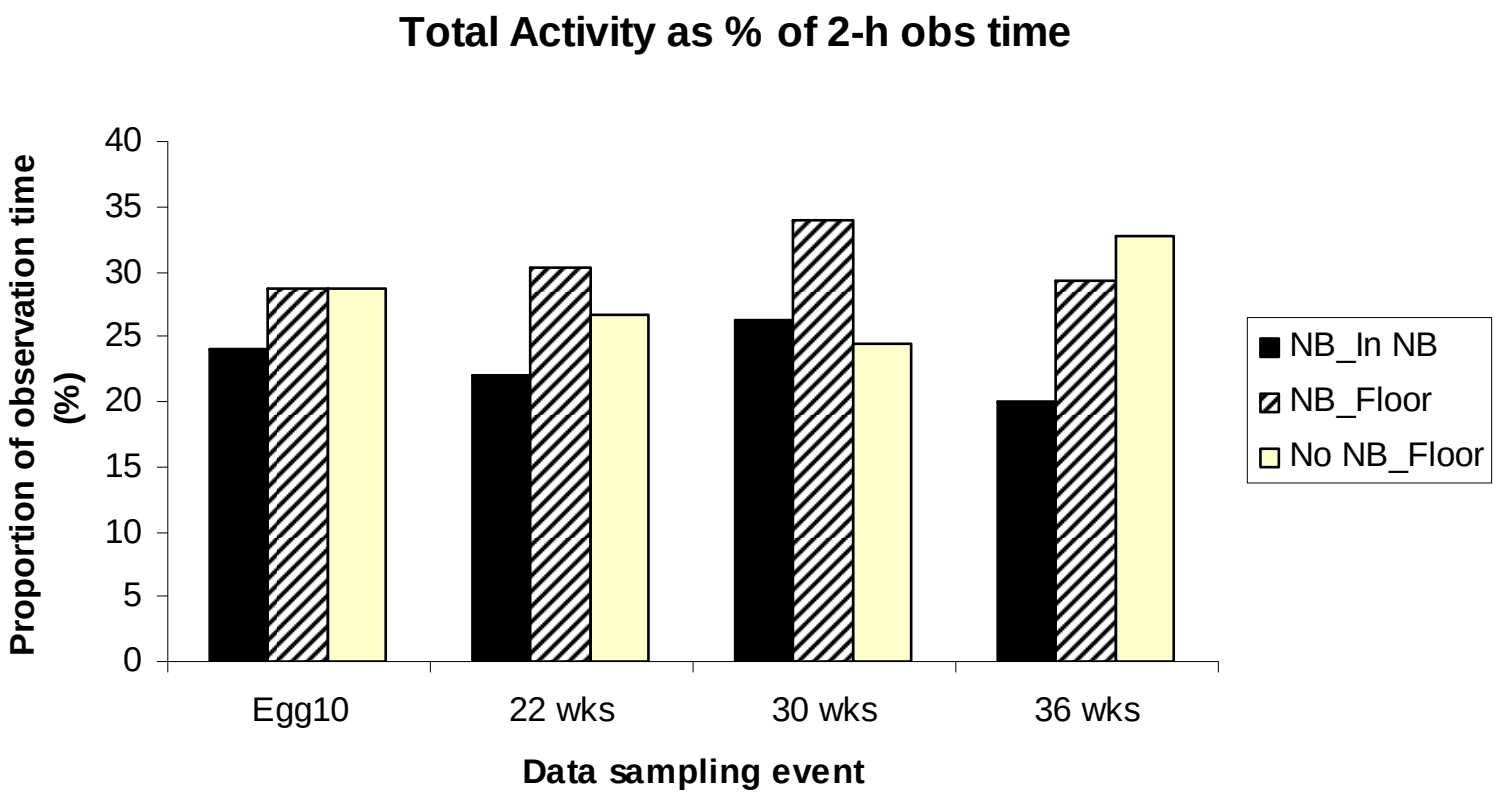


Hens are relatively inactive in the dark.

Consistent nest box layer

Hen behaviour 2 h before oviposition

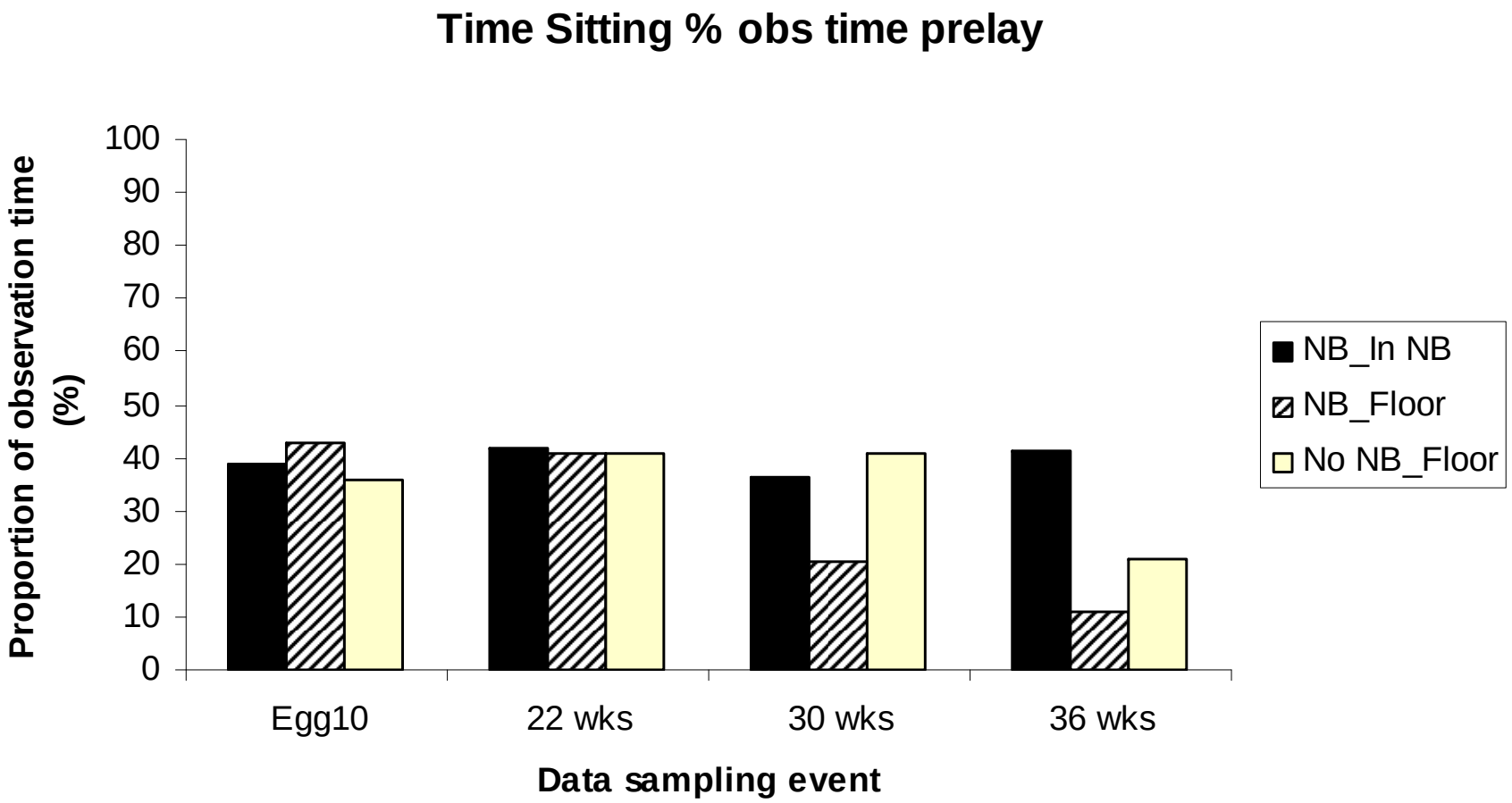
n=135 egg laying events



No effects of nest box treatment, group size or sampling event

Hen behaviour 2 h before oviposition

n=135 egg laying events



Selected hen behaviours 2 h before oviposition and physiological stress measures

Hens in cages with nest boxes (n=74 egg laying events)

Corticosterone concentrations in:	Plasma	Egg albumen
Total activity (duration)	**P = 0.039** *b = -0.005166*	P = 0.704
Boundary crossings (number)	P = 0.477	P = 0.940
Stand (duration)	P = 0.065 *b = -0.0000498*	P = 0.314
Run (freq of occurrence)	P = 0.068 *b = 0.06349*	P = 0.709
Drink (duration)	**P = 0.001** *b = -0.001536*	P = 0.987
Feed (duration)	P = 0.066 *b = -0.0001207*	P = 0.446

After adjusting for age, group size and oviposition site

Conclusions: consistency of nest box use

Most hens consistently used the nest box for egg laying

- consistency was apparent by about egg 10

Consistency of nest box use was not related to plasma corticosterone but was related to egg corticosterone conc.

Conclusions: pre-laying behaviour / activity

Increased pre-laying activity seems to be associated with lower plasma corticosterone concentrations

Pre-laying "activity" is stimulated by the ambient light

Conclusions: physiological stress response

A nest box in the cage increased plasma corticosterone conc. at 23 weeks (regardless of group size)

- associated with social behaviour / competition for the resource?

No long-term adverse effects on stress physiology:

- between nest box layers compared to wire floor layers
- for hens that were prevented from laying in the nest box

Whatever importance hens attach to a nest box, it is insufficient to result in long-term effects on the HPA-axis.

Thanks to

&

DPI Victoria

The Animal Welfare
Science Centre

www.animalwelfare.net.au

Non-Invasive Measures of Stress in Poultry

PhD Candidate: Joanna Engel

AWSC Poultry Welfare Seminar

29 October, 2010

ANIMAL WELFARE SCIENCE CENTRE

State Government Victoria Department of Primary Industries

THE UNIVERSITY OF MELBOURNE

MONASH University

THE OHIO STATE UNIVERSITY

Outline

- Introduction/Background
- Objective
- Further Development of Non-Invasive Measures of Stress
  - Methodology
  - Statistical Analysis
  - Results
  - Discussion

Introduction

- Increase in interest in non-invasive ways of measuring stress in animals

- Blood sampling
  - Invasive
  - Approx. 2 minute limit (Broom & Johnson, 1993)

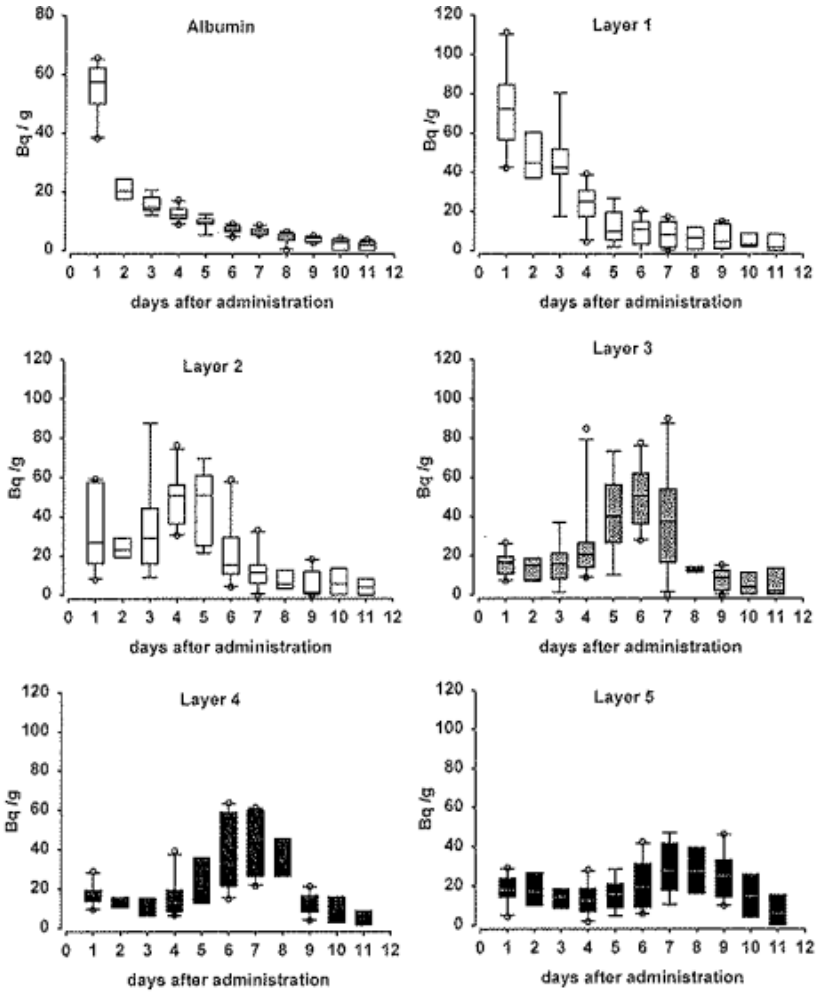
- Can we measure physiological stress in samples other than plasma?

- Corticosterone can be measured non-invasively in many species via:
  - Saliva
  - Urine
  - Faeces
  - Eggs

- Corticosterone can be measured non-invasively in many species via:
  - Saliva
  - Urine
  - **Faeces**
  - **Eggs**

- No publications describing the relationship between Plasma, Faeces, and Egg (yolk and albumen) corticosterone concentrations

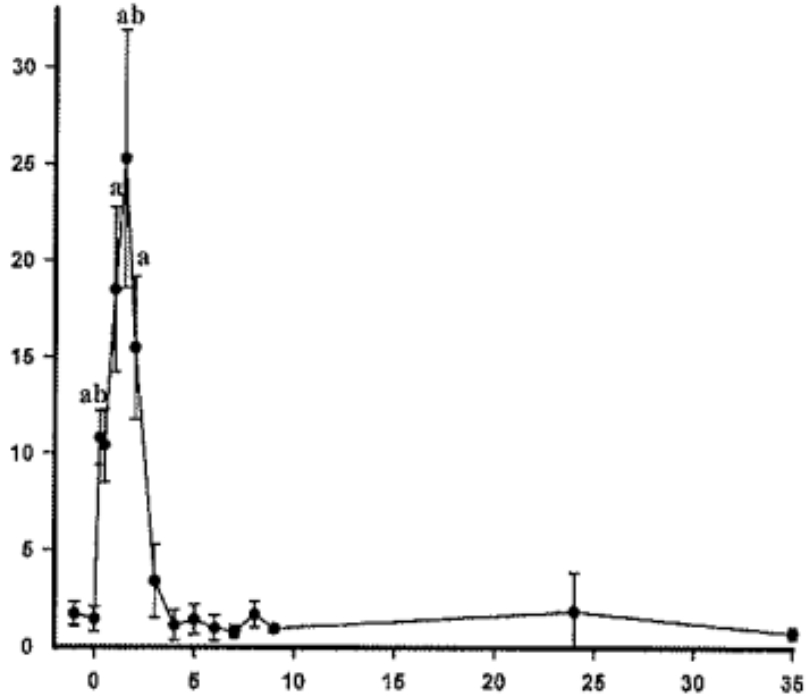
Effect of corticosterone administration on egg corticosterone concentrations



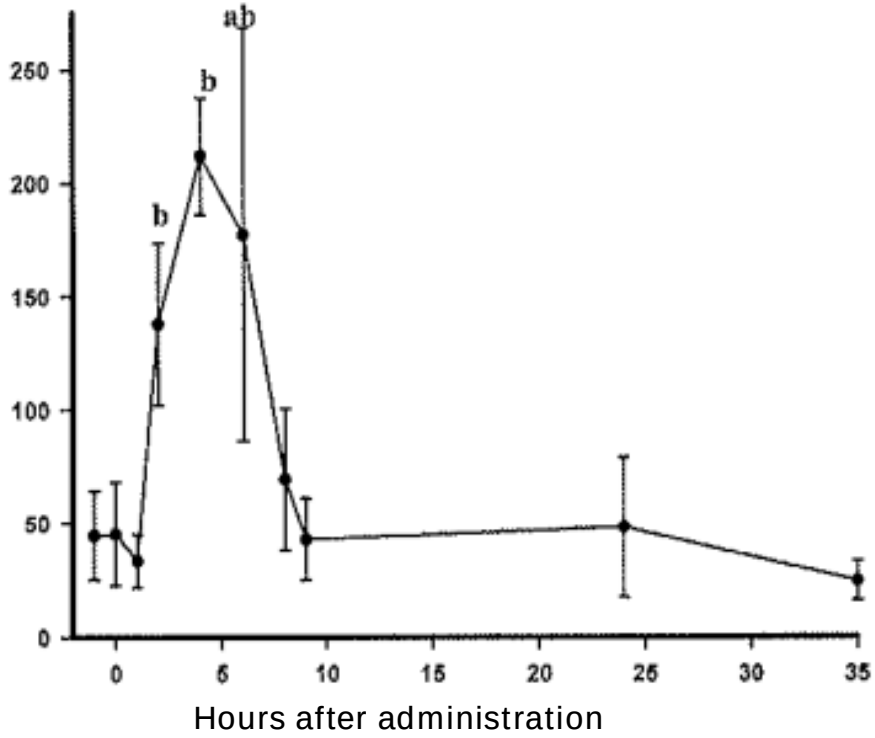
Radioactivity (Bq/g) in albumen and different yolk layers after administration of ^{3}H-labeled corticosterone to 10 laying hens.

From Rettenbacher et al. (2005)

Relationship between plasma and faecal corticosterone concentrations



Plasma corticosterone concentrations (ng/ml) in chickens after administration of ACTH.

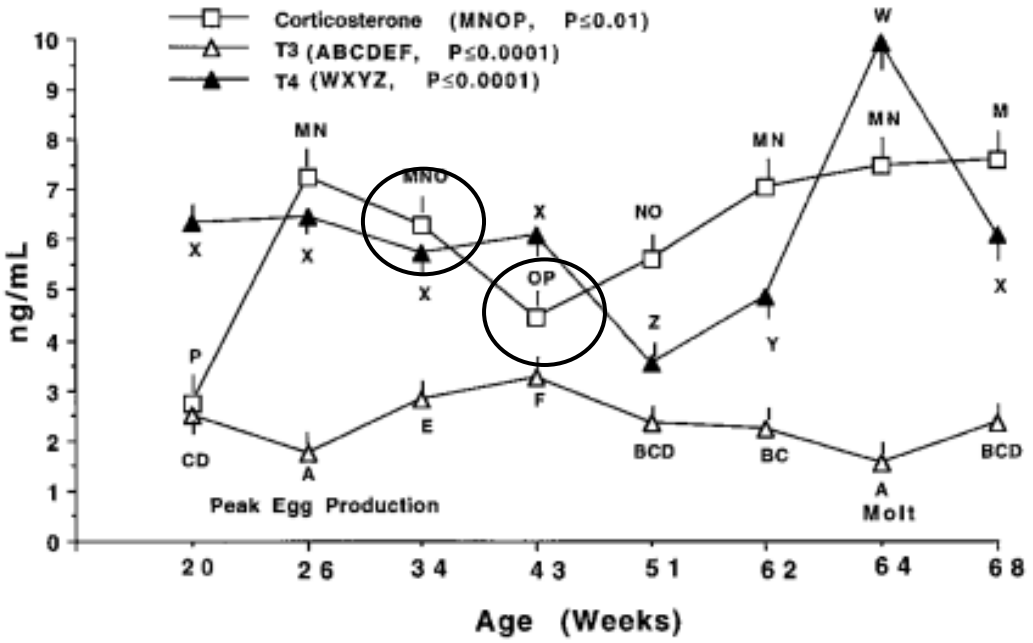


Fecal corticosterone metabolite concentrations (ng/g) in the same chickens after administration of ACTH.

From Dehnhard et al. (2003)

Age differences in plasma corticosterone

- Age difference in plasma corticosterone (CORT) concentration
  - ~6.3 ng/mL at 34 weeks
  - ~4.5 ng/mL at 43 weeks



From Davis et al. (2000)

Objective

- To further investigate the relationship between plasma corticosterone concentration and non-invasive (egg yolk and albumen and faeces) measures of corticosterone concentration by utilizing a previously noted difference baseline plasma corticosterone in hens of different ages.

Further Development of Non-Invasive Measures of Stress

Methodology

- Hy-Line Brown Laying hens (n = 154)
- 2 Commercial Poultry Sheds
  - 10 cages at each of 2 ages
    - 34 Weeks (peak production)
    - 47 Weeks (late production)
- Birds were exposed to 14.5 and 16 hours of light for 34 and 47 weeks of age, respectively.
- The Cage was the Experimental Unit

Methodology (cont.)

- Sample collection

Day of Experiment	Plasma Collected	Eggs Collected	Faeces Collected
1	✓	✓	✓
2			
3		✓	✓
4		✓	✓

- Samples pooled for each cage and analyzed for each day:
  - 1 Plasma sample per cage
  - 3 Egg (Albumen and Yolk) samples/cage
  - 3 Faecal samples/cage
- Corticosterone HS Enzyme Immunoassay (EIA) (IDS Ltd., Boldon, UK).

Statistical Analysis

- SPSS 18 (SPSS Inc., Chicago, IL, USA)

- Anova
  - To compare corticosterone concentrations between the different age points

- Spearman Correlation
  - Relationships between the different measurements

Results

The effect of age on corticosterone concentration in different samples.

	Age (Weeks)			
Sample	34	47	S.E.M.	P-value
Plasma (ng/ml)	***1.03***	***1.38***	***0.13***	***0.06***
Mean Egg Albumen (ng/g)	19.02	19.82	0.37	ns
Mean Egg Yolk (ng/g)	**3.61^{b}**	**4.12^{a}**	**0.11**	**0.01**
Mean Faeces (ng/g)	30.09	31.81	0.95	ns

Means with different superscripts are significantly different.

Spearman Correlation between Plasma corticosterone and other measures.

Variable	Correlation Coefficient	Sig. (2-tailed)
Age	*0.416*	*0.068*
Albumen Cort_1	-0.074	0.758
Albumen Cort_3	0.072	0.762
Albumen Cort_4	-0.284	0.225
Mean Albumen Cort	-0.202	0.394
Yolk Cort_1	*0.388*	*0.091*
Yolk Cort_3	0.238	0.313
Yolk Cort_4	-0.221	0.349
Mean Yolk Cort	0.316	0.175
Faecal Cort_1	-0.017	0.945
Faecal Cort_3	0.17	0.474
Faecal Cort_4	*-0.418*	*0.067*
Mean Faecal Cort	-0.057	0.811

Plasma corticosterone not significantly correlated to any non-invasive measures of corticosterone.

Spearman Correlation between Age and corticosterone concentrations Plasma, Egg and Faeces.

Variable	Correlation Coefficient	Sig. (2-tailed)
Plasma Cort	*0.416*	*0.068*
Albumen Cort_1	0.052	0.828
Albumen Cort_3	0.104	0.662
Albumen Cort_4	-0.104	0.662
Mean Albumen Cort	0.173	0.465
Yolk Cort_1	**0.642****	**0.002**
Yolk Cort_3	*0.399*	*0.081*
Yolk Cort_4	-0.139	0.560
Mean Yolk Cort	**0.520***	**0.019**
Faecal Cort_1	**0.451***	**0.046**
Faecal Cort_3	**0.711****	**0.000**
Faecal Cort_4	**-0.538***	**0.014**
Mean Faecal Cort	0.364	0.114

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

Discussion

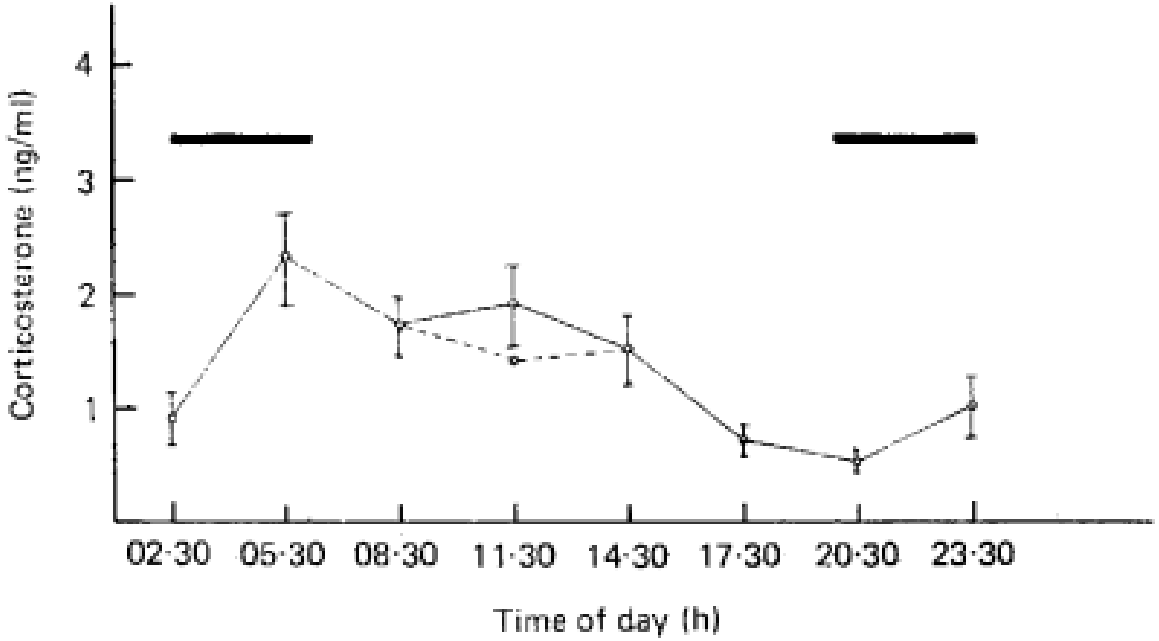
- Trend for age difference in plasma corticosterone concentration
  - Opposite direction of that noted by Davis et al. (2005)
- Mean Yolk corticosterone concentration
  - Same direction as trend in plasma corticosterone concentration
- Clear lack of significant relationships

Limitations

- Is it possible that under baseline conditions there is not enough variation in corticosterone concentrations to measure strong correlations?

- Samples may not represent identical periods of time
  - Blood – single sample out of the diurnal pattern
  - Egg Albumen – likely represents window of approximately 6 hours
  - Egg Yolk – portions could represent multiple days
  - Faeces – collected over entire 24 hours

Circadian Rhythm of Plasma Corticosterone in Chickens



Daily variation in the mean corticosterone content in the plasma of 10 laying hens. The dark period from 20.00 to 06.00 hr is shown by the horizontal bar. Three eggs were laid when blood samples were taken at 11.30 h; the dashed line represents the value when the hormone concentrations in these 3 birds are omitted.

From Beuving and Vonder (1977)

Limitations

- It is possible that plasma corticosterone does not represent concentrations in other areas of the body
  - Total corticosterone measured, not free corticosterone (active hormone)

- More intensive study of this kind?
  - More blood samples to cover more of the circadian rhythm corticosterone exhibits
  - Sample over more days
  - Increase number of experimental units (cages)

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THANK YOU!

The Animal Welfare
Science Centre

www.animalwelfare.net.au

Opportunities to improve the human animal relationship in poultry

Dr Lauren Edwards

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State Government Victoria Department of Primary Industries

THE UNIVERSITY OF MELBOURNE

MONASH University

THE OHIO STATE UNIVERSITY

Introduction

- The poultry meat and egg industries are among the most prolific in the world
  - Also the most intensive
- These birds are totally dependent on humans for their needs
- While humans don't physically interact with these birds everyday, they are still responsible for their welfare in a number of ways
- Today I will highlight some of the key areas where the quality of the human-animal relationship is vital in determining hen welfare, and some areas that could be improved

The human-animal relationship

- We can define a relationship as a series of interactions between two individuals
- Individuals can learn to predict the likely outcome of future interactions and respond appropriately
- Thus, if the human-animal interactions are aversive, the animal will experience fear and work to avoid interacting with humans in the future

Fear of humans in poultry

- Poultry are innately fearful of humans
  - It is likely that they view humans as predators
- Murphy and Woodgush (1978)
  - Raised chicks without human contact for 6 wks
  - All chick withdrew when exposed to a human for the first time
- This fear can be altered through subsequent experience with humans
  - Pleasant or neutral interactions ameliorate fear
  - Unpleasant interactions exacerbate it
- Intensive farming creates a bias for more interactions to be negative than rewarding

Fear of humans and animal welfare

- Fear is detrimental to animal welfare, as it is an unpleasant emotional experience
- It elicits a stress response
- It has been shown to reduce welfare and productivity in a number of livestock species

Fear of humans and productivity - broilers

- Gross and Siegel (1982)
  - Gentle handling, talking and offering food increased FCE and immune function compared to birds that received minimal handling or deliberate frightening
- Zulkifli et al (2002)
  - Visual contact with humans had no effect on weight, FCE or mortality, but did improve immune function and reduce stress response (H:L ratio) following restraint
- Zulkifli and Siti Nor Azah (2004)
  - Both positive and negative handling increased growth and FCE and reduced stress response (H:L ratio) to capture and inversion
  - Both visual and tactile contact were equally as effective

Fear of humans and productivity - broilers

On commercial farms

- Hemsworth et al (1994)
  - Fear of humans accounted for 29% of the variation in FCE in commercial broilers
- Hemsworth et al (1996)
  - Fear of humans was negatively correlated with FCE and growth rates in commercial broilers
- Cransberg et al (2000)
  - Fear of humans was associated with mortality (first week of life), but not FCE or growth rate.

Fear of humans and productivity - layers

- Gross and Siegel (1979)
  - Gentle stroking resulted in improved immune function and increased growth rates
- Hemsworth and Barnett (1989)
  - Birds housed on the top tier showed greater fear, increased stress response to handling and reduced productivity
- Barnett et al (1994)
  - Regular visual contact increased egg production and immune function compared to minimal contact
- Edwards (2009)
  - Regular visual contact increased egg production and tended to decrease stress response to human presence

Fear of humans and productivity - layers

On commercial farms

- Barnett et al (1992)
  - Fear of humans was negatively correlated with egg production in commercial layers

- Edwards (2009)
  - Fear of humans was positively correlated with egg production and stress responses

Opportunities to improve the HAR

- Visual contact appears equally as effective, if not better, than tactile contact in reducing fear of humans in poultry
- Close proximity and increased time in visual contact with the birds will reduce fear
- Noise results in stress and fear
- Fast speed of movement and sudden exposure to humans is fear provoking

- Manipulating human behaviour in these aspects is likely to reduce fear of humans

Other areas for improvement

- Fear reduction at the hatchery?

- It has also been suggested that birds that are highly fearful of humans will suffer the most during depopulation
  - (Knowles and Broom 1990, Reed et al 1993)

Broken bones in laying hens

Gregory and Wilkins (1989)

- 24% spent hens had broken bones prior to being commercially loaded onto the truck
- This decreased to 14% when birds were depopulated individually
- Incidence of broken bones varied from 10-50% of hens between batches

- A more recent survey found 14% of birds had broken bones prior to stunning (Gregory et al, 1994, cited in Tinker et al, 2004).
  - Attributed to improved awareness of the issue
- 3% of broilers had broken bones (Gregory, 1994)

Opportunities for improvement

- It has been suggested that the main cause of broken bones during depopulation is impact with the cages and crates
  - Possibly due to handling style and escape attempts

- Reed et al (1993)
  - Environmental enrichment and exposure to a human for 30 mins/daily or no enrichment
  - Restraint and depopulation caused fear in both groups of birds
  - There was a higher incidence of impacts and injuries in the non-enriched birds

- However variation in human handling may also be important

Variation in DOAs for broiler catching crews

Team	Low mortality loads	High mortality loads	% with high mortality rates
1	16	9	36
2	10	18	64
3	16	3	16
4	3	32	91
5	18	2	10
6	14	5	26
7	5	5	50
8	13	9	41
9	3	7	70
10	2	10	83
11	1	0	0

Bayliss and Hinton 1990

Variation in DOAs for broiler catching crews

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7	5	5	50
8	13	9	41
9	3	7	70
10	2	10	83
11	1	0	0

Bayliss and Hinton 1990

Depopulation and transport

- Suggests that even though between-farm variation may exist, at least part of this variation may be due to the handling styles of different crews.
- Varying the handling styles can reduce breakages
  - The incidence of broken bones was shown to be reduced from 24% to 14% when hens were removed from their cages individually rather than in groups (Gregory and Wilkins, 1990).

- Optimising work conditions is also likely to improve handling during depopulation (Tinker et al 2004)
  - Adequate time and labour, minimise distances to be travelled etc
  - De Alencar et al (2006) related management style to mortality rates on Brazillian broiler farms

Improving the human-animal relationship

- Thus, welfare improvements could be made on two levels
  - Reducing fear of humans and thus the stressfulness of human-animal interactions throughout the bird's life
  - Improving handling techniques by humans during depopulation

- A third factor that influences the human-animal relationship indirectly is management
  - Optimising work conditions
  - Building positive relationships and work motivation

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References

- BARNETT, J. L., HEMSWORTH, P. H. & NEWMAN, E. A. (1992) Fear of humans and its relationship with productivity in laying hens at commercial farms. *British Poultry Science,* 33**,** 699-710.
- BARNETT, J. L., et al (1994) The effects of modifying the amount of human contact on behavioural, physiological and production responses of laying hens. *Applied Animal Behaviour Science,* 41**,** 87-100.
- Bayliss and Hinton (1990). Transportation of broilers with special reference to mortality rates. Applied Animal Behaviour Science 28, p. 93-118
- CRANSBERG, P. H., HEMSWORTH, P. H. & COLEMAN, G. J. (2000) Human factors affecting the behaviour and productivity of commercial broiler chickens. *British Poultry Science,* 41**,** 272-279.
- DE ALENCAR, et al (2006) Broiler mortality and human behaviour at work.*Scientia Agricola (Piracicaba, Braz.),* 63**,** 529-533.
- DE JONGE, F. H. & GOEWIE, E. A. (2000) For the good ofEdwards (2009) The human-animal relationship in the caged laying hen. PhD Thesis.
- Gregory and Wilkins (1989) Broken bones in domestic fowl: Handling and processing damage in end-of-lay battery hens. British Poultry Science, 30. p. 555-562
- Gregory (1994) Pathology and handling at the slaughterhouse. World's Poultry Science Journal, 50. p. 66-67
- GROSS, W. B. & SIEGAL, P. B. (1979) Adaptation of chickens to their handler, and experimental results. *Avian Diseases,* 23**,** 708-714.
- GROSS, W. B. & SIEGAL, P. B. (1982) Socialization as a factor in resistance to infection, feed efficiency, and response to antigenin chickens. *American Journal of Veterinary Research,* 43**,** 2010-2012.
- HEMSWORTH, P. H. & BARNETT, J. L. (1989) Relationships between fear of humans, productivity and cage position of laying hens. *British Poultry Science,* 30**,** 505-518.
- HEMSWORTH, et al. (1994) Behavioural responses to humans and the productivity of commercial broiler chickens. *Applied Animal Behaviour Science,* 41**,** 101-114.
- HERMANS, E. J., PUTMAN, P., BAAS, J. M., KOPPESCHAAR, HMurphy and Wood-Gush (1978) The interpretation of the behaviour of domestic fowl in strange environments. *Biology of Behaviour,* 3**,** 39-61.
- KNOWLES, T. G. & BROOM, D. M. (1990) The handling and transport of broilers and spent hens. *Applied Animal Behaviour Science,* 28**,** 75-91.
- Reed et al (1993). The effect of environmental enrichment during rearing on fear reactions and depopulation trauma in adult caged laying hens. Applied Animal Behaviour Science, 36. p. 39-46
- Tinker et al (2004) Handling and catching of hens during depopulation. In 'Welfare of the laying hen', ed. Perry, G.C. CABI
- ZULKIFLI, I., et al (2002) The effects of regular visual contact with human beings on fear, stress, antibody and growth responses in broiler chickens. *Applied Animal Behaviour Science,* 79**,** 103-112.
- ZULKIFLI, I. & SITI NOR AZAH, A. (2004) Fear and stress reactions, and the performance of commercial broiler chickens subjected to regular pleasant and unpleasant (contacts with human being. *Applied Animal Behaviour Science,* 88**,** 77-87.

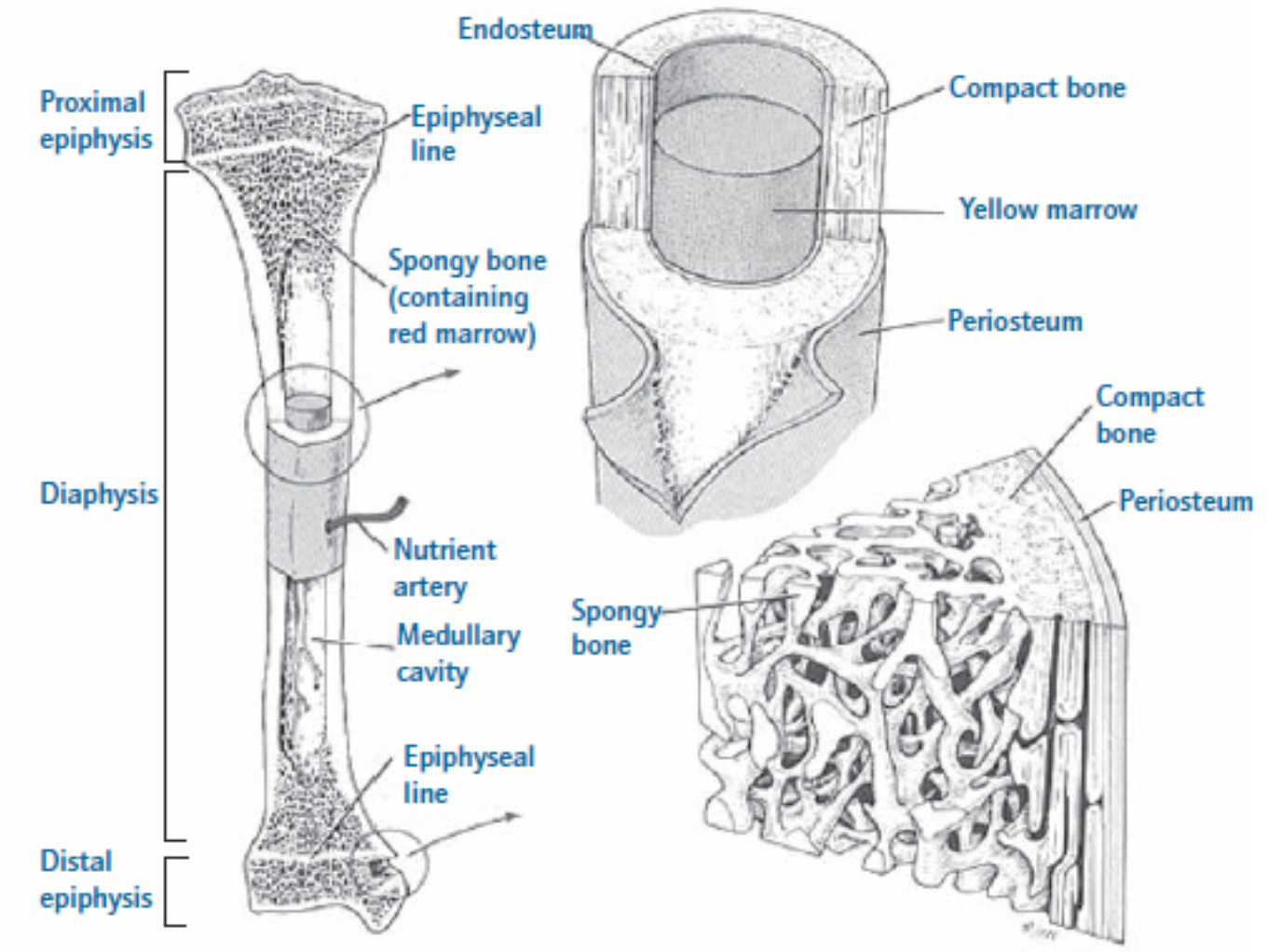
Lameness in Meat Chickens

Peter Groves
University of Sydney

References

- AAAP, 2006. *Avian Disease Manual, 6th Ed. pp 186-189*
- Berg & Sanotra, 2003. *Animal Welfare*, **12**: 655-659.
- Bradshaw, R.H. et al., 2002. *Avian & Poultry Biology Reviews* **13**(2):45-103.
- Brickett et al.,2007. *Poultry Science* **86**:2117-2125
- Buijs, S. et al., 2009. *Poultry Science* **88**:1536-1543
- Crespo, R. & Shivaprasad, H.L. 2008. In *Diseases of Poultry, 12th Ed.* pp1160-1162.
- Dawkins, M.S et al., 2004. *Nature* **427**:342-344.
- Elfick, D. 2010. *Proceedings NZ Poultry Industry Conference,* Palmerston North. **10**:52-63
- Genin, O. et al., 2008. *Proceedings World's Poultry Congress*, Brisbane. P258
- Hepworth et al., 2010. *Avian Pathology* **39**(5):405-409
- Kestin, S.C. et al., 1992. *Vet Record* **131**:190-194
- Oveido-Rondon et al., 2008. *Proceedings World's Poultry Congress*, Brisbane. P258
- Oveido-Rondon et al., 2010. *Proceedings AAAP meeting*, Atlanta.
- Petek, M. et al., 2010. *Veterinaria IR Zootechniika T*.**51**(73):36-43.
- Powell, K.C and Bittar, I. 2009. DSM Nutritional Products, Inc. Arkansas.
- Sherlock, et al., 2010. *Br. Poultry Science* **51**(1):22-30.
- Thorp, B.H. 2008. In *Poultry Diseases, 6th Ed.* Elsevier. pp470-482
- Whitehead, C.C. 2010. *Proceedings Australian Poultry Science Symposium*, University of Sydney. pp22-25

Figure 1 - The structure of a bone with its unique mineralised properties



http://www.vetsweb.com/poultry/nutrition/feed-additives/mycotoxins-affect-bone-structure-and-leg-weakness-83.html

What conditions are we considering?

- Chondronecrosis (Femoral head necrosis)
- Pododermatitis (footpad burn)
- Tenosynovitis
- Rickets
- Tibial Dyschondroplasia
- Varus-valgus deformity
- Rotated tibia
- Spondylolisthesis (“Kinky Back”)
- Snapped gastrocnemius tendon
- “Soft Bone” condition

Current leg problem prevalence

- Since the 1980's, continued genetic selection focus on viability factors (leg strength, ascites, etc) has seen major improvements (Elfick, 2010)
- < 3% clinical lameness (Powell, 2009)
- Average bird losses from non-infectious leg problems over the final 3 weeks of broiler life would be about 0.35% (95% CI 0.30 to 0.39%)
- Individual farms may have problems up to 2.4% but there are few of these

Chondronecrosis (Femoral Head Necrosis)

- One of the most widespread problems (Whitehead, 2010).
- Bacterial osteomyelitis (*Staph.*, *E. coli*)
- Bacteria trapped in the growth plate blood vessels – femoral head weak here.
- Epiphyseolysis (separation of the cartilage cap) or the femoral neck fractures
- Egg hygiene / immunosuppressive conditions

Femoral Head Necrosis

Rickets

- Seen in rapidly growing chicks
- Deficiency of Ca, P or Vit D.
- Malabsorption problems can produce the syndrome (ISS)
- Thickening of the epiphyseal plate
- Bones and beak are soft
- Birds often squat, have a stiff legged gait, enlarged ends of long bones; maybe beading of the ribs

Ricketts

Tibial Dyschondroplasia

- Disruption of normal ossification in growing bones
- Common abnormality, most commonly observed in the proximal tibiotarsus
- Lesion is an accumulated mass of nonmineralized cartilage (failure of removal of chondrocytes)
- Multifactorial aetiology

Tibial Dyschondroplasia

Tibial Dyschondroplasia – risk factors

- Genetics
- Ca:P ratios in feed (rel. excess in P). Complicated by phytate and use of phytase
- Metabolic acidosis (excess chloride relative to Na and K in feed)
- Lesions take time to form – the larger the lesion, the longer the formation time (1cm= 10 days)
- Most likely due to marginal Ca:P irregularities around 2 wks of age




Tibial Dyschondroplasia

TD

- Lameness results if the cartilage mass is large
- The weakened bone may fracture
- Bones may “bow” antero-posteriorly and cause difficulties in processing the birds at the abattoir

Tibial Dyschondroplasia

Tibial Dyschondroplasia / Rickets

- Young birds: insufficient bone calcification - soft deformed bones (Rickets)
- Older birds: Retained cartilage “plug” in growth plate areas (most obvious in tibia)
- Weak bones, easily deformed, painful (reluctance to move)

Rotated Tibia (Torsional deformity)

- Femur-tibia axis should be straight (torsion $<15^{o}$).
- Torsion allows the bone to bend or twist under loads (avoid fractures)
- Amount of torsion α load applied and properties of the bone. Modified by poor mineralisation
- Altered loading may result from abnormal activity or abnormal conformation

Tibial Rotation

- Lateral rotation of the long axis of tibia
- Can be up to 90^{0}
- Morbidity described at <1% (AAAP, 2006)
- Cause unknown – earlier rickets may predispose (Crespo & Shivaprasad, 2008)

Varus-Valgus Deformity

- Improper development of hip joint causes angulation of the femur
- “Bowing” of the leg causes the achilles tendon to “slip” off the inside of the tibio-tarsus


aaap


aaap

Varus-Valgus Deformity

- The shank deviates outwards & the bird walks on its hock(s)
- Causes:
  - Manganese deficiency, biotin deficiency, Mycotoxins.
  - Genetic
  - Earlier rickets or TD (Thorp, 2008)

“Soft Bone” Syndrome

- Increased in recent years
- Not understood (or even recognised)
- Older references to “spraddle legs” – blamed on slippery hatcher trays (never made sense)

Soft Bone Syndrome ?

Soft Bones

- Sporadic
- Obvious after hatching
- PM signs – bones are soft (bendable without breaking)
- “Spraddle” chicks often have # femoral neck
- Culled out in hatchery
- By delivery to farm , more are apparent
- Cull these and more found over the next few days.

Soft bones

- Can have high early cull rates and many “non-starters” in flock
- Similarities to Rickets but not responsive to Vitamin D therapy
- Is this a sign of a wider flock problem which leads to the later issues?

Soft bones

- Aetiology?
- No response to nutritional supplementation (parent or chick)
- More prominent with young donor flocks (?)
- Obvious at hatch - Is it associated with incubation defects?

- **?**

Risk factors for Leg Weakness

- Genetic differences (Kestin *et al*., 1992)
- Growth rate (Bradshaw et al., 2002; Brickett *et a*l., 2007, Whitehead, 2010)
- Stocking density – varied results
  - Increased (Brickett *et al*., 2007, Petek *et al*., 2010)
  - Peaked at intermediate levels (Buijs *et al*., 2009, Hepworth *et al*., 2010)
  - Not related (Dawkins, *et al*., 2004)
- Lack of exercise (Sherlock *et al*., 2010)
- Long photoperiod (Brickett *et al*., 2007, Bradshaw *et al*., 2002 and many others)
- Wet litter (Sherlock *et al*., 2010)

Is there an association with egg incubation?

- Spraddle legs associated with high humidity (Crespo & Shivaprasad, 2008)
- Overheating in first 8 days associated with TD (Genin *et al.*, 2008)
- Non-uniform pre-heating of eggs and twisted legs at 40 days (Oveido-Rondon *et al., 2008*)
- Early cool and later hot temperatures (36^{o}C and 39^{o}C) affected bone development (Oveido-Rondon *et al.*, 2008).
- Early cool and later hot temperatures affected tendon fibre and collagen type (Oveido-Rondon *et al.*, 2010).

Recent research*

- Has shown differences in bone ash at 0 and 14 days, faster early growth to 14 days and “leg pain” or “weakness” at 6 weeks with differing incubation profiles
- Using variations in temperature and humidity within “normal” incubation ranges.

* Supported by The Australian Poultry CRC

How do we measure broiler leg weakness/ pain?

- Apart from the clinically recognisable syndromes, we see poor locomotion in broilers
- Traditionally measured – Gait Score (Kestin *et al*., 1992)
- Many studies fail to identify the underlying conditions (Bradshaw *et al*., 2002).

Gait Scores (Kestin *et al*., 1992)

- Six categories (0-5).
- 0 (completely normal) to 5 (immobile).
- Birds scoring 1 have slight defects. Birds with gait score 2 have a definite and identifiable defect in their gait. Birds with score 3 have an obvious gait defect.
- Subjective and somewhat complex – subject to operator bias
- Difficult to do in small pens

USA Gait Scoring System

US Gait Scoring System Marking from 0-2		
0	No obvious signs of problems	Balance
1	Obvious signs	Clear limp, awkward but can walk 5ft
2	Severe signs	Will not walk 5ft

"The Kestin six category system requires a lot more work to assess the capability of the birds," Prof Webster said.

http://www.thepoultrysite.com/articles/1009/testing-gait-scoring-systems

Latency To Lie

- Newer method of assessing broiler locomotion (Weeks et al., 2002) - a more objective measure of leg weakness
- Uses the chicken's natural aversion to water
- Originally involved flooding a waterproof pen with shallow layer of water. Timed to see how long they take to lie down.
- The shorter the time reflects their pain / comfort with standing.

Latency To Lie modification

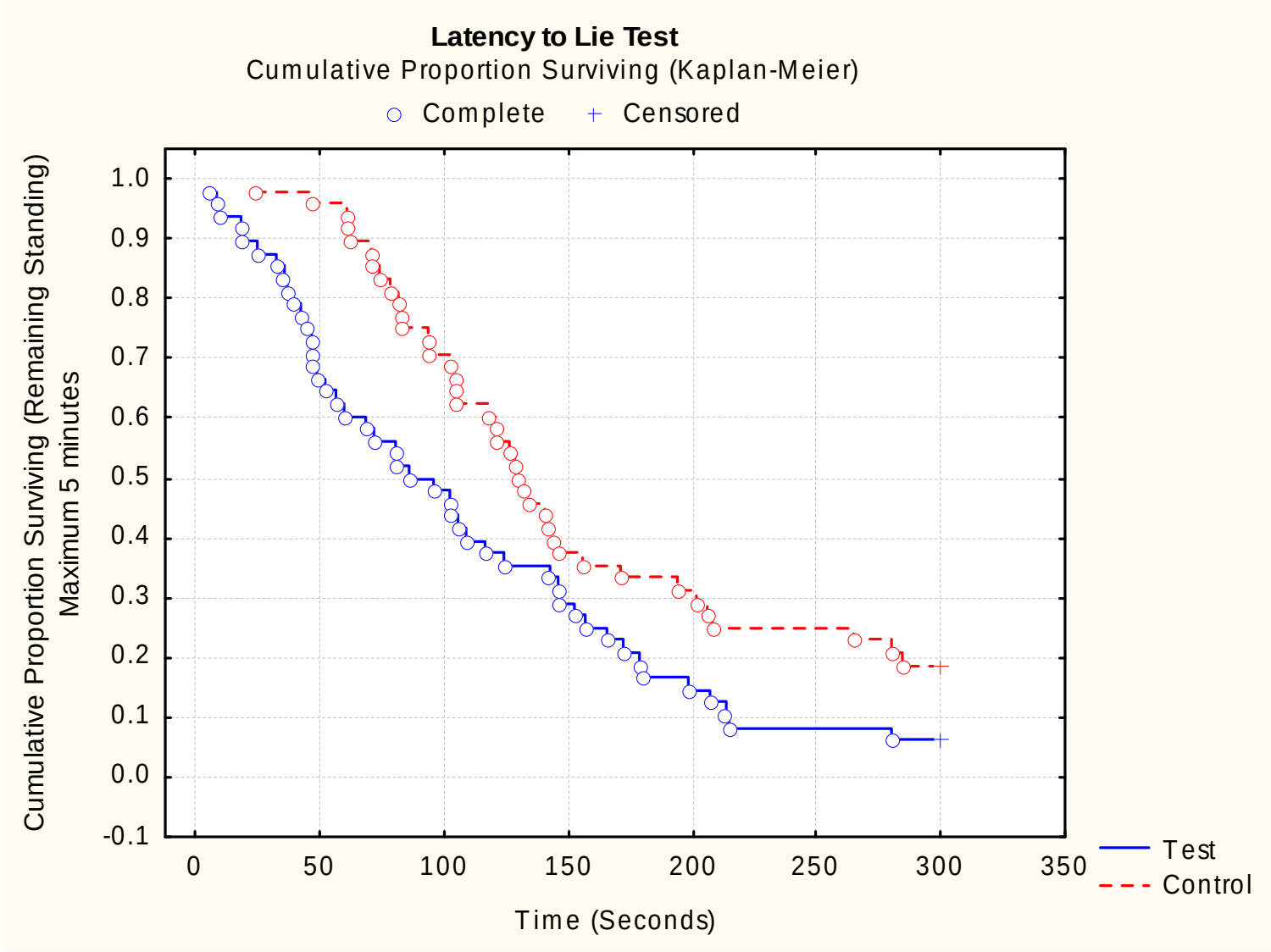
- Modified by Berg & Sanotra (2003) -birds placed into a tub individually and timed

- Good agreement with Gait Score results

Latency To Lie

5 minutes maximum time

Latency-to-Lie & Incubation



Conclusions

- Improvements in skeletal integrity from genetic selection have been progressive over the last 20 years. This is continuing but does take time to reach the field (5 years – Elfick, 2010)
- In the meantime, attention needs to continue on management improvements – risk factors.
- Perhaps we can refine incubation profiles as a contribution to further improvement.