

The relationship between genetic diversity and phenotypic characteristics in the Irish Draught Horse



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Irish Draught Horse

- Native horse breed
- Traditionally multi-purpose utility breed
 - Draught
 - Riding
 - Crossed with TB to produce Irish Sport Horse/Hunter
- Foal crop in 2011
 - 800 pure-bred
 - Up from 120 in 1972
 - 900 cross-bred



Conservation

- Studbook aims to conserve genetic diversity by
 - Research and monitoring
 - Breeder information
 - Inclusion in Inspection regime
 - Encourage breeding from “genetically diverse” horses



Genetic Diversity

- Challenge
 - Main market is for cross-bred progeny aimed at showjumping, hunting and leisure market
 - Preserve traditional phenotypic characteristics while maintaining market viability



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Market prices

2005-2011	n	Mean (€)	Std Dev (€)	Min (€)	Max (€)
Pure-bred ID	49	2794	1481	700	7200
Cross-bred ID	254	3806	2076	400	16000
Other SH	963	3963	3139	320	40000
2011					
Pure-bred ID	10	2140	1067	900	4800
Cross-bred ID	30	3000	1804	400	9000
Other SH	149	3046	1843	320	10000



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Research Aims

- Assess erosion in traditional phenotypic characteristics
- Establish why some bloodlines are rare?
 - Genetic improvement
 - Thoroughbred influence
 - Export



Materials & Methods

- Stallion - conformation traits
 - N = 506, born from 1961 to 2008
 - 75 inspected in 2010-2011
 - 3 objectively measured traits
 - Cannon bone circumference, height at withers, girth
- All data analysed using SAS (GLM and Chi-square)



Materials & Methods

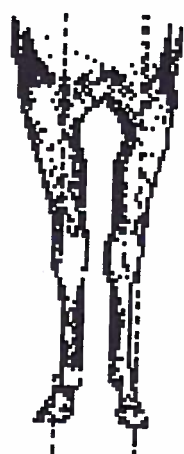
- Mare - linear profile results
 - N = 529
 - Profiled in 2010-2011
 - 27 conformation traits
 - 10 movement traits
 - Compared the incidence of phenotypic faults between mares with low mean kinship values and other mares
 - Analysis of Thoroughbred influence



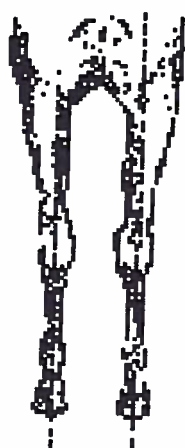
Linear Scoring

- Linear scoring
 - descriptive method of assessing a horse
 - describes where the horse lies between the biological extremes for any given trait

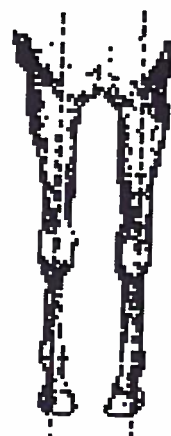
Stance of forelimbs



Toed out



Correct



Toed in

		a b c d e f g h i										
Conformation/Trait		Obvious	Average	Obvious		Obvious		Obvious		Obvious	Comments	
1. Body shape	rectangular	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	square							
2. Head: appearance (horns, ears, eyes, jawbones & girth)	fine	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	plain	<input type="checkbox"/>	roman nose	<input type="checkbox"/>	long			
3. Head-neck connection	light	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	heavy							
4. Length of neck	long	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	short	<input type="checkbox"/>	deep cut of chest					
5. Muscling of neck	heavy	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	poor	<input type="checkbox"/>	ewe-neck					
6. Position of neck	vertical	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	horizontal							
7. Height of withers	high	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	flat							
8. Position of shoulder	sloping	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	straight	<input type="checkbox"/>	narrow chest					
9. Barrel	deep	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	shallow							
10. Line of back	strong	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	weak							
11. Line of loins	strong	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	weak							
12. Shape of croup	sloping	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	flat							
13. Length of croup	long	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	short							
14. Forearm	strong	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	weak	<input type="checkbox"/>	bed in elbow					
15. Cannon bone length	short	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	long							
16. Substance of legs	heavy	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	light	<input type="checkbox"/>	bed in knee					
17. Stance of forelegs	over at knee	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	back at knee	<input type="checkbox"/>	standing					
18. Stance of pastern	sloping	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	upright							
19. Heels	high	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	low							
20. stance of hind legs	sickle	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	[] [] [] [] [] [] [] [] [] [] []	straight	<input type="checkbox"/>	camped out	<input type="checkbox"/>	abnormal	<input type="checkbox"/>	abnormal style	



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Stallion Conformation

- Cannon bone circumference significantly decreased in the 1980s ($p < 0.01$) but has stabilised
- No significant change in height at withers or girth
- Supports anecdotal evidence that breed has become lighter over time
- This reflects breeders mating decisions.



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Mare Conformation

Trait	Incidence (%) in low mean kinship mares	Incidence (%) in all mares
Poor muscling of neck	22	10
Straight position of shoulder	27	21
Weak line of loins	25	11
Small knees	14	8
Blurred leg quality	27	9
Weak hindquarters & gaskins	36	25
Incorrect walk	19	8
Incorrect trot	29	17

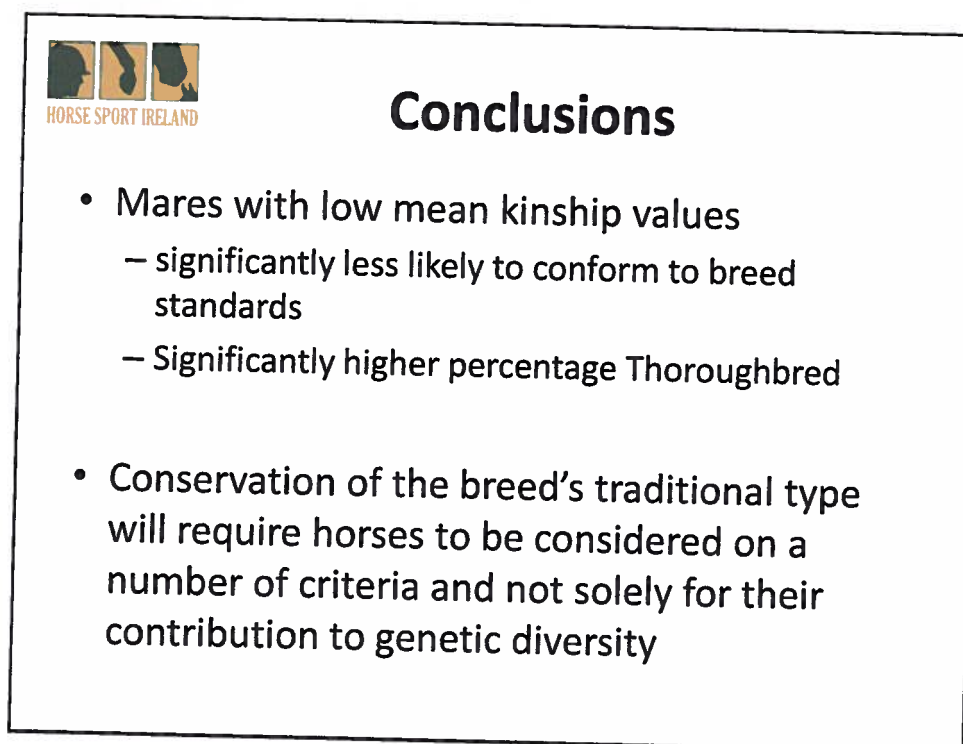
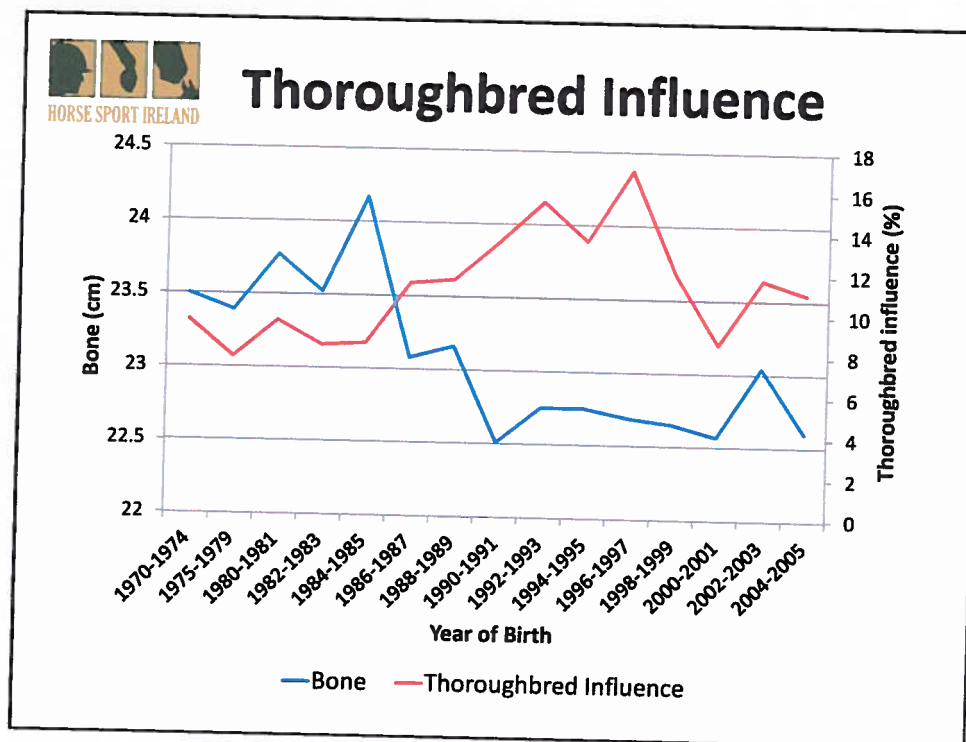


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Thoroughbred Influence

Mean Influence % (SEM)	n	Low mean kinship horses	Non-low mean kinship horses	p-value
Mares	529	14.4% (0.76%)	12.7% (0.33%)	0.0377
Stallions	75	9.4% (4.1%)	8.9% (0.71%)	NS

- Small number of influential stallions with low mean kinship values due to a large Thoroughbred influence in their pedigrees (50%)





Recommendations

- Genetic evaluations for traditional characteristics would provide useful information to breeders
- Investigate the implementation of Optimum Contribution selection



Thank You