

Breed Analysis Report for Shetland Cattle; November 2007

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The previous report (September 2006) by Alderson, Holloway and Hardman set out the breed structure analysis in some detail. The items of discussion and conclusions of that report remain largely relevant, and therefore it should act as the main reference point. This report will take the form of an update with additional comments where appropriate

Results:

Effective founder number (EFN):

The endangered position of some families is counterbalanced by the dominance of other families and lines, and this has led to a reduction in EFN (a measure that adjusts for unequal influence of founders - also known as founder genome equivalents). There is an indication that the EFN has continued to fall in the last six years (Table 1), although the fall is not consistent. A further measure of unequal contributions is the number of dominant founders. In recent years, only eight founders (3 bulls and 5 cows) together have contributed more than 40% of the ancestry of the calf crop. However, despite this, the EFN of the 2006 crop is 31.54 which, although low, is reasonable in relation to the total number of contributing founders (81), especially when compared to some other rare breeds. The number of active ancestors is likely to increase as extra generations pass, and the main relevance of this measure is as an indicator of inbreeding.

Table 1
Measures of within-breed diversity

Measure	2001	2002	2003	2004	2005	2006
Effective founder number	32.41	32.83	33.96	32.26	31.47	31.54
No. of active founders	77	80	80	80	76	76
No. of active ancestors	798	871	853	905	909	1011

Bull line founders:

The influence of founders of bull lines is not a prime measure of the genetic health of a breed as other bulls, which have not founded bull lines, may have made a greater contribution. However, the four 'bull line founders' (Glebe Wallace, Heather Marshal, Knocknagael J4 and Knocknagael Tommy) have maintained a position from year to year that is sufficiently constant (Table 2) for us to be confident that each line is secure and unlikely to disappear.

Table 2

Contributions (%) of founder sire line bulls to calf crop

Bull	2001	2002	2003	2004	2005	2006
Glebe Wallace	2.77	2.87	3.00	2.68	2.76	2.72
Heather Marshal	1.25	1.39	1.46	1.19	1.29	1.24
Knocknagael J4	2.56	2.39	2.29	2.40	2.20	2.26
Knocknagael Tommy	5.83	5.70	5.44	5.85	5.78	5.77

Herd Book Volume One:

The most significant representatives of the four bull lines in Volume One (1981) of the New Foundation Herd Book (Glebe Rasmie, Heather Chieftain, Stanemore Odin and Araclett Heracles) also have maintained a reasonably constant position during the last six years (Table 3).

Table 3
Contributions of HB Volume 1 bulls to calf crop

Bull	2001	2002	2003	2004	2005	2006
Glebe Rasmie	10.06	9.85	10.14	9.59	9.54	9.39
Heather Chieftain	9.99	11.11	11.70	9.51	10.31	9.93
Stanemore Odin	6.94	7.15	6.95	7.95	7.40	7.75
Araclett Heracles	5.41	5.47	4.95	5.20	5.26	5.05

In some cases the influence of a founder may come down only one line of descent. Thus all the influence of Heather Marshal is transmitted through Heather Chieftain, whereas less than 5% of the influence of Knocknagael Tommy is transmitted through Araclett Heracles.

Note: These contributions are for comparative purposes only between the animals in Table 3. They can not be compared with the % figures in Table 4 and 5.

Young bulls:

Despite the reasonable security indicated by the analysis above, current breeding patterns continue to give some cause for alarm. There is a tight concentration of breeding on the Islands particularly, partly driven by a prioritisation of selection for colour. Although the main culprits of the recent genetic 'bottleneck' are moving further back in pedigrees, their legacy continues to present a threat to the diversity of the breed. The imbalance can be remedied, and previous advice has identified bulls such as **Tivis Hill Keen** on the Mainland or **Struiehill Saturn** on the Islands as sires of potential value (please see September 2006 report).

Regional effects:

Mainland

Breeders on the Mainland seem to have appreciated the potential danger of a genetic bottleneck, as the most popular young sires of the 2006 crop (Table 4) show a marked reduction in the influence of Boris and Collafirth Rasmie. There is some concentration of breeding as both Centurion and Fearless are sons of St Trinians Navigator, but there is a wide choice of bulls with other useful genetic influences.

Sires such as **Greenoak Erebus** (2005), **Randolph Donald** (2003) and **St Trinians Adam** (2003) especially stand out as bulls with the ability to improve the genetic balance and diversity of the breed (although Adam has both Boris and Knocknagael Rory in near pedigree), and would be useful additions to the Semen Bank.

Colour does not seem to be a major factor with breeders on the Mainland, but Wild Meadows Freddie is a red brindle for anyone who is interested.

Table 4
Influence of young bulls on 2006 crop of calves on the Mainland

Bull	Year of birth	Contribution	Notes
St Trinians Dillion	2001	5.25	
St Trinians Navigator	1998	4.00	
St Trinians Adam	2003	4.00	
Collafirth Gordon	1999	3.88	
Templeson Lorenzo	2003	3.50	
Randolph Donald	2003	3.00	
Greenoak Erebus	2005	3.00	
Wild Meadows Freddie	2003	3.00	
St Trinians Fearless	2001	3.00	son of Navigator
St Trinians Centurion	2000	3.00	son of Navigator

Islands

Breeders on the Islands continue to focus their attention on a narrower spectrum of breeding. Only two bulls in the eleven most influential young sires (Table 5) do not belong to the concentrated Collafirth Rasmie and Hillwell Huxter groupings. Part of this concentration appears to be driven by colour considerations, initially highlighted by Templeson Boris and Collafirth Rasmie (both red) and now continued by a great grandson of Rasmie, Hillwell Arcus (grey and white). Some of the Hillwell bulls (Arcus, Luddy, Nonny and Peerie Willie) have a highly concentrated influence of Rasmie.

Two bulls on the Islands list provide good opportunity to break out of the Huxter/Boris/Rasmie restriction. **Collafirth Laxness** (2003) has an excellent blend of bloodlines and, if colour is a factor of interest, he is from the sireline of Murrister Pete who had grey markings. **Gillarunna Hakki** (2000) also offers a good blend of bloodlines.

Table 5
Influence of young bulls on 2006 crop of calves on the Islands

Bull	Year of birth	Contribution	Notes
Hillwell Gerald	2001	7.18	son of Flea
Yahaarwell Cuillin	1998	7.04	son of Huxter
Hillwell Arcus	2001	6.18	ggs of Rasmie
Hillwell Peerie Willie	2002	5.75	son of Gerald
Collafirth Laxness	2003	5.75	
Hillwell Luddy	2003	5.46	son of Arcus
Hillwell Flea	1998	4.45	gs of Rasmie
Gillarunna Hakki	2000	4.02	
Hillwell Nonny	2004	3.45	son of Arcus
Benston Frazier	2000	2.87	son of Cuillin
Benston Foster	2000	2.87	son of Cuillin

There are some interesting examples of breeding in the Islands list. For example, St Trinians Spitfire is the double grandsire of both Luddy and Nonny, which contributes to the high level of inbreeding to Rasmie. Hillwell Gerald is linebred to a cow, Waterloo Doris, a daughter of Murrister Olympus.

Please note again: these contributions are for comparative purposes only between the animals in Tables 4 and 5. They can not be compared with the % figures in Tables 2 and 3.