Sable Cluster Analysis Summary
September, 2014

Data was obtained from the ADGA for 8 dairy breeds. All results were limited to those animals reported as Purebred (PB) or American (AM); however, all animals were included in the pedigree analysis to establish ties between animals, including cases where the ancestors are from another breed. Cluster analysis is a procedure that groups related animals based on pedigree relationship. This is a technique used by NAGP to assess where repository animals are grouping with the currently available genetic pool for each breed. It also establishes a practical approach for obtaining animals for the repository in a way that maximizes genetic diversity. Animals that were included in the cluster analysis included sires of PB and AM offspring born 2010 to present that are also PB or AM themselves.

Table 1 shows the summary statistics based on the pedigree and cluster analyses.
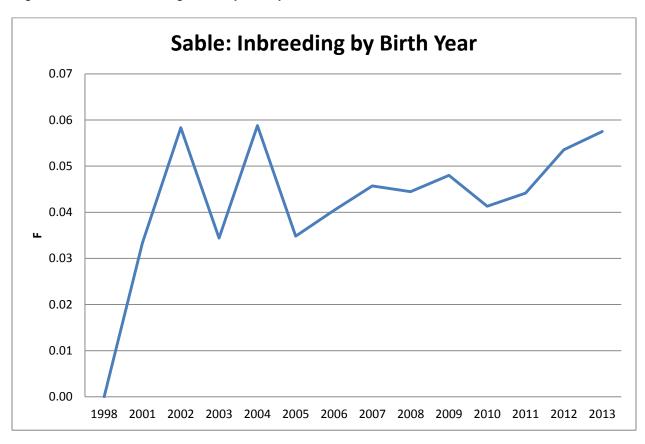
Table 1. Summary statistics for Sable

	Sable
Animals that are PB or AM	2,482
Full pedigree file (until all ancestors are unknown)	20,121
Unique sires	655
Unique dams	1,301
Mean inbreeding (F)	0.047
F range	0 – 0.43
Repository bucks	0
Clustered bucks	300*

*Sable clusters include Saanen sires producing Sables
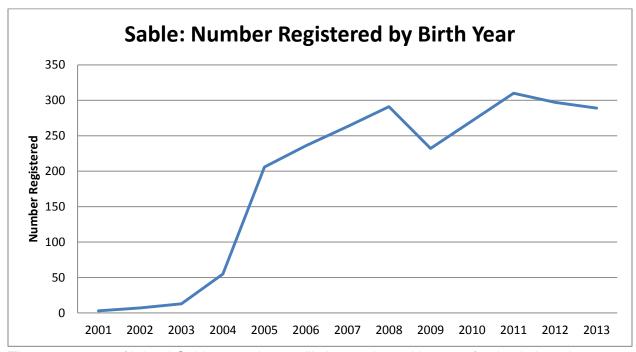
Pedigree & Inbreeding Analysis

Figure 1 shows the inbreeding trend for Sable goats. Current inbreeding levels are 5.7% (2013), and have been fairly steady for the past 12 years. Because this breed has another breed pool to pull from, inbreeding should be easier to manage than would normally be expected from a small breed.

Figure 1. Sable inbreeding trend by birth year

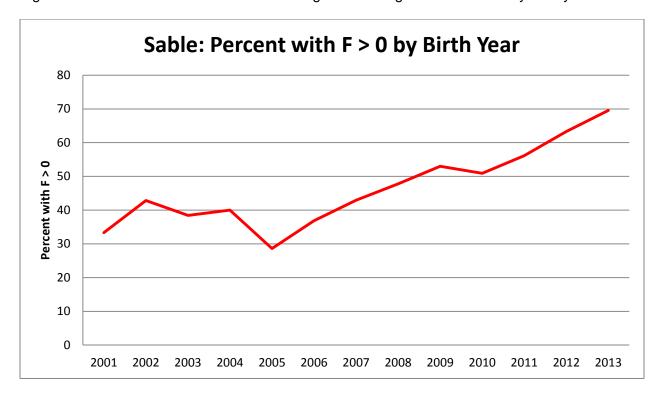**Sable: Inbreeding by Birth Year**

Sable registrations have generally seen an increase over time with 289 registrations for 2013 born animals (Figure 2).

Figure 2. Sable goats registered by birth year

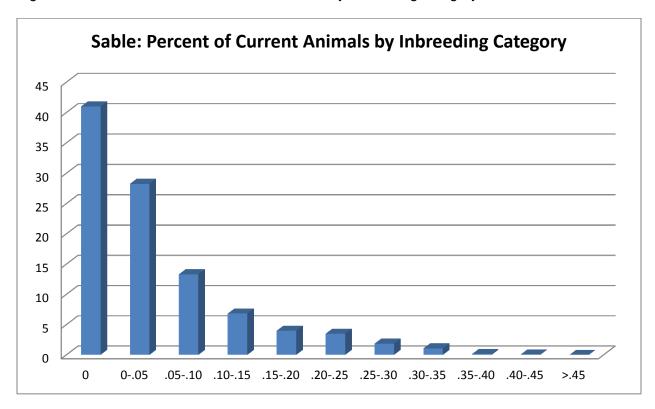**Sable: Number Registered by Birth Year**

The percentage of inbred Sable goats is steadily increasing, with 70% of animals born in 2013 having a non-zero inbreeding coefficient.

Figure 3. Percent of Sables with an inbreeding coefficient greater than zero by birth year

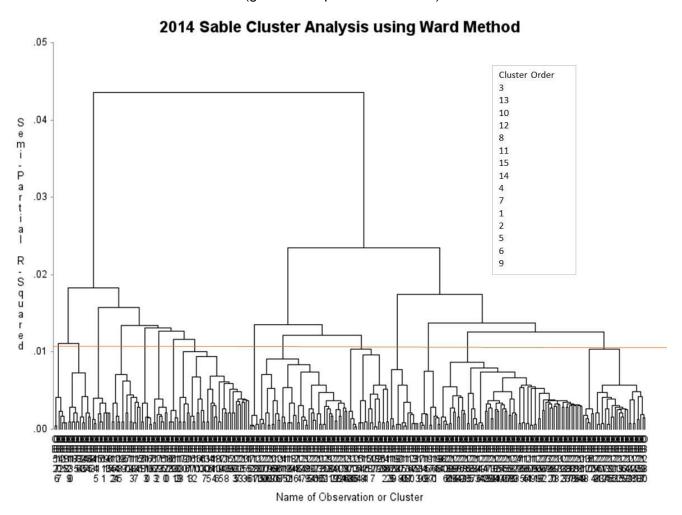**Sable: Percent with F > 0 by Birth Year**

As is expected with a 'young' breed, overall inbreeding is relatively low. This is reflected in the current population (animals born 2009 and later) where 82.6% of the goats have an inbreeding coefficient less than 0.10 (Figure 4).

Figure 4. Percent of Sables born 2009 and later by inbreeding category

Sable: Percent of Current Animals by Inbreeding Category

Fifteen clusters were identified as representing the 300 clustered bucks. The clusters included Sable bucks in addition to Saanen bucks that have produced Sable goats.

Figure 5. Tree diagram for Sable cluster analysis of sires of PB and AM offspring born 2010 and later that are PB or AM themselves (gold line depicts cluster level)

2014 Sable Cluster Analysis using Ward Method

The overall relationship between the clustered bucks is 0.047; only cluster 14 is lower than this value. There are no Sable bucks in the NAGP repository.

Table 2. Sable cluster results showing the number, mean, and variance for between and within cluster relationships

Between Clusters			
	n	Mean	Variance
	300	0.047	0.003
Within Cluster			
	n	Mean	Variance
Cluster 1	21	0.132	0.020
Cluster 2	15	0.289	0.026
Cluster 3	7	0.335	0.021
Cluster 4	5	0.527	0.012
Cluster 5	11	0.282	0.026
Cluster 6	72	0.093	0.003
Cluster 7	45	0.152	0.007
Cluster 8	6	0.359	0.022
Cluster 9	32	0.154	0.007
Cluster 10	10	0.258	0.011
Cluster 11	8	0.273	0.021
Cluster 12	15	0.129	0.015
Cluster 13	12	0.220	0.017
Cluster 14	36	0.021	0.005
Cluster 15	5	0.388	0.015

The within and between cluster relationship matrix is shown in Figure 6. With few exceptions, the diagonal (within cluster) has higher relationships than the off-diagonal (between clusters), indicating the cluster analysis has properly allocated bucks to clusters.

Figure 6. Within and between cluster relationship matrix for Sable