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Accuracy of Recorded Birth and Calving Dates of Dairy Cattle in the United States

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ABSTRACT

Frequencies of births that were reported for specific days of the month were documented for US dairy cattle born since 1987 by birth year, herd size, and registry status and compared with calving frequencies for those dates. Because birth dates are expected to be random and uniformly distributed throughout each month, percentages of births on individual dates were expected to be equal (3.3% for d 1 to d 28, 3.2% for d 29, 3.0% for d 30, and 1.9% for d 31). However, percentages of reported birth dates for d 1, 2, 10, 15, and 20 were higher than expected. The percentage of reported births for d 1 was highest (5.3%) of all days of the month regardless of herd size or registry status. The nonuniform distribution of birth dates within month indicated that a substantial number of birth dates were unknown and that estimated birth dates had been reported. About one-third of the birth dates recorded on d 1 appeared to have been estimated, or altered to gain an advantage in cattle shows. The highest frequencies for birth dates on d 1 (5.9 to 7.4%) were found for registered cows during months that initiated age groupings for dairy shows (March, June, September, and December). Birth dates for some registered cows were intentionally misreported as confirmed by comparison of birth dates of individual cows with calving dates of their dams. Reported calving dates appeared to be more accurate than reported births; the inflated frequency of recorded calvings on d 1 was only about 30% as large as the inflated frequency of recorded births. Because cow age is determined by birth date, proper reporting of birth dates is important to ensure the accuracy of standardized yield and fitness records and the genetic evaluations that are based on those records. When animals' recorded birth dates and their dams' calving dates differ, more credence should be given to the latter to improve accuracy.
(**Key words:** birth date, calving date, record accuracy)

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Abbreviation key: AIPL = Animal Improvement Programs Laboratory, **DRPC** = dairy records processing center, **ME** = mature equivalent.

INTRODUCTION

Obtaining highly accurate data is dependent on diligent record keeping. Correct birth dates of dairy animals are essential because that information is associated with the animal throughout its life and impacts standardized milk yield and fitness traits through age adjustment. Because some birth dates are never recorded and others are misplaced or never provided for entry in the management database, some DHI affiliates and dairy records processing centers (**DRPC**) have allowed DHI technicians and producers to code animals with unknown birth dates as estimated. Birth dates for some animals may have been altered intentionally to be assigned a younger show class or obtain a preferred contemporary group. Generally this gives an advantage to those animals in the show ring because size has a positive impact on the placing, particularly in young animals. In addition, this may even add more value to the animal if it is sold.

The purpose of this study was to determine the accuracy of the recorded birth dates through an examination of the percentage of those reported for each month and each day of the month. Insight was provided by comparing those birth dates with the percentage of calving dates reported for those same months and days of the month. In addition, daughters' birth dates and their dams' calving dates were compared to determine the consistency of reporting. It was documented by Norman et al. (1974) that calvings vary by seasons of the year. With the recent interest in grazing, the number of herds that are calving earlier in the calendar year may have increased to take advantage of the growing season. Because seasonal calving patterns exist, the only assumption made was that birth dates and calving dates occur randomly throughout the month, i.e., are equally likely to occur on each day of the month. This implies that for a typical year, 3.3% of birth dates and calving dates should occur on d 1 to 28. Likewise, expected percentages of births and calvings on d 29, 30, and 31 are 3.2,

3.0, and 1.9%, respectively. No information is provided to confirm the validity of this assumption. Nevertheless, because of the variation in gestation length, the question of whether data are recorded accurately is likely to be revealed whether or not the assumption is valid. Year, herd size, and registry status were also investigated to determine their relationship to the recording of birth dates and calving dates.

MATERIALS AND METHODS

Breed associations and DRPC provide the Animal Improvement Programs Laboratory (**AIPL**) (Beltsville, MD) with animal pedigree and lactation information including breed, identification number, birth date, registry status, herd code, and calving date. Birth dates and calving dates were summarized according to month and day of the month for selective years. Birth dates coded as estimated ("00" for the day born or coded with an "e") were summarized by birth years according to registry status. This study was based on 9,607,939 lactation records from both registered and grade cows born after 1986. Those cows were 93% Holsteins, 5% Jerseys, and 2% from the five other breeds (Ayrshire, Brown Swiss, Guernsey, Milking Shorthorn, and Red and White). Crossbred cows that were not enrolled in a breed association grading-up program were not included unless they were coded as the same breed as their sire and dam.

Summaries showed the percentage of birth dates and calving dates reported for d 1 versus other days of the month for each calendar month. This permitted the examination of any difference between the percentages of recorded birth dates on d 1 of show classes versus the last day of the previous month. Purebred Dairy Cattle Association (1998) recommendations for dairy cattle shows separate calves and yearlings into classes by 3-mo age groups, starting on d 1 of March, June, September, and December. Heifers born on d 1 of those months usually will be larger than those born throughout the following 3-mo period and will usually receive an advantage in the judges' placings because of their size. Heifers born days or weeks before the starting dates of a new age class and intentionally misreported as belonging to a younger age class would have even more advantage. If birth dates were intentionally misreported, the distribution of birth date and calving date could be different. However, some cases of intentional misreporting may have occurred in which the individual doing the recording changed both the birth date and dam's calving date but kept them in agreement.

The relationship was investigated between herd size and accuracy of birth dates. Three herd size groups were defined: small (<50 cows), medium (50 to 150 cows), and large (>150 cows). Small, medium, and large herds were further examined to determine which months and days of the month had the highest frequency of birth dates.

In 1992, AIPL added an edit to its genetic evaluation system that compares an animal's birth date with her dam's calving dates. The current editing system at AIPL notifies the DRPC if the birth date differs by 10 to 30 d from the calving date of the dam, but AIPL does not change the birth date. Also, an AIPL edit rejects a record if the birth date of the animal differs by 31 to 180 d from the calving date of the dam (Norman et al., 1994). Those edits were not applied to data prior to 1992 for this study, and no effort was made to revise those data in the national database.

This study also matched animals' birth date with their dams' calving date for females with 1997 birth dates to check correspondence among the birth and calving dates. Animals resulting from embryo transfer were removed from this examination because this relationship would only apply to the animal and her surrogate dam, for which identity was not recorded in the database.

RESULTS AND DISCUSSION

Frequencies of days of the month from recorded birth dates and calving dates for selected years since 1990 are shown for all cows in Table 1. Some separate frequencies for registered and grade cows are shown in subsequent tables. The highest frequency was on d 1 for each month. Overall, 5.3% of the birth days were recorded on d 1 across months, which is 2.0% higher than the mean frequency of birth dates from d 1 to d 28 (3.3%). A slightly higher frequency (by 0.2%) of birth dates was recorded on d 2, 10, and 15, and (by 0.1%) on d 20. A slightly lower frequency (by 0.2%) of birth dates was recorded on d 13, 23, 24, 26 to d 29, and 31 than expected. Data from recent years appears to be more accurate for d 1 as the percentage recorded was closer to that expected. The frequency of d 1 declined from 5.5% in 1990 to 4.8% in 1996 and 1997 (not shown). Accuracy of recording appears to have changed little for the other 12 d cited.

Frequencies of days of the month for recorded calving dates for the same years as birth dates are also in Table 1. If calving dates and birth dates were all recorded correctly, the same percentages for days of the month should be found in both. The highest frequency for calving day was also d 1 for each month. Overall, 3.9% of the calving dates were recorded on d 1, which is 0.6% higher than the mean frequency of calving dates from d 1 to d 28 (3.3%). Therefore, mean difference between the frequency of calving dates and birth dates for d 1 was 1.4%. The inflated frequency (above 3.3%) of d 1

Table 1. Frequency (%) of recorded births and calvings by year and day of month.[1]

Day of month	Birth year					Calving year				
	1990	1992	1994	1996	All years	1990	1992	1994	1996	All years
1	5.5	5.4	5.2	4.8	5.3	3.8	3.9	3.9	4.0	3.9
2	3.4	3.5	3.4	3.5	3.5	3.3	3.4	3.3	3.4	3.4
3	3.2	3.3	3.2	3.3	3.3	3.2	3.3	3.2	3.2	3.3
4	3.2	3.2	3.3	3.2	3.2	3.2	3.3	3.2	3.2	3.3
5	3.3	3.2	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
6	3.2	3.2	3.2	3.3	3.2	3.3	3.3	3.2	3.2	3.3
7	3.1	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
8	3.2	3.2	3.2	3.3	3.3	3.3	3.3	3.3	3.3	3.3
9	3.2	3.1	3.1	3.2	3.2	3.2	3.2	3.2	3.2	3.2
10	3.5	3.6	3.5	3.5	3.5	3.5	3.6	3.7	3.6	3.6
11	3.1	3.2	3.2	3.2	3.2	3.2	3.2	3.3	3.1	3.2
12	3.3	3.3	3.3	3.3	3.3	3.4	3.4	3.3	3.3	3.3
13	3.2	3.1	3.2	3.1	3.1	3.2	3.2	3.2	3.1	3.2
14	3.2	3.3	3.2	3.2	3.2	3.3	3.3	3.3	3.2	3.3
15	3.5	3.5	3.5	3.4	3.5	3.5	3.5	3.5	3.5	3.5
16	3.3	3.2	3.3	3.2	3.2	3.3	3.2	3.3	3.3	3.3
17	3.2	3.1	3.2	3.2	3.2	3.3	3.2	3.2	3.2	3.2
18	3.3	3.2	3.3	3.3	3.3	3.3	3.3	3.4	3.3	3.3
19	3.2	3.1	3.2	3.1	3.2	3.2	3.2	3.2	3.2	3.2
20	3.5	3.4	3.4	3.4	3.4	3.6	3.5	3.6	3.6	3.6
21	3.1	3.1	3.2	3.2	3.2	3.3	3.2	3.2	3.2	3.2
22	3.1	3.2	3.2	3.2	3.2	3.2	3.2	3.3	3.2	3.2
23	3.1	3.1	3.2	3.2	3.1	3.2	3.2	3.2	3.2	3.2
24	3.1	3.1	3.2	3.1	3.1	3.3	3.2	3.2	3.2	3.2
25	3.2	3.2	3.2	3.2	3.2	3.3	3.3	3.3	3.4	3.3
26	3.1	3.1	3.1	3.2	3.1	3.3	3.2	3.2	3.3	3.2
27	3.1	3.1	3.1	3.1	3.1	3.2	3.1	3.1	3.2	3.2
28	3.1	3.1	3.1	3.2	3.1	3.2	3.3	3.2	3.3	3.2
29	2.8	3.0	2.8	3.1	2.9	3.2	3.3	2.9	3.1	2.9
30	2.8	2.9	2.9	2.9	2.9	3.0	2.9	2.9	3.1	2.9
31	1.7	1.7	1.7	1.7	1.7	1.8	1.7	1.7	1.7	1.7

[1]Expected percentages are 3.3% for d 1 to 28, 3.2% for d 29, 3.0% for d 30, and 1.9% for d 31.

for calving date was only 30% as large as the inflated recording of d 1 for birth date. The only apparent reason for this to occur is if birth dates were deliberately recorded incorrectly.

Only a few of the grade cows included in Table 1 were coded with estimated birth dates (Table 2). These

Table 2. Frequency (%) of birth dates coded as estimated by registry status and birth year.

Birth year	Registry status	
	Registered[1]	Grade
1987	0	1.1
1988	0	0.9
1989	0	0.8
1990	0	0.8
1991	0	0.7
1992	0	0.5
1993	0	0.4
1994	0	0.3
1995	0	0.2
1996	0	0.2
1997	0	0.1
Mean	0	0.5

[1]Cows that were enrolled in the breed association herd book.

decreased from 1.1% in 1987 to 0.1% in 1997. Between 1987 and 1997, 0.5% of cows were coded with estimated birth dates. No cows enrolled in a breed association herd book (registered) were coded as *estimated* because of an AIPL edit. Although some registered cows with lactation records may have been coded as *estimated* by DRPC, actual birth dates provided earlier by breed associations and maintained in the AIPL file were used.

The reason for the sharp decline in coding for estimated birth dates is not known. The decline in estimated birth dates was apparently not as large as the reduction in the coding for estimated dates. A 2.0% higher incidence of birth dates was recorded on d 1 than expected (Table 1). Only 0.5% of the birth dates of grades are coded as estimated (Table 2). This indicates that many estimated birth dates were not coded as such or were intentionally misreported. For example, in 1996, 4.8% birth dates were recorded on d 1 (Table 1), whereas 0.0 and 0.2% birth dates for registered and grade cows, respectively, were coded as estimated (Table 2). The difference between 4.8% (percentage of birth dates on d 1 of the month in 1996) and 3.3% (the percentage of birth dates expected on any day of the month) is

Table 3. Mean frequency (%) of recorded birth and calving dates for cows born after 1986 that were enrolled in the breed asociation herd book (registered) by month and day of month.[1]

Day of month	Month											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Recorded birth date												
1	4.0	4.2	**7.2**	4.1	3.7	**5.9**	3.5	3.7	**7.4**	3.6	4.0	**6.8**
2	3.4	3.8	4.9	3.5	3.2	4.1	3.2	3.3	5.1	3.3	3.7	4.7
3	3.4	3.7	3.7	3.5	3.2	3.3	3.1	3.3	3.8	3.1	3.5	3.7
4	3.3	3.7	3.4	3.5	3.2	3.2	3.3	3.3	3.4	3.2	3.6	3.3
10	3.5	4.0	3.4	3.6	3.6	3.4	3.4	3.5	3.5	3.5	3.6	3.4
15	3.4	3.7	3.2	3.5	3.5	3.3	3.4	3.5	3.3	3.4	3.6	3.2
20	3.4	3.7	3.2	3.4	3.6	3.5	3.5	3.5	3.3	3.4	3.5	3.2
28	3.2	**2.7**	2.8	3.2	3.2	3.4	3.4	2.9	2.9	3.2	2.9	3.0
29	3.0	0.7	2.7	3.0	3.0	3.1	3.3	2.8	2.7	3.1	2.7	2.7
30	3.1	. . .	2.7	3.1	2.9	3.2	3.2	2.8	2.7	3.2	**2.5**	2.7
31	2.9	. . .	2.5	. . .	**2.6**	. . .	3.0	**2.4**	. . .	3.0	. . .	2.6
Recorded calving date												
1	3.8	4.1	**5.3**	4.2	4.0	**5.4**	3.8	3.7	**5.4**	3.8	4.0	**5.3**
2	3.5	3.7	4.0	3.6	3.3	3.9	3.3	3.1	4.0	3.2	3.5	4.0
3	3.3	3.5	3.3	3.4	3.2	3.4	3.2	3.0	3.5	3.1	3.4	3.4
4	3.3	3.5	3.3	3.4	3.2	3.3	3.3	3.0	3.3	3.1	3.4	3.3
10	3.6	3.8	3.6	3.6	3.6	3.7	3.5	3.5	3.7	3.6	3.7	3.6
15	3.5	3.7	3.5	3.6	3.6	3.5	3.5	3.5	3.5	3.5	3.6	3.3
20	3.4	3.9	3.5	3.6	3.6	3.6	3.6	3.7	3.6	3.6	3.7	3.4
28	3.1	**3.5**	2.9	3.1	3.1	3.2	3.3	3.4	3.0	3.2	3.1	3.0
29	3.0	0.8	2.8	3.0	3.0	3.0	3.2	3.3	2.8	3.1	2.9	2.8
30	3.1	. . .	2.9	3.1	3.0	3.2	3.2	3.4	2.9	3.2	**2.9**	2.9
31	2.9	. . .	2.6	. . .	**2.7**	. . .	2.9	**3.0**	. . .	3.0	. . .	2.7

[1]Expected percentages are 3.2% for those months with 31 days, 3.3% for months with 30 days, 3.5% for d 1 to 28 for February, and 0.9% for February 29.

Table 4. Mean frequency (%) of recorded birth and calving dates for grade cows born after 1986 by month and day of month.[1]

Day of month	Month											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Recorded birth date												
1	7.0	5.7	**5.5**	5.7	5.4	**5.7**	4.8	5.0	**5.5**	5.2	5.0	**5.2**
2	3.2	3.7	3.3	3.4	3.2	3.1	3.0	3.1	3.3	3.2	3.3	3.3
3	3.2	3.5	3.3	3.3	3.0	3.0	3.0	3.1	3.3	3.1	3.3	3.3
4	3.1	3.5	3.2	3.5	3.0	3.1	3.1	3.1	3.2	3.0	3.3	3.2
10	3.5	3.9	3.5	3.7	3.4	3.5	3.4	3.4	3.6	3.6	3.4	3.4
15	3.5	3.8	3.6	3.6	3.4	3.7	3.5	3.5	3.7	3.6	3.6	3.5
20	3.2	3.6	3.4	3.4	3.4	3.6	3.4	3.5	3.4	3.4	3.5	3.3
28	3.0	**3.5**	3.0	3.2	3.2	3.4	3.3	3.1	3.1	3.2	3.2	3.1
29	2.9	0.8	2.9	3.1	3.2	3.3	3.2	3.2	2.9	3.0	3.2	2.9
30	3.1	. . .	2.9	3.1	3.2	3.4	3.3	3.2	3.1	3.2	**3.3**	3.1
31	2.9	. . .	2.9	. . .	**3.0**	. . .	3.1	**3.0**	. . .	3.1	. . .	3.0
Recorded calving date												
1	3.5	3.9	**3.6**	3.8	3.7	**3.9**	3.6	3.4	**3.8**	3.7	3.7	**3.8**
2	3.3	3.6	3.2	3.4	3.3	3.4	3.2	3.0	3.4	3.2	3.3	3.3
3	3.2	3.5	3.1	3.4	3.2	3.3	3.1	3.0	3.2	3.1	3.3	3.3
4	3.2	3.4	3.2	3.4	3.3	3.3	3.2	3.0	3.3	3.1	3.3	3.3
10	3.5	3.8	3.5	3.6	3.5	3.7	3.5	3.4	3.7	3.5	3.5	3.5
15	3.4	3.7	3.4	3.6	3.4	3.6	3.5	3.4	3.6	3.5	3.5	3.4
20	3.5	3.8	3.5	3.5	3.5	3.6	3.5	3.6	3.7	3.5	3.6	3.5
28	3.2	**3.6**	3.2	3.3	3.2	3.3	3.3	3.4	3.1	3.2	3.3	3.2
29	3.1	0.9	3.1	3.1	3.0	3.2	3.3	3.4	2.9	3.1	3.2	3.1
30	3.1	. . .	3.1	3.2	3.1	3.4	3.3	3.5	3.1	3.2	**3.3**	3.1
31	3.0	. . .	2.9	. . .	**2.9**	. . .	3.0	**3.2**	. . .	3.1	. . .	3.0

[1]Expected percentages are 3.2% for those months with 31 days, 3.3% for months with 30 days, 3.5% for d 1 to 28 for February, and 0.9% for February 29.

Table 5. Mean frequency (%) of cows born after 1986 by herd size and registry status.

	Herd size		
Registry status	<50	50 to 150	>150
Registered[1]	39	35	15
Grade	61	65	85

[1]Cows that were enrolled in the breed association herd book.

1.5%. Only 0.2% of birth dates were coded as estimated (because the majority of animals were grades). The percentage of birth dates on d 1 of the month in 1996 (4.8%) was 45% greater than the percentage of birth dates expected on any day of the month (3.3%).

Table 3 illustrates potential show class effects on recorded birth and calving dates for registered cows. Significantly more birth dates were recorded on d 1 of March, June, September, and December, the beginning of show classes, compared with d 1 of the remaining 8 mo. For example, 7.4% of recorded birth dates were on September 1, a 4.1% increase over the expected frequency (3.3%). Those four frequencies were nearly twice that expected, with increases from 2.6 and 4.1%. The mean reported frequency for d 1 of the 8 mo that are not the beginning of show classes was 3.8%. This was 0.5% more recorded birth dates than expected on d 1 for the months that do not initiate a show class; therefore, the additional 3.6% of the registered births recorded on d 1 of September appear to be misreported intentionally. Furthermore, the frequency of birth dates on the last day of the 4 mo before the beginning of show classes was significantly lower than expected. The most likely reason is so that a number of those animals would qualify for a more desirable class at cattle shows. Frequencies of calving dates of registered animals' dams (Table 3) on d 1 of March, June, September, and December were slightly higher than for all other days; nevertheless, recorded calving dates were more evenly distributed throughout the month than were recorded birth dates.

Table 6. Mean frequency (%) of recorded birth dates for cows born after 1986 by herd size and day of month.[1]

Day of month	Herd size		
	<50	50 to 150	>150
1	5.4	5.2	5.0
2	3.6	3.4	3.3
3	3.3	3.2	3.2
4	3.3	3.2	3.2
5	3.3	3.3	3.2
6	3.2	3.3	3.2
7	3.2	3.2	3.2
8	3.3	3.3	3.2
9	3.1	3.2	3.2
10	3.6	3.5	3.4
11	3.2	3.2	3.2
12	3.3	3.3	3.2
13	3.1	3.2	3.2
14	3.2	3.2	3.2
15	3.5	3.5	3.5
16	3.3	3.2	3.2
17	3.2	3.2	3.2
18	3.3	3.3	3.2
19	3.1	3.2	3.2
20	3.5	3.4	3.3
21	3.2	3.2	3.2
22	3.2	3.2	3.2
23	3.1	3.2	3.2
24	3.1	3.2	3.2
25	3.2	3.2	3.3
26	3.1	3.1	3.2
27	3.0	3.1	3.2
28	3.1	3.1	3.2
29	2.8	2.9	3.0
30	2.8	2.9	2.9
31	1.7	1.8	1.9

[1]Expected percentages are 3.3% for d 1 to 28, 3.2% for d 29, 3.0% for d 30, and 1.9% for d 31.

Compared with recorded birth dates for registered cows, grade cows' birth dates were more uniform throughout each month (Table 4). Whereas registered cows had consistently higher percentages of birth dates on d 1 of March, June, September, and December than for the other 8 mo, grades did not and averaged 5.5% across all months. Grade cows are seldom exhibited in cattle shows, and there is no incentive to misrepresent the birth date. A comparison of Tables 3 and 4 indicates that grade animals have a higher frequency of births on d 1 than do registered animals for months that do not start show classes. This could indicate that the real birth dates were unknown more frequently for grades than for registered animals.

Table 5 shows the distribution of herd size relative to registry status. As expected, small and medium herds

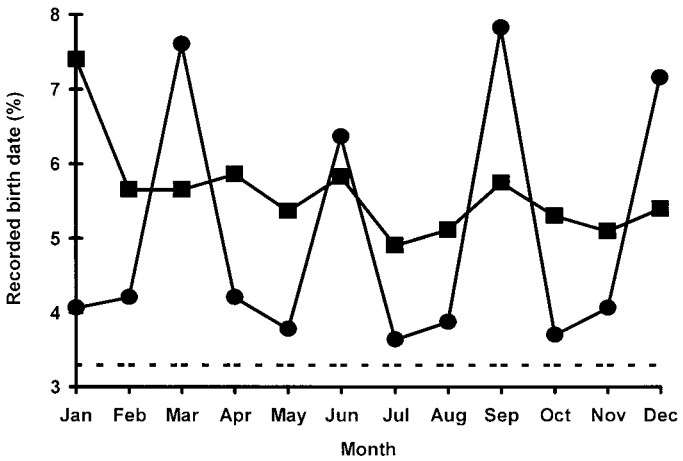

Figure 1. Mean frequency (%) of birth dates recorded on d 1 of month for herds with <50 registered (●) or grade (■) cows born after 1986 as compared with expected percentage (– – –).

Table 7. Mean frequency (%) of recorded birth dates for herds with <50 cows born after 1986 by month and day of month.[1]

Day of month	Month											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.1	5.1	**6.5**	5.2	4.8	**6.0**	4.4	4.7	**6.6**	4.7	4.7	**6.1**
2	3.3	3.8	4.1	3.5	3.2	3.6	3.1	3.2	4.2	3.2	3.5	4.0
3	3.3	3.6	3.5	3.4	3.1	3.1	3.1	3.1	3.5	3.1	3.4	3.5
4	3.2	3.6	3.3	3.5	3.1	3.1	3.2	3.2	3.3	3.1	3.5	3.3
10	3.6	3.8	3.6	3.7	3.6	3.5	3.5	3.4	3.6	3.6	3.6	3.4
15	3.5	3.8	3.5	3.6	3.5	3.6	3.5	3.5	3.5	3.5	3.6	3.3
20	3.3	3.7	3.4	3.5	3.6	3.6	3.5	3.6	3.4	3.5	3.5	3.3
28	3.1	**3.2**	2.9	3.1	3.2	3.3	3.3	3.1	2.9	3.2	3.0	3.0
29	2.9	0.7	2.8	3.0	3.1	3.2	3.2	3.0	2.8	3.0	2.9	2.8
30	3.0	. . .	2.8	3.1	3.1	3.3	3.2	3.1	2.9	3.2	**2.9**	2.9
31	2.9	. . .	2.6	. . .	**2.8**	. . .	2.9	**2.8**	. . .	3.0	. . .	2.7

[1]Expected percentages are 3.2% for those months with 31 days, 3.3% for months with 30 days, 3.5% for d 1 to 28 for February, and 0.9% for February 29.

had a higher percentage of registered cows (39 and 35%) than did large herds (15%). This agrees with the findings of Meinert and Norman (1994) and Norman et al. (2001).

Table 6 shows little variation between small, medium, and large herds in frequency of recorded birth dates. Small herds had a slightly higher frequency of birth dates each month on d 1, 2, 10, and 20 compared with herds with >50 cows. Likewise, small herds had slightly fewer birth dates reported on d 27, 29, 30, and 31 than did large herds.

Table 7 shows the distribution of recorded birth dates in small herds. On d 1 for March, June, September, and December, the mean percentage of calves reported born on those days were almost double the mean percentage reported born on all other days of the month. Further investigation into the effects of registry status (Figure 1) on the frequency of births reported on d 1 illustrates that much of the inflation in recording occurred for registered cows in the 4 mo that are the beginning of show classes. Grade cows were more evenly distributed with the exception of January 1, which was substantially higher, most likely because of a large number of truly estimated births, for which the day and perhaps even the month or year were unknown.

Table 8 shows the distribution of recorded birth dates in large herds by month and day of the month. Because large herds predominantly consist of grade cows, this table is similar to the table for grade cows' recorded birth dates and also shows much smaller peaks on d 1 of each month starting a show class than for small herds. Figure 2 further illustrates that the peaks are less prominent for large herds than for small herds, particularly for registered animals on d 1 of each month starting a show class. Although recorded birth dates of grade cows on d 1 of each show class month were higher than the mean percentage for d 1 to 28 (3.3%), they were consistent across all months. As with small herds,

Table 8. Mean frequency (%) of recorded birth dates for herds with >150 cows born after 1986 by month and day of month.[1]

Day of month	Month											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.0	5.5	**5.3**	5.0	5.0	**5.3**	4.5	4.7	**5.2**	4.7	4.5	**4.9**
2	3.2	3.7	3.3	3.4	3.4	3.2	3.1	3.2	3.4	3.2	3.2	3.2
3	3.1	3.5	3.4	3.3	3.1	3.2	3.0	3.2	3.4	3.1	3.3	3.2
4	3.2	3.5	3.2	3.5	3.1	3.1	3.1	3.1	3.4	3.1	3.3	3.2
10	3.2	3.8	3.3	3.5	3.2	3.4	3.2	3.3	3.4	3.4	3.6	3.3
15	3.4	3.8	3.3	3.6	3.4	3.5	3.4	3.5	3.5	3.5	3.6	3.4
20	3.1	3.5	3.4	3.4	3.3	3.4	3.3	3.2	3.3	3.2	3.3	3.2
28	3.0	**3.3**	3.0	3.2	3.3	3.5	3.3	3.0	3.1	3.2	3.3	3.2
29	3.1	0.9	3.0	3.1	3.2	3.3	3.2	3.2	3.0	3.1	3.3	3.1
30	3.1	. . .	3.0	3.2	3.2	3.4	3.3	3.0	3.1	3.2	**3.3**	3.2
31	3.1	. . .	3.0	. . .	**3.2**	. . .	3.3	**3.0**	. . .	3.2	. . .	3.1

[1]Expected percentages are 3.2% for those months with 31 days, 3.3% for months with 30 days, 3.5% for d 1 to 28 for February, and 0.9% for February 29.

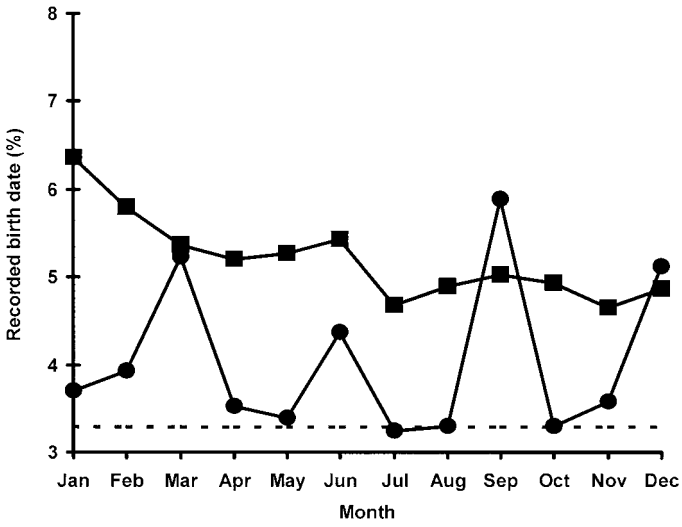

Figure 2. Mean frequency (%) of birth dates recorded on d 1 of month for herds with >150 registered (●) or grade (■) cows born after 1986 as compared with expected percentage (– – –).

grade cows in large herds also had a high percentage of recorded birth dates on January 1. A higher frequency of calvings was reported on d 1 during the first 6 mo of the year, especially for grades. The reason for this is not known. Results from medium herds generally were intermediate to those from small and large herds and are not shown. Both registered and grade cows had a high percentage of birth dates on d 1, which apparently includes a group of cows for which the birth dates are truly unknown; however, birth dates for some registered cows apparently were intentionally misreported as evidenced by their higher frequencies.

To further understand the reason for differences between birth date and calving date frequencies, the recorded birth dates of 789,779 cows born in 1997 were matched against their dams' recorded calving dates. Birth year 1997 was chosen because it allowed adequate time for animals to have a first-lactation record that was the basis for knowing their existence, while giving a representation of the current population. Table 9 shows that of the animals with recorded birth dates in the AIPL database, approximately 37% could not be matched to a dam's lactation record. Of the remaining 497,832 animals, 95.2% had an identical date for birth of animal and calving of dam. An additional 1.8% differed by from 1 to 10 d, and 0.4% differed by 11 to 30 d. Differences of 31 to 365 d were found for some animals, which could indicate difficulty in finding the appropriate parity of the dam.

In Table 10, the animals were subdivided by registry status. Results support earlier findings: registered animals had more discrepancies than grades. Over 95% of grade animals had exact matches between animals' birth date and dams' calving date, whereas only 92% of registered animals had the same. Only 0.9% of grades differed by 1 to 10 d, compared with 3.4% of registered cows. The difference was less noticeable for those that varied by 11 to 30 d: 0.5% of registered conflicting with the animals' birth date, while 0.4% of grades differed by that amount. A chi-square test revealed frequencies differed between registered and grade cows ($P < 0.001$). Results from these matches between individual animals and their dams support the conclusions that were drawn from examining the frequency of birth dates and calving dates independently: calving dates were recorded more accurately than birth dates, and inaccurate birth dates were primarily caused by the deliberate altering of known birth dates for a small percentage of registered animals.

The misreporting of birth dates could potentially affect a cow's genetic evaluation by causing inaccuracies in the calculation of her mature equivalent (**ME**) values. To determine the consequences that misreporting birth dates had on ME yield, first lactation records were simulated for cows in California, New York, and Wisconsin with an actual milk yield of 9,072 kg. For simulated cows with a reported birth date 1 mo after its actual occurrence, ME milk was inflated by 111 to 124 kg, depending on state and month of calving. Misreporting the simulated cows' birth dates by 2 mo inflated ME milk by 206 to 239 kg. This inflation of ME yield would bias a cow's genetic evaluation, but only by a portion

Table 9. Frequency of cows by difference between cow's recorded birth date and dam's calving date for cows born in 1997 with dam's lactation records in the Animal Improvement Programs Laboratory database.

Difference (days)	Number	Percentage of total
1 to 10	9041	1.8
11 to 30	2078	0.4
31 to 180	782	0.2
181 to 365 (mismatches, embryo transfers)	11,955	2.4
Exact matches	473,976	95.2
Total[1]	497,832	

[1]An additional 2,911,947 cows had lactation records but no information for their dams.

Table 10. Frequency of cows by difference between cow's recorded birth date and dam's calving date by registry status for cows born in 1997 with dam's lactation records in the Animal Improvement Programs Laboratory database.

	Registered[1]		Grade	
Difference (days)	Number	Percentage of total	Number	Percentage of total
1 to 10	6045	3.4	2996	0.9
11 to 30	906	0.5	1172	0.4
31 to 180	291	0.2	491	0.2
181 to 365	2442	1.4	9513	3.0
Exact matches	170,491	92.4	303,485	95.5
Total[2]	180,175		317,657	

[1]Cows that were enrolled in the breed association herd book.

[2]An additional 2,911,947 cows had lactation records but no information for their dams.

of this amount (typically <20%). The impact on her sire's genetic evaluation would be minimal, unless ages were intentionally misreported for a large portion of her paternal half-sisters also. In that case, the bias in a bull's evaluation could approach the full magnitude of bias in the daughters' ME yield.

CONCLUSIONS

This study provides evidence of the existence of a substantial number of unknown birth dates, even though most are not coded as estimated; about one-third of the birth dates recorded on d 1 were estimated or altered, probably to produce an advantage in cattle shows. The results indicate that the frequencies of birth dates on d 1 of the month (in all herd sizes and in both registered and grade cows) were all higher than the mean percentage for d 1 to 28. The use of the estimated birth date code should be more widely used to differentiate between cows that have estimated birth dates and those that are known. Because birth dates are used to determine age, their correct reporting is important to ensure accuracy in animals' standardized yield and fitness records and, therefore, in genetic evaluations for yield and fitness traits.

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