



# By the Numbers

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## Genetic progress indicators

Many discussions today revolve around various opinions regarding the design of an efficient beef production system and the genetics necessary to meet those goals. Angus breeders have used performance data to practice multi-trait selection that has improved the seedstock available to the beef industry. By simultaneously selecting to enhance traits that are considered biologically antagonistic, we see tremendous genetic improvement in areas once considered a dream.

### How are we doing?

How do we know that we have made genetic changes in Angus cattle rather than just having changed the management routine to make calves grow and grade better? Assessing genetic trends in a breed for various traits is one way to quantify genetic progress. After

**Table 1: Angus genetic trend, by birth year**

Year	BW	YW	MW
1975	-1.8	-8	-1
1980	-0.7	2	1
1985	1.2	19	13
1990	2.5	34	24
1995	2.5	46	26
2000	2.5	60	31
2005	2.3	73	32
2006	2.3	75	32
2007	2.2	78	34

Source: Adapted from [www.angus.org/Nce/GeneticTrends.aspx](http://www.angus.org/Nce/GeneticTrends.aspx).

all, expected progeny difference (EPD) values are calculated in an evaluation, such as in the recent National Cattle Evaluation (NCE) release for Fall 2009, and the average EPD is computed for every birth year.

For example, all the EPDs for calves born in 2006 are averaged, and that value is reported for each trait, as depicted in the genetic trend chart found at [www.angus.org/Nce/GeneticTrends.aspx](http://www.angus.org/Nce/GeneticTrends.aspx). This same process takes place for every birth year to complete the table.

With each evaluation, the table is rebuilt with EPDs generated to allow continued assessment of the trend. More practically, the values can be depicted as a graph. Fig. 1 illustrates the genetic trend for marbling EPD.

**Over time, Angus breeders have diligently collected carcass and ultrasound data to better characterize carcass merit in the breed.**

If the line would have been flat, or horizontal, then no trend from a genetic progress standpoint would have occurred. In contrast, this graph depicts improvement in marbling EPD over time. Selection pressure has been placed on the marbling EPD, with the goal to move Angus genetics in the desired direction. Over time, Angus breeders have diligently collected carcass and ultrasound data to better characterize carcass merit in the breed. The fruits of these efforts now can be documented, in part, by the increase in percent of Choice cattle and *Certified Angus Beef*® (CAB®) acceptance rate.

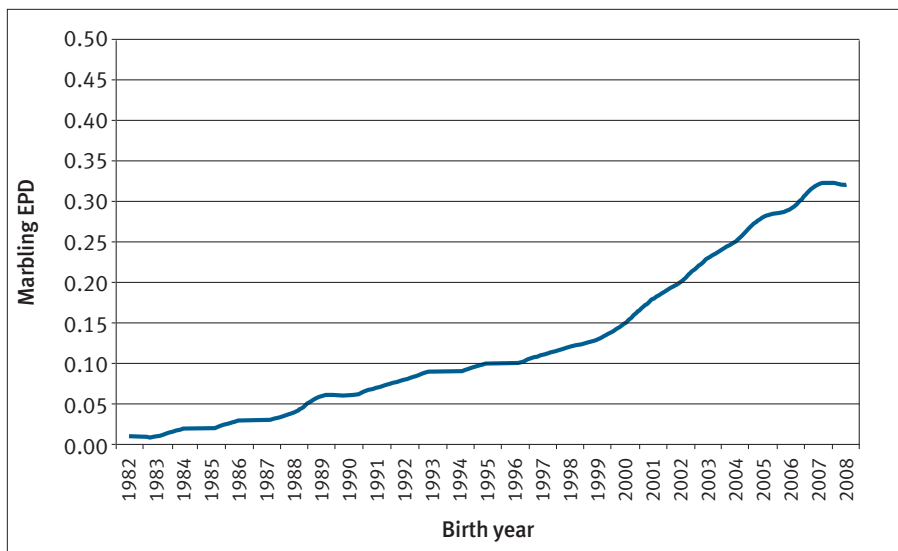
Genetic change may not always occur as rapidly as breeders would like. When you consider the calculations behind the graph, it takes some lag time for animals to accumulate in each birth year represented. Let's look at a couple of additional examples. Birth weight is moderately correlated with other measures of growth (weaning weight, yearling weight, mature weight, etc.). What does that mean? A correlation is a measure of how two traits vary together. A correlation closer to 1.00 simply means that as one trait increases, the other trait also increases. Correlations close to 0 would imply that by selecting for one trait, the other trait is not influenced.

So, by selecting for higher-performing animals at yearling time, we will normally tend to also increase birth weight as a correlated response to the selection for yearling weight. The published genetic correlations for birth and yearling weight range from 0.40 to 0.70, with an average of about 0.55. That is a strong correlation, but it does leave some opportunity to identify genetics where improvement can be made for both traits.

### Making improvements

By utilizing the available genetic selection tools, Angus breeders have made remarkable strides in breeding and identifying seedstock to improve these traits. Table 1 can be used to demonstrate the progress made in improving these traits. Note that during the past 22

**Fig. 1: Genetic change in marbling EPD by animal birth year.**



years (1985 to 2007), the average birth weight (BW) EPD has gone from +1.2 to +2.3 pounds (lb.). During that same timeframe, the average yearling weight (YW) EPD has moved from +19 to +73 lb., an increase of 54 lb.

An accompanying consideration in weight discussions, the genetic trend for mature weight (MW) is creeping up as well, but not at the rate of yearling weight. Whether the plateau in recent years will hold has yet to be seen, with cow size affected in this area.

We field the occasional question implying that the EPDs have increased drastically, but the increases in the individual performance

data over time have not kept pace. Table 2 shows the Angus Herd Improvement Records (AHIR®) adjusted weights by birth year for bull calves during the last several years. Note that over that same period, adjusted birth weight has remained stable, while the average yearling weight submitted to AHIR over that same time has increased 169 lb. Genetic selection tools have enabled breeders to maintain birth weight in Angus cattle, while concurrently improving growth genetics in the breed.

The economics of the industry continue to emphasize the importance of calf performance, whether on the cow or in the feedlot, to make a profit. It's important to note that the 169-lb. increase includes management and environment and does not reflect only genetic progress. It's just a phenotypic trend to illustrate weight differences that breeders encounter.

### Balancing act

Another example of correlated traits that may not always provide a desirable effect in beef production is between yearling weight and mature size. Historically, as we selected for increased weaning weights and postweaning gain, we also pulled along extended growth curves and much larger mature weights.

Producers today have attempted to keep these strongly correlated traits in balance by selecting for superior growth and performance while also applying downward pressure on mature size. Some of the extreme environments and management schemes in which we raise cows demand females that will maintain and reproduce on limited resources. The enhancement of the mature weight (MW) and mature height (MH) EPDs through the expansion of the

mature cow weight database has accelerated the ability to identify Angus sires that can make impressive improvement in both of these traits.

So, when we talk about the balancing act a breeder must perform in designing cattle that can achieve high expectations for a number of traits, we see how complex this can become. Can we really find animals with moderate birth weights and phenomenal performance in a package that will produce moderate-sized mature females to fit in a production environment? The answer is yes. Consider Fig. 2, which combines the genetic trend for BW EPD, YW EPD and MW EPD.

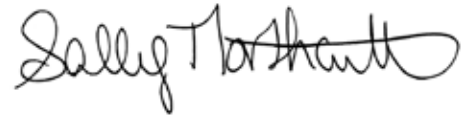
The trend lines for all three traits were on similar paths until about 1990. At that time, growth continued to be a highly sought commodity, but as the accurate tools became available, we also began applying pressure for moderating birth weight while maintaining reasonable mature cow size. The results are impressive and exciting for the Angus breed.

The trend for yearling weight remains in an upward slope, while both birth weight and mature size EPDs have leveled off over that time frame.

### Continuing to improve

We must continually enhance the selection tools available that allow us to characterize Angus genetics. As Angus breeders we need the means to continually make improvements

in our genetics. More importantly, our customer, the commercial cow-calf producer, is going to demand it. The continued selection for genetics with a focus on the improvement of economically relevant traits to the beef industry will continue to be top-of-mind for the progressive seedstock producer.



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**Editor's Note:** "By the Numbers" is a column by Association performance programs staff to share insights with Angus members about data collection and interpretation, the National Cattle Evaluation (NCE), genetic selection, and relevant technology and industry issues. If you have questions or would like to suggest a topic for a future column, contact Sally Northcutt, director of genetic research, or Bill Bowman, director of performance programs, at 816-383-5100.

**The fruits of these efforts now can be documented, in part, by the increase in percent of Choice cattle and Certified Angus Beef® (CAB®) acceptance rate.**

**Table 2: AHIR® average adjusted weights and measurements, by year**

Year	Birth bulls	Yearling bulls
1975	69	866
1980	74	922
1985	80	978
1990	83	1,066
1995	82	1,081
2000	81	1,112
2005	80	1,147
2006	80	1,145
2007	80	1,136
2008	80	1,147

**Table source:** Adapted from [www.angus.org/Nce/AHIRAvg.aspx](http://www.angus.org/Nce/AHIRAvg.aspx).

**Fig. 2: Fall 2009 Angus genetic trend for birth weight (BW), yearling weight (YW) and mature weight (MW) EPDs**

