AETA 2009 Survey Report

Introduction

Included in this report are survey data collected from the member embryo transfer business's (ETB's) of the American Embryo Transfer Association for 2009. This report represents a subset of the AETA membership and the embryo transfer industry in the USA.

ETB Data

A Map of the ETB's reporting data in 2009 are represented in Figure 1. When compared to 2008 there was a 10.6% decrease in reporting ETB's (Table 1) and a decrease in professional and support staff (Table 2: 2.8% and 12.5%, respectively). The addition of Louisiana, Mississippi, Massachusetts and South Carolina increase the number of states without a reporting ETB to 20 compared to 16 in 2008 (represented in yellow).

Figure1: Regional Map of ETB's

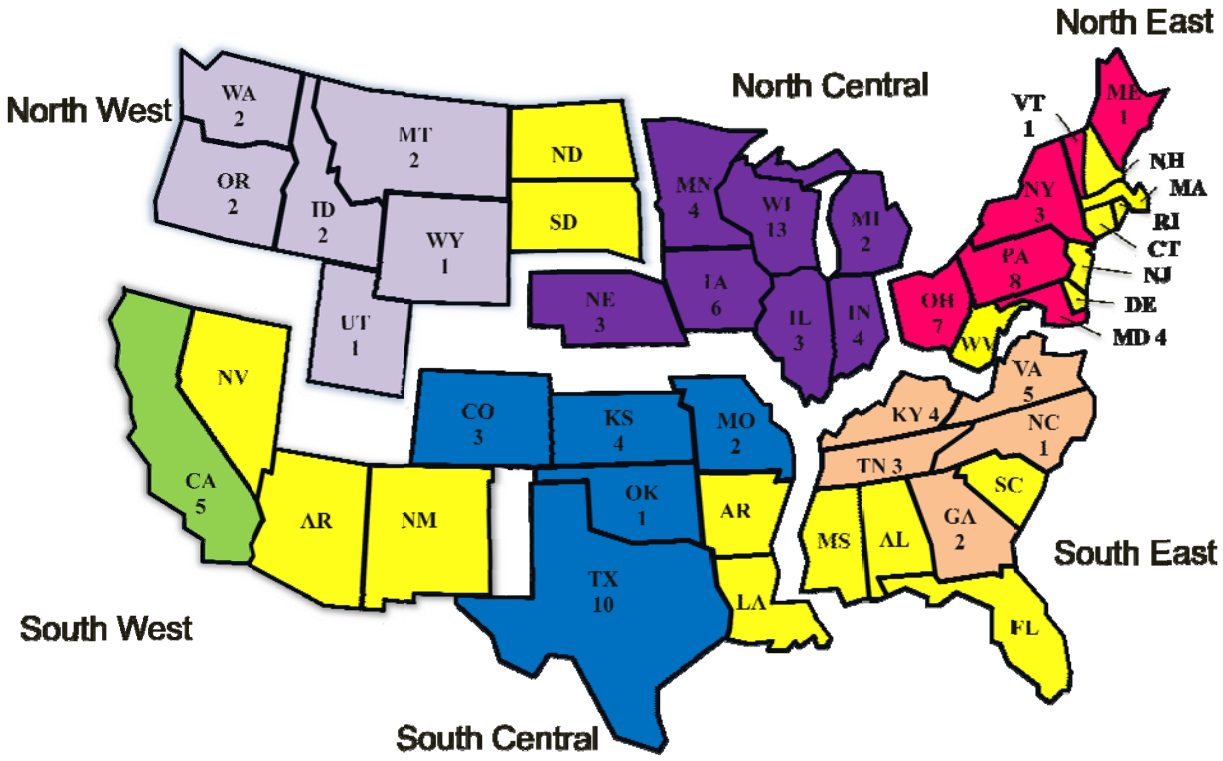

Table1: Number of ETB's					
Region	**2005**	**2006**	**2007**	**2008**	**2009**
North East	28	29	24 (3)	25	24 (1)
North Central	39	37	40 (5)	39 (1)	35
North West	15	14	13 (1)	14	10
South East	18	18	17	16 (1)	15
South Central	30	24	23 (3)	23	20
South West	4	4	4 (1)	4	3 (2)
Totals	**134**	**126**	**121 (13)**	**121 (2)**	**107 (3)**
Non-Certified ETB's in Parenthesis, Non-Certified ETB's not reported in 2005 and 2006.					

Table 2: Professional and Support Staff at ETB's					
Region	**Company's % ET**	**Professional Staff**	**Support Staff**	**Professional Staff / ETB**	**Support Staff / ETB**
North East	67%	26.5	19.2	1.1	0.8
North Central	63%	42.0	116.4	1.2	3.3
North West	75%	8.4	6.0	0.8	0.6
South East	68%	15.1	16.8	1.0	1.1
South Central	72%	21.3	39.8	1.1	2.0
South West	49%	6.6	2.5	1.3	0.5
	66%	119.9 -2.8%	200.7 -12.5%	1.1	1.4

Dairy Embryo Production Data

Non-stimulated collections from Dairy cows resulted in a recovery of 159 ova from 253 attemps and a recovery rate of 62.9%. From the 159 ova recovered only 48.4% were viable embryos (77 viable embryos). Therefore, non-stimulated collections result in a success rate of 30.4% or a failure rate of 69.6%. Non-stimulated collections were only 1.7% (253/14751) of the total collections reported and are not included in the stimulated collections data.

Total embryo production by region is reported in table 3. There was a 33% decrease in stimulated collections compared to 2008 data. As a result of the decrease in collections, there was also a decrease on the total number of viable embryos produced (-29%), embryos frozen (-32%), and total transfers (-23%) in 2009 compared to 2008. The South West region was the only region to have an increase in the number of transfers in 2009.

Table 3: Total embryo production by region in Dairy cows for 2009 [a]

	Collections	Viable [b]	Frozen	Fresh Transfers	Frozen Transfers	Total Transfers
North East	**5267** -28%	**29301** -23%	**15862** -23%	**13439** -23%	**8679** -16%	**22118** -20%
North Central	**6229** -35%	**39786** -31%	**24166** -35%	**15609** -24%	**14897** -23%	**30506** -24%
North West	**498** -38%	**3082** -34%	**1656** -31%	**1426** -36%	**1439** -13%	**2865** -26%
South East	**1535** -25%	**9683** -25%	**6511** -24%	**3172** -26%	**2211** -17%	**5383** -22%
South Central	**213** -60%	**1242** -57%	**689** -47%	**553** -64%	**559** -84%	**1112** -77%
South West	**756** -49%	**4074** -42%	**1776** -63%	**2298** +5%	**2583** +120%	**4881** +45%
Totals	**14498** -33%	**87168** -29%	**50660** -32%	**36497** -24%	**30368** -22%	**66865** -23%

[a] Data includes collections using both Traditional and sex-sorted semen and exclude non-stimulated collections in 2009 and % change from 2008.
[b] Viable embryos include both frozen and fresh transferred embryos.

Beef Embryo Production Data

Non-stimulated collections in Beef cows resulted in the recovery of 18 total ova from 29 attempts and a recovery rate of 62.1%. From the 18 total ova recovered 72.2% were viable embryos (13 viable embryos). Therefore, non-stimulated collections result in a success rate of 44.8% per collection or a failure rate of 55.2%. Non-stimulated collections were only 0.13% (29/22658) of the total collections reported and are not included in the stimulated collections data.

Data for beef embryo production in 2009 is presented in table 4. Similar to the dairy production, there was a decrease (-27%) in the total number of stimulated collections from 2008. As a results of the decrease in collections there was a concurrent decrease in viable embryos (-25%), embryos frozen (-23%), and total embryos transferred (-17%) in 2009 compared to 2008. In the

North East and South East region there was an increase in number of frozen embryos transferred (3 and 5%, respectively).

Table 4: Total embryo production by region in Beef cows for 2009 [a]

	Collections	Viable [b]	Frozen	Fresh Transfers	Frozen Transfers	Total Transfers
North East	**1511** -26%	**9859** -25%	**6969** -27%	**2890** -18%	**3694** +3%	**6584** -7%
North Central	**8435** -19%	**57849** -14%	**49237** -14%	**8612** -10%	**29038** -10%	**37650** -10%
North West	**1317** -46%	**9344** -40%	**7056** -39%	**2288** -44%	**5716** -22%	**8004** -30%
South East	**4212** -18%	**30520** -15%	**18998** -10%	**11522** -13%	**13149** +5%	**24671** -5%
South Central	**7111** -34%	**46790** -36%	**29679** -33%	**17111** -38%	**24893** -15%	**42004** -26%
South West	**43** -79%	**329** -78%	**213** -80%	**116** -72%	**330** -19%	**446** -46%
Totals	**22629** -27%	**154691** -25%	**112152** -23%	**42539** -27%	**76820** -10%	**119359** -17%

[a] Data includes collections using both Traditional and sex-sorted semen and exclude Non-stimulated collections in 2009 and % change from 2008.
[b] Viable embryos include both frozen and fresh transferred embryos.

Average Collection Data for Dairy and Beef

The average collection data was analysis using the GLM procedures of SAS and. A number of ETB's have service areas in multiple regions but only report their data in their home region. Therefore the effect of region was not statistically analyzes. Average collection data is reported in table 5 and percentage of total ova collected is shown in table 6. There was no significant breed type by semen type interactions, therefore only the main effects were analyzed. The only significant difference ($P<0.008$) between Dairy and Beef was in viable embryos (5.7 ± 0.2 vs 6.9 ± 0.2, respectively) when traditional semen was used for the collection. When collection data was evaluated as a percentage of total ova collected (table 6) there were not differences between dairy and beef. Therefore difference between semen type will be reported within breed type.

Dairy. In dairy collections, there was a significant increase ($P<0.001$) in the number of total ova collected when using sex-sorted semen (13.8 ± 1.0) compared to traditional semen (10.4 ± 0.3). This indicates that ETB's and/or clients are selecting donors that have a history of above average embryo production for use with sex-sorted semen. Sex-sorted semen compared to traditional semen in dairy results in a decrease ($P<0.001$) in viable embryos (4.0 ± 0.4 vs $5.7 \pm$

0.2) with an increase (P<0.001) in the degenerate embryos (3.0 ± 0.6 vs 1.6 ± 0.2) and unfertilized oocytes (6.8 ± 0.8 vs 3.1 ± 0.2, P<0.001) collected. When data is presented as a

Table 5: Average Collection results in Dairy and Beef in 2009

	Semen	Total Ova	Deg	UFO	Viable embryos	% Failed
Dairy	**Sex-Sorted**	13.8 ± 1.0 [a]	3.0 ± 0.6 [a]	6.8 ± 0.8 [a]	4.0 ± 0.4 [a]	19.7 ± 4.6
	Traditional	10.4 ± 0.3 [b]	1.6 ± 0.2 [b]	3.1 ± 0.2 [b]	5.7 ± 0.2 [b]	15.2 ± 2.7
Beef	**Sex-Sorted**	14.7 ± 2.3	3.0 ± 1.2	7.1 ± 1.2 [a]	4.5 ± 0.8 [a]	22.5 ± 5.9 [a]
	Traditional	12.4 ± 0.4	2.0 ± 0.3	3.5 ± 0.2 [b]	6.9 ± 0.2 [b]	10.1 ± 1.1 [b]

Least Square mean values (± se) with different letters within breed type and column are significantly different (P <0.001). Shaded Means are different (P<0.008) between breed types.

percentage of total ova collected, sex-sorted semen resulted in a decrease in the percentage of viable embryos (31.9% ± 2.7 vs 56.1% ± 1.5) with an increase in degenerate embryos (21.4% ± 2.9 vs 14.5% ± 1.1) and unfertilized oocytes (46.4% ± 4.0 vs 29.5% ± 1.2) recovered compared to traditional semen. Additionally, there was no increase (P>0.1) in the failure rate when using sex-sorted semen (19.7% ± 4.6) compared to tradition semen (15.2% ± 2.7). This could also indicate that donors are pre-selected based on collections history before sex-sorted semen is used.

Table 6: Percentage Degenerate, UFO and Viable embryos of total ova Collected in Dairy and Beef for 2009

	Semen	Deg	UFO	Viable embryos
Dairy	**Sex-Sorted**	21.4 ± 2.9% [a]	46.4 ± 4.0% [a]	31.9 ± 2.7% [a]
	Traditional	14.5 ± 1.1% [b]	29.5 ± 1.2% [b]	56.1 ± 1.5% [b]
Beef	**Sex-Sorted**	15.5 ± 2.6%	45.9 ± 5.2% [a]	38.6 ± 5.2% [a]
	Traditional	15.9 ± 1.6%	27.8 ± 1.4% [b]	56.3 ± 1.6% [b]

Least Square mean values (± se) with different letters within column are significantly different (P <0.001)

Beef. Unlike diary collections using sex-sorted semen, there was no significant increase in total ova collected (14.7 ± 2.3 vs. 12.4 ± 0.4) compared to traditional semen. This may indicate that other factors like availability of accepted sires may have more of an influence on the use of sex-sorted semen than a donor's flush history. Using sex-sorted semen in beef results in a decrease ($P<0.001$) in viable embryos (4.5 ± 0.8 vs 6.9 ± 0.2) with an increase ($P<0.001$) in unfertilized oocytes (7.1 ± 1.2 vs 3.5 ± 0.2, $P<0.001$) compared to traditional semen, but had no effect on degenerate embryos (3.0 ± 1.2 vs 2.0 ± 0.3). Data is presented as a percentage of total ova collected in Table 6. Sex-sorted semen resulted in a decrease in the percentage of viable embryos (38.6% ± 5.2 vs 56.3% ± 1.6) with an increase in unfertilized oocytes (45.9% ± 5.2 vs 27.8% ± 1.4) recovered compared to traditional semen. The decrease in viable embryos in beef resulted from a decrease in sex-sorted semen's ability to fertilize oocytes. Unlike dairy collections, there was an increase ($P<0.001$) in the failure rate in beef cattle when sex-sorted semen (22.5% ± 5.9) is used compared to traditional semen(10.1% ± 1.1). This could also indicate that factors other than a donor's flush history may affect the use of sex-sorted semen in beef cows.

Freezing Method

Data for different freezing methods are presented in table 7. Currently in the USA the majority of the embryos are prepared for direct transfer. Less than 5% of dairy and less than 1% of beef are frozen using 10% glycerol. Currently the technology using vitrification methods are not being used on commercial application in the USA.

Table 7: Freezing method

	DT	Glycerol	Vitrification	total
Dairy	**47866** 94.5%	**2339** 4.6%	**455** 0.9%	**50660**
Beef	**111447** 99.4%	**704** 0.6%	**1** >0.01%	**112152**

IVF Collection Data

In 2008, only 3 labs reported OPU collections, in 2009 there were an additional 2 labs reporting OPU collections (table 8). In addition, 7 different ETB's reported receiving fresh IVF produced embryos from an established IVF lab for transfer. The number of OPU sessions increase in by 87.6% in dairy cows but decreased (-15.9%) in beef cows compared to 2008. There was a 22.3% increase in the total number of transferable embryos produced. Although the data was not statically analyzed do to low number of reporting Labs, both dairy and beef had similar average number of oocytes collected (16.5) and transferable embryos (3.5) produces.

Table 8: IVF Collection data in 2009 [a]					
	Total			Per OPU	
	OPU	Oocytes	Transferable Embryos	Oocytes	Transferable Embryos
Dairy	2287 (+87.6%)	38632	7579	16.9	3.3
Beef	2598 (-15.9%)	41873	9417	16.1	3.6
	4885 (+13.4%)	80505	16996 (+22.3%)	16.5	3.5 (+8.4%)
[a] % Change from 2008 in parenthesis when reported.					

Other Species

Only 5 ETB's reported embryo transfer work in other species (table 9). This should represent only a very small number of the total embryo transfer work in the USA in other species.

Table 9: Total embryo production in Other Species for 2009					
	ETB's	Collections	Viable [a]	Frozen	Fresh Transfers
Equine	3	185	146 0.79	78	68
Ovine	1	128	934 7.8	49	885
Caprine	2	4	15 3.8	15	0
[a] Total Viable and Average per recovery					

Export in 2009

The number of beef and dairy embryos exported from the USA are list by country in table 10. There was a decrease in the total number of beef (-57.7%) and dairy (-24.4%) embryos exported compared to 2008. Export of dairy embryos was highest to Japan, and Australia had the highest beef embryo exports. Japan, Germany, Australia, China and Netherlands were the five highest importing countries.

Table 10: Number of Embryos exported per country

Country	Beef	Dairy	Total
Argentina	121	115	236
Australia [3]	773	284	1057
Austria	10	61	71
Brazil	373	296	669
Canada	261	430	691
China [4]	199	830	1029
Columbia	98	44	142
Costa Rica	175	19	194
Czech Republic	0	4	4
Denmark	0	4	4
England	10	55	65
Ethiopia	0	35	35
Finland	34	97	131
France	0	219	219
Germany [2]	110	1083	1193
Holland	0	183	183
Iran	0	22	22
Ireland	8	390	398
Italy	0	187	187
Japan [1]	0	1311	1311
Mexico	194	32	226
Netherlands	0	759	759
New Zealand	30	0	30
Pakistan	0	72	72
Panama	126	0	126
Paraguay	61	0	61
Poland	0	134	134
Scotland	0	0	0
South Africa	11	101	112
Spain	0	99	99
Sweden	0	17	17
Switzerland	0	252	252
Taiwan	0	30	30
Thailand	47	0	47
Turkey	16	0	16
United Kingdom	145	193	338
Total	2681 -51.7%	7358 -24.4%	10039 -34.3%

Summary

Overall summary of the embryo transfer industry in the USA showed a decline in most categories compared to 2008.

Dairy data

The number of collections in Dairy cows in 2008 and 2009

Region	2008			2009		
	Single	Sex-Sorted Semen	Traditional semen	Single	Sex-Sorted Semen	Traditional semen
North East	**122** 46.4%	**372** 72.0%	**6939** 32.6%	**98** 41.7%	**107** 30.0%	**5160** 36.5%
North Central	**117** 44.5%	**65** 12.6%	**9545** 44.9%	**122** 52.0%	**179** 49.6%	**6050** 42.8%
North West	**11** 4.2%	**20** 3.9%	**782** 3.7%	**9** 3.8%	**13** 3.6%	**485** 3.4%
South East	**2** 0.8%	**54** 10.4%	**1981** 9.3%	**1** 0.4%	**47** 13.0%	**1488** 10.5%
South Central	**4** 1.5%	**6** 1.2%	**531** 2.5%	**5** 2.1%	**10** 2.8%	**203** 1.4%
South West	**7** 2.7%	**0** 0%	**1474** 6.9%	**0** 0.0%	**5** 1.4%	**751** 5.3%
Totals	**263**	**517**	**21252**	**235**	**361**	**14137**

The number of collections in Dairy cows in 2009

Region	Sex-Sorted Semen			Traditional semen		
	Total	% of year	% change	Total	% of year	% change

North East	107	30.0%	-71.2%	5160	36.5%	-25.6%
North Central	179	49.6%	+175.4%	6050	42.8%	-36.6%
North West	13	3.6%	-35.0%	485	3.4%	-38.0%
South East	47	13.0%	-13.0%	1488	10.5%	-24.9%
South Central	10	2.8%	+66.7%	203	1.4%	-61.8%
South West	5	1.4%	+500%	751	5.3%	-49.0%
Totals	**361**		**-30.2%**	**14137**		**-33.5%**

Viable embryos Collected in Dairy cows in 2009

Region	**Sex-Sorted Semen**			**Traditional semen**		
	Total	**% of year**	**% change**	**Total**	**% of year**	**% change**
North East	328	24.0%	-77.6%	28973	33.8%	-20.7%
North Central	669	49.1%	+87.9%	39117	45.6%	-30.6%
North West	83	6.1%	0.0%	2999	3.5%	-34.6%
South East	206	15.1%	+19.8%	9477	11.0%	-25.6%
South Central	35	2.6%	+59.1%	1207	1.4%	-58.2%
South West	43	3.1%	+430.0%	4031	4.74%	-42.7%
Totals	**1364**		**-35.0%**	**85804**		**-29.1%**

Beef data

The number of collections in Beef cows in 2008 and 2009						
Region	**2008**			**2009**		
	Single	**Sex-Sorted Semen**	**Traditional Semen**	**Single**	**Sex-Sorted Semen**	**Traditional Semen**
North East	**0** 0.0%	**2** 0.4%	**2027** 6.7%	**18** 62.1%	**5** 1.2%	**1506** 6.8%
North Central	**8** 34.8%	**485** 90.8%	**9909** 32.5%	**7** 24.1%	**344** 84.1%	**8091** 36.5%
North West	**10** 43.5%	**9** 1.7%	**2444** 8.0%	**0** 0.0%	**5** 1.2%	**1285** 5.8%
South East	**3** 13.0%	**27** 5.1%	**5091** 16.7%	**1** 3.5%	**0** 0.0%	**4180** 18.8%
South Central	**2** 8.7%	**11** 2.1%	**10828** 35.5%	**3** 10.3%	**23** 5.6%	**7088** 31.9%
South West	**0** 0.0%	**0** 0.0%	**200** 0.7%	**0** 0.0%	**32** 7.8%	**43** 0.2%
Totals	**23**	**534**	**30499**	**29**	**409**	**22193**

Collections data in Beef cows in 2009						
Region	**Sex-Sorted Semen**			**Traditional semen**		
	Total	**% of year**	**% change**	**Total**	**% of year**	**% change**
North East	5	1.2%	+150%	1506	6.8%	-25.7%
North Central	344	84.1%	-29.1%	8091	36.5%	-18.4%
North West	5	1.2%	-44.4%	1285	5.8%	-47.42%
South East	32	7.8%	+18.5%	4180	18.8%	-17.9%
South Central	23	5.6%	+109.1%	7088	31.9%	-34.5%
South West	0	--	--	43	0.2%	+78.5%
Totals	**409**		**-23.4%**	**22193**		**-27.2%**

Viable embryos Collected in Beef cows in 2009

Region	Sex-Sorted Semen			Traditional semen		
	Total	**% of year**	**% change**	**Total**	**% of year**	**% change**
North East	8	0.4%	+14.3%	9851	6.5%	-24.9%
North Central	1941	87.5%	-31.2%	55908	36.7%	-13.1%
North West	19	0.9%	-75.3%	9258	6.1%	-40.4%
South East	86	3.9%	+10.3%	30434	20.0%	-14.7%
South Central	164	7.4%	+396.7%	46626	30.6%	-35.9%
South West	0	--	--	329	0.2%	-77.8%
Totals	**2218**		**-35.0%**	**152406**		**-19.8%**