

IETS 2012 Statistics and Data Retrieval Committee Report

The year 2011 worldwide statistics of embryo transfer in domestic farm animals

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Summary: 2011 global *in vivo* bovine embryo transfers remain stable, while *in vitro* transfers increased for the sixth consecutive year.

The year 2012 represents the 21st consecutive year that the International Embryo Transfer Society's (IETS) Statistics and Data Retrieval Committee has global embryo transfer (ET) statistics to report. This report is composed of global ET activity from January 1, through December 31st, 2011.

Although the number of bovine flushes were up by almost 13% in 2011 the number of transferrable *In vivo* derived (IVD) embryos collected/flushed worldwide remained constant compared to the data reported in 2010. The world-wide tally of 732,862 IVD embryos collected in 2011 compared closely to the 732,000 embryos recovered in 2010. However, the number of bovine IVD embryos transferred into recipients was down by 3.1% (590,561 in 2010 and 572,342 in 2011). The decline in transfers was primarily seen in Asia, N America and S America. Oceania, reported increases in the number of IVD embryos transferred. Globally, the number of frozen bovine IVD embryos transferred outnumbered fresh transfers by 71,612 (309,806 frozen to 238,194 fresh). The trend towards more frozen transfers than fresh has been consistent since the mid 1990's.

Worldwide, there were 70,490 beef donors flushed, and 47,638 dairy donors flushed. These numbers are slightly inaccurate due to the fact that the European bovine ET data was not separated into beef and dairy. For the purpose of this publication the European continent data was assumed to be split evenly between beef and dairy donors.

The total number of transferrable bovine *in vitro* produced (IVP) embryos worldwide was 453,471 in 2011 compared to 450,541 in 2010. This represents an increase, albeit slight, in global IVP production for the 6th consecutive year. South America, primarily Brazil, again leads the world of IVP production and transfers. The total number of IVP embryos transferred worldwide in 2011 was 373,836 which is an increase of 10% from 2010 (339,685). Brazil alone was responsible for 318,119 (85%) of the world's IVP transfers in 2011.

Worldwide, including *in vivo* and *in vitro* fresh and frozen, there were 69,157 fewer bovine embryos transferred in 2011 (921,836) as compared to 990,993 in 2010.

Global equine ET activity remained constant in 2011. The number of reported flushes (40,833) was down by 819 (41,652 in 2010). The number of transfers (28,661) was down by only 163. Brazil and Argentina led the way in mares flushed with 16,800 and 11,824 respectively. The US and Australia reported no change in flush numbers for the 2011 calendar year.

Small ruminant embryo production in 2011 dropped by 13,429 embryos (40%) from 2010 (33,153 embryos). Consequently, the number of embryo transfers decreased by 75% from 2010 to 2011. Australia was again the leader in ovine embryo production and transfers. Worldwide there were 91 swine donors flushed producing 1567 embryos. A small number of cervid embryos (52) were reported for the 2011 calendar year.

If all species listed in this publication are considered including *in vivo* and *in vitro* production, there were 1,230,773 embryos collected worldwide in 2011. That is 12,727 less than in 2010.

Also, all species included, there were 1,005,952 embryos transferred into recipients worldwide in the 2011 calendar year. That is up 15,270 from 990,682 transferred the previous year.

Introduction

The goal of the IETS Statistics and Data Retrieval Committee is to collect and report accurate *in vivo* and *in vitro* bovine, equine, swine, and small ruminant embryo collection/flush and transfer statistics from every ET practitioner in every geographical area of the world. Collecting data is a great challenge each year for everyone involved including ET practitioners.

Countries that are members of regional ET societies or associations i.e., the American Embryo Transfer Association (AETA), the European Embryo Transfer Association (AETE), the Canadian Embryo Transfer Association (CETA), and the Society of Brazilian Embryo Technology (SBTE) to name a few, are well organized and have established collection protocols that make reporting consistent from year-to-year. However, many countries do not have associations and data collectors in those countries must call on the ET practitioners that they know personally to provide them with data. This requires a tremendous amount of effort on behalf of the regional data collectors. In some countries only a small percentage, or sometimes none, of the practitioners are contacted about submitting their annual ET statistics. Certainly, much of the ET that is performed worldwide is not included in this report. Also, it is not easy to collect all the data from countries that are members of ET associations. For example, in the US most ET practitioners are members of the AETA, but only the certified members are required to submit their production data each year. Non-certified members usually do not submit information because they are not required to do so. Plus, there are a number of practitioners in the US that are not members of the AETA. There is no organized method to communicate with that segment of the industry. With current collection protocols it is estimated that only 60% of the

US data is actually reported to the IETS each year. However, efforts are on-going to improve the system of collecting ET data to provide the industry with more complete and accurate numbers. Europe, who is very punctual with their data submission to the committee, received data from 134 of 198 known ET teams. One third of their practitioners submitted no data at all.

Currently, ET data is collected by country and organized by continent. See Table 1A and 1B for a list of continents and their basic ET data for 2011 and 2010 respectively. There is a map of each continent (see Maps) with countries color coded yellow that submitted data by a resident practitioner or team for the 2011 calendar year. Countries that are colored light blue had ET activity reported by a practitioner from another country in the 2011 season. White or non-colored countries did not report any ET activity nor did a non-resident ET practitioner report activity in those countries. Also, tables 7-12 of this document displays the names of regional collectors and their respective countries so that new or existing ET teams in those areas know who to contact to submit data in the future.

This year's report includes a retrospective comparison of bovine ET data going back two decades to illustrate how the ET industry has evolved (refer to Tables 1A, 1C, and 1D).

1. Report of bovine *In Vivo* derived embryos in 2011

The reported number of flushes/collections was up by almost 13% in 2011 (see Table 1A). All continents except Africa reported gains, while S America remained steady in the number of bovine flushes. But, the number of *IVD* embryos transferred into recipients decreased by 3.1% worldwide (Table 1A). Frozen embryo transfers again gained ground from the previous year with an 8.4% increase over 2010. Overall, *IVD* embryo production and transfer numbers remained constant with the percentage of frozen embryos transferred continuing to climb while fresh transfers gradually decline each year (see Table 3 Fresh vs. frozen transfers 2011).

Table 1A. Bovine *In Vivo* Derived Embryo Activity in 2011

CONTINENTS	Flushes	Transferrable Embryos	Number of Transferred Embryos			
			FRESH	FROZEN	TOTAL & PERCENTAGE	
AFRICA	1,438	9,401	4,056	2,469	6,525	1.14%
ASIA	15,444	124,362	24,026	51,697	75,723	13.23%
EUROPE	23,480	108,712	41,040	69,381	110,421	19.29%
N. AMERICA	54,837	362,781	109,197	139,418	248,615	43.44%
S. AMERICA	12,174	68,187	36,953	26,054	63,007	11.01%
OCEANIA	10,755	59,419	32,921	35,130	68,051	11.52%
2011 Totals	118,128	732,862	248,193	324,149	572,342	100.00%
2010 Totals	104,651	732,000	243,885	291,279	590,561	

Per Cent Change	12.88%	0.12%	1.77%	11.28%	-3.09%	
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Table 1B. Bovine *In Vivo* Derived Embryo Activity in 2010

CONTINENTS	Flushes	Transferrable Embryos	Number of Transferred Embryos			
			FRESH	FROZEN	TOTAL & PERCENTAGE	
AFRICA	1,515	9,738	4,685	3,730	8,415	1.42%
ASIA	12,986	131,718	34,148	53,590	87,738	14.86%
EUROPE	17,694	117,813	48,555	60,859	109,414	18.53%
N. AMERICA	51,735	338,540	106,400	147,271	253,671	42.95%
S. AMERICA	12,263	77,643	47,353	24,205	71,558	12.12%
OCEANIA	8,458	56,775	21,895	37,870	59,765	10.12%
TOTAL	104,651	732,227	263,036	327,525	590,561	100.00%
2009 Totals	103,851	702,358	243,495	290,605	534,100	
Change	+0.77%	+4.25%	+8.03%	+12.70%	+10.57%	

A retrospective analysis of Table 1 comparing 2011 data (Table 1A) to 1991 (Table 1C) and 2001 (Table 1D) indicates how the ET industry has grown and continent ET percentages have changed from ten and twenty years ago. It also illustrates how the committee and its members have evolved with their ability to collect data. From 1991 until 2011 almost all continents have increased their number of flushes and transfers with the exception of Europe. In 1991 Europe reported approximately 25,000 flushes/collections, and 23,500 in 2011. That could be somewhat misleading in that their data collection was extremely efficient relative to other countries in the early days of this committee's activities. In 1991 Europe reported 48% of the world's bovine embryo transfers, but dropped to about 20% in both 2001 and 2011. North America, who currently leads the world in IVD embryo transfers did not report the number of embryos collected in 1991. These charts are interesting to see the geographical evolution of both applied science and data collecting ability over the past two decades.

Table 1C. Bovine *In Vivo* Derived Embryo Activity in 1991

CONTINENTS	Flushes	Transferrable Embryos	Number of Transferred Embryos			
			FRESH	FROZEN	TOTAL & PERCENTAGE	
AFRICA	489	2,337	NA	NA	1,918	0.80%
ASIA	2,111	9,285	NA	NA	22,299	9.26%
EUROPE	24,982	123,275	NA	NA	115,685	48.06%

N. AMERICA	22,594	NA	NA	NA	88,246	36.66%
S. AMERICA	2,556	11,847	NA	NA	12,582	5.23%
OCEANIA	NA	NA	NA	NA	NA	
1991 Totals	52,732	146,744	NA	NA	240,730	100.00%

Table 1D. Bovine *In Vivo* Derived Embryo Activity in 2001

CONTINENTS	Flushes	Transferrable Embryos	Number of Transferred Embryos			
			FRESH	FROZEN	TOTAL & PERCENTAGE	
AFRICA	929	5,218	2,284	2,142	4,426	0.99%
ASIA	10,440	80,521	14,703	39,574	54,277	12.08%
EUROPE	19,594	109,698	44,890	49,713	94,603	21.06%
N. AMERICA	55,981	315,628	110,619	111,082	221,701	49.36%
S. AMERICA	11,007	53,610	47,655	10,034	57,689	12.84%
OCEANIA	3,340	15,402	7,927	8,523	16,450	3.66%
2001 Totals	101,291	580,077	228,078	221,068	449,146	100.00%

Africa's (M de la Rey) bovine embryo flush numbers were down slightly from 1515 in 2010 to 1438 in 2011. There was also a decline of almost 2000 *IVD* embryos transferred in 2011. As in previous years, the majority of Africa's ET data is generated from the Republic of South Africa. This is the first year in the last three that Botswana and Zimbabwe failed to report any ET activity.

Asia's ET data is thought to be grossly underreported due to China's lack of national organization. There seems to be no central base from which to monitor ET activity there. Embryo activities seem to be generated at the provincial level with little or no organization nationally. The committee does have a data collector (Zhu Shien) for China, but there was no data submission for the second year in-a-row from him. The only data coming from China in 2011 was 1,196 dairy embryos imported from the US. For the second time in as many years Sun-Ho CHOI has reported ET activity from Korea. He reported 102 dairy flushes in 2011 compared to 67 a year ago, and 312 beef flushes which were down from 679 in 2010. Almost 9000 *IVD* bovine embryos were transferred in Korea in 2010, but only 729 in 2011. There was no explanation as to the cause of such a significant decline. Thailand's ET activity was stable in 2011. He reported 41 dairy flushes in 2010, but only 29 in 2011. Beef donor activity was also down slightly for Thailand – 80 flushes in 2011 vs. 85 in 2010. From a combined 109 flushes came 656 transferrable embryos. A total of 81 *IVD* embryos were transferred in Thailand in 2011 compared to 728 the year before. Again, no comment accompanied the data for why a sharp decline in transfers. Although there is not a Russian representative on the committee,

Wehrman from the US reported exporting 83 beef and 701 dairy embryos to Russia in 2011. Japan (Dochi) continues to dominate Asia in the amount of bovine ET performed in that continent. They have reported increases in the number of *IVD* flushes for the third consecutive year; 10,924 in 2009, 11,611 in 2010, and now 14,982 in 2011. The ratio of beef to dairy embryo production is about 6:1 respectively. Based on reported data Asia is responsible for transferring 13.8% of the world's *in vivo* derived embryos.

Europe (collector H Knijn), a continent of 47 countries, had 25 countries that reported data for 2011. That's up from 21 in 2010. As always, they are very thorough and prompt with their data reporting. The number of flushes in 2011 (23,480) was up 32% (5,786) from 2010 (17,694). Annually, Europe was responsible for transferring 19% of the world's *IVD* embryos. Table 2 illustrates a few shifts among countries in Europe relative to the volume of embryos transferred. Some of the countries in Europe do not provide breed information, so comparing dairy and beef is not possible. France and The Netherlands consistently find themselves to be the top two European countries reporting ET data. Overall, Europe had a healthy increase in ET activity in 2011 compared to 2009 and 2010. Historically, this report has included a table (see Table 2) of the top 12 European countries listed in order by the number of *IVD* embryos transferred for the last year. The only change in the chart is marked by the addition of Norway and removal of the Czech Republic.

Table 2. The top twelve European countries ranked by number of *In Vivo* derived embryos transferred in 2011 (AETE, 2011).

Country	Number of Flushes	Number Embs Transferred	
France	5665	29232	→
Netherlands	4045	21006	↗
Germany	2215	14676	↗
UK	5186	13976	↗
Italy	2103	12619	↗
Belgium	1022	5119	↗
Finland	418	4033	↘
Switzerland	533	2958	↗
Norway	6	2958	↗
Spain	626	2662	↗
Ireland	420	1653	↘
Denmark	447	1504	↘

↘ denotes decrease from previous year. ↗ denotes increase over previous year.

Table 3 Fresh vs. Frozen Bovine Transfers 2011

CONTINENTS	Number of Transferred Embryos			
	FRESH	FROZEN	TOTAL & PERCENTAGE	
AFRICA	4056	2469	6525	1.14%
ASIA	24026	51697	75723	13.23%
EUROPE	41040	69381	110421	19.29%
N. AMERICA	109197	139418	248615	43.44%
S. AMERICA	36953	26054	63007	11.01%
OCEANIA	32921	35130	68051	11.89%
TOTAL	248193	324149	572342	

Overall, the number of flushes reported by North America (Wehrman) was up by 6% (from 51,735 in 2010 to 54,837 in 2011). Although the number of transferrable *IVD* embryos collected was up by 7% in 2011, the total number of *IVD* embryos transferred by was down by 5,056 (-2%). S Romo from Mexico reported a significant increase in the total number of flushes from 2010 (197) to 2011 (576). That's an increase of nearly 200%. There were no notes from Romo as to the reasons, but perhaps it was increased reporting from all the practitioners? There were 73 dairy and 503 beef flushes in 2011 in Mexico. As for *IVD* embryos transferred in 2011 there were only 3,029 as opposed to 4041 transferred in 2010. Canada (R Mapletoft) reported nearly identical *IVD* flush numbers from 2010 to 2011 (12,969 to 12,956 flushes respectively). Canada flushed more dairy cows (10,852) than beef (2,117) in 2011, which is normal for them. Canadian *IVD* transfer data were very similar in 2010 and 2011 (55,136 and 53,779 respectively). The US (M Wehrman) was up slightly in the number of flushes reported in 2011. Beef and dairy combined there were 41,171 total flushes compared to 38,552 in 2010. However, the number of *IVD* transfers (190,125) in 2011 decreased from 194,794 in 2010. N America (Canada, Mexico, and US) continues to dominate the percentage (43.4%) of global bovine *IVD* embryos transferred.

South America only had four countries reporting data by an in-country data collector for 2011; Argentina, Brazil, Panama, and Uruguay. Columbia had no ET activity in 2011 from bovine or equine. Ecuador, who contributed data last year, had no in-country data to report, but the US exported embryos there. The US also exported embryos to the Dominican Republic, Costa Rica, Nicaragua, Paraguay, and St Martinique. Peru reported some flushing in 2010, but no ET activity in 2011. The other S American country collectors are G Bo from Argentina (bovine), L Losinno from Argentina (equine), J Viana (bovine) and M Alvarenga (equine) from Brazil, L Nassar from Panama, and P Bañalás from Uruguay. For the S American continent Bo reported no change in

the number of flushes from 2010 to 2011 (12,263 and 12,174 respectively), but a substantial 13.5% decrease in the number of *IVD* embryos transferred into recipients (from 71,558 in 2010 to 63,007 in 2011). The most likely reason for such a sharp decline is a shift to transferring more *in vitro produced* embryos. S America transferred 11% of the world's *in vivo* derived embryos in 2011. As for the number of *IVD* embryos transferred the reporting S American countries are ranked in order from first to last for data reported in 2011: 1) Brazil/35,563, 2) Argentina/24,361, 3) Uruguay/2296 and Panama for back-to-back years only reported *In vitro* produced embryo data.

Oceania (R Pashen/Australia and R Linwood/N Zealand) reported an increase in the number of flushes (10,755 in 2011 vs.8454 in 2010). Also, the number of embryos transferred increased substantially from 2010 (59,765) to 2011 (68,051). In prior years data from Oceania has been underreported. NZ has been unable to get data from a high percentage of the 12 known ET teams there, but R Linwood collected data from eight of them in 2011. As discussed in last year's committee report Australia is not well organized between the veterinarians and non-veterinarians, which makes it extremely difficult, if not impossible, to gather stats from the latter group.

Globally, more frozen *in vivo* derived embryos were transferred in 2011 than fresh embryos (324,149 and 248,193 respectively). That statistic held true for every continent except South America where more fresh embryos were transferred than frozen (36,953 fresh and 26,054 frozen). That could be due to the large population of recipients there.

The top five countries (table 4) outside N America and Europe had a change in 2011. Although S Africa reported a few more flushes than New Zealand in 2011 they were edged out in the number of *IVD* transfers, 7707 for N Zealand and 6,489 for S Africa.

Table 4. The Top Five Countries Outside Europe and North America in 2011 (based on number of bovine *in vivo* embryos transferred)

Country	Number of Flushes	Number Bovine Embryos Transferred
Japan	14,982	72,100
Australia	8,138	60,344
Brazil	5,193	35,563
Argentina	6,011	24,097
N Zealand	1,205	7,707

2. Report of bovine *In Vitro* produced embryos in 2011

Globally (see Table 5), the number of *in vitro* produced (*IVP*) embryos was up slightly (less than 1%) from a year ago (453,471 in 2011 and 450,549 in 2010). S America was responsible for 325,349 of those embryos. Brazil, the clear global leader in *IVP* embryos produced 318,116 (86% of the world's total) in 2011 compared to 264,263 embryos in 2010. Brazilian ET practitioners transferred 318,119 *IVP* embryos in 2011) compared to 264,262 in 2010. That is a 20% increase in the last year. Brazil reports transferring more frozen *IVP* embryos each year. In 2010 J Viana reported 12,214 frozen *IVP* transfers and 15,546 in 2011. Panama (Nasser) continues to be aggressive producing 6,282 *IVP* embryos in 2011. That number is over double the 2905 *IVP* embryos reported in 2010. Nasser reported 3,756 fresh transfers and 325 frozen. Uruguay was the third leading S American country with 926 *IVP* embryos, which were about 100 more than in 2010. Argentina reported only 25 *IVP* embryos produced in 2011, which was a significant reduction from 2010. Asia reported 62,418 *IVP* embryos produced in 2011 compared to 117,000 in 2010. That's more than a 80% drop in production for the continent. This will be explained later. Japan (Dochi) was responsible for 61,480 of those embryos compared to 68,000 in 2010 (9% decline). Korea (CHOI), who in 2010 reported over 48,000 *IVP* embryos produced only reported producing 577 *IVP* embryos in 2011. He only reported the OPU embryos produced and not the abattoir production. He did report transferring 1408 frozen and 2703 fresh *IVP* transfers in 2011 (4111 total transfers). This is confusing because he reported only 577 embryos produced in 2011. But, he did not report the abattoir embryos produced in 2011, so that number is unknown. It's possible that since Korea had such a frozen inventory that they limited *IVP* production in 2011? Thailand (R Parnpai) showed some *IVP* activity producing 61 *IVP* embryos in 2011. Thirty-four of those were transferred fresh. That is stable from the 59 embryos reported in 2010. N America made 48,474 *IVP* embryos compared to 43,000 in 2010 which is a 12.7% increase in production. The US reported 40,602 *IVP* embryos produced in 2011 compared to 35,000 embryos in 2010. Canada produced 5,176 *IVP* embryos in 2011 which was down from 7600 in 2010. Mexico reported 2693 *IVP* produced in 2011 compared to 481 in 2010. These data placed N America in third place worldwide behind S America and Asia with 10.7% of the global production. The number of *in vitro* produced embryos transferred worldwide also showed a healthy 10% increase from 340,000 in 2010 to 373,869 in 2011.

Continents	Transferrable Embryos	Number of Transferred Embryos			TOTAL & PERCENTAGE
		FRESH	FROZEN		
AFRICA	0	0	0	0	0.00%
ASIA	62,418	4,086	6,699	10,785	2.88%
EUROPE (8 cts)	8,034	8,034	3,419	11,453	3.06%
N. AMERICA	48,474	17,850	2,930	20,780	5.56%

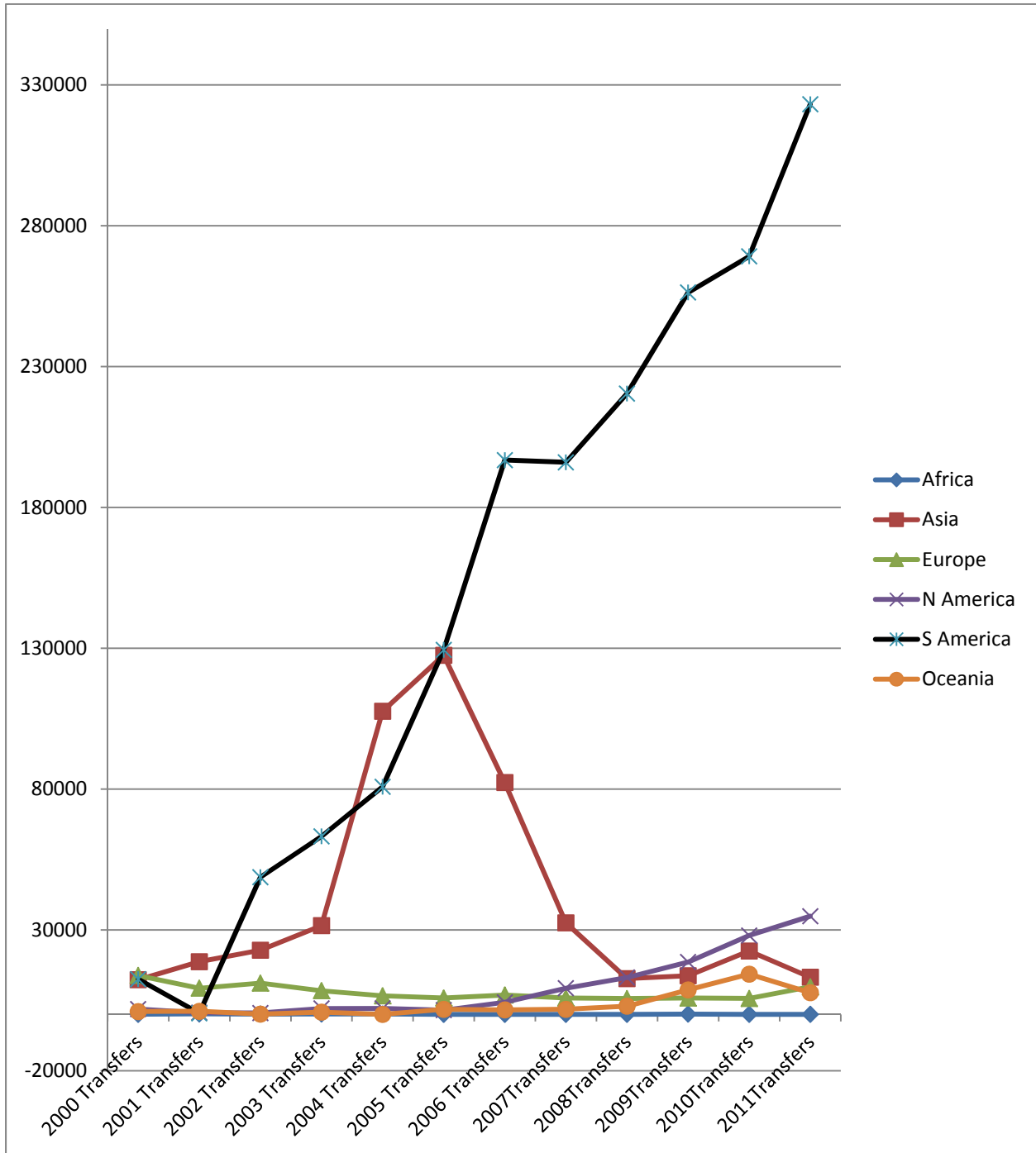
S. AMERICA	325,349	307,278	15,879	323,157	86.44%
OCEANIA	9,196	6,679	1,015	7,694	2.06%
TOTAL	453,471	343,927	29,942	373,869	100.00%
2010 Totals	450,549	315,715	23,970	339,685	
Per Cent Change	0.65%	8.94%	24.91%	10.06%	

Chart 1 compares the number of *IVD* to the number of *IVP* produced embryos transferred annually worldwide since the year 2000. The lines continue to evolve towards convergence. However, Chart 2 illustrates that most of the *in vitro* production is coming from South America, mainly Brazil. The chart clearly shows that S America continues at a high rate to utilize *IVP* technology. Chart 2 looks as if the US may be trending steadily upward for the last few years, but by no means is challenging Brazil for the global share of *IVP* production. The rest of the world looks stable with the activity of *IVP* embryos.

Chart 1. Comparison of the number of in vivo and in vitro embryos transferred annually since 2000.



Chart 2. The trends of in vitro produced embryos transferred by continents since 2000



The trend in 2011 was to continue to transfer mostly fresh *IVP* embryos instead of frozen, but the percentage of frozen transfers is creeping upwards. Data from Table 5 indicates that worldwide 8% of the *IVP* embryos transferred in 2011 were frozen compared to 7% in 2010.

IVP embryo production is growing geographically throughout the world. Africa was the only continent that failed to report any embryos produced *in vitro*. Japan, Korea, and Thailand all reported *IVP* embryos from Asia. In Europe five of the twenty-five countries reporting produced *IVP* embryos; France, Germany, The Netherlands, Italy, and Turkey. The Netherlands led for the second consecutive year with 3814 embryos produced (2863 a year ago) followed by Germany with 3217. As for the number of *IVP* embryos transferred into recipients in Europe eight countries reported data compared to seven in 2010. The Netherlands topped the 2011 list by transferring 3269 *IVP* embryos compared to 2593 in 2010. Germany was second with 1619 transfers (1481 in 2010). Ireland was third having transferred 1653 *IVP* embryos. From fourth through ninth in order was; Italy (832), France (515), Portugal (66), Belgium (59), Turkey (56), and Switzerland (24). Most of those European countries had increases in the number of *IVP* embryos transferred in 2011. In N America all three countries again reported *IVP* embryo production and transfers. The US produced 40,602 *IVP* embryos which was an increase from 34,969 in 2010. In 2011 the US reported 30,427 *IVP* transfers compared to 26,742 in 2010. That represented a 15% increase in one year. Canada reported a decline in the number of *IVP* produced. They went from 7608 *IVP* embryos in 2010 to 5176 in 2011. Of those 5176 embryos 3000 were made from abattoir derived oocytes. They also transferred 1618 *IVP* embryos in 2011, which was up from 850 in 2010. Mexico was also active on the *IVP* front producing 2693 embryos in 2011 of which 596 were abattoir derived. They also transferred 2730 *IVP* embryos in 2011. A noteworthy stat is that Mexico imported and transferred 37 frozen *IVP* embryos. There was no mention of the origin of those embryos. From S America, Argentina, Brazil, Panama, and Uruguay all reported *IVP* activity in 2011. Brazil dominated the *IVP* production by performing 53,019 OPU sessions averaging 15 oocytes and 6 embryos per session. That equates to 318,116 transferrable embryos produced in 2011. Panama was second in S American *IVP* production with 6282 embryos. Uruguay was third producing 926 embryos and Argentina fourth with only 25 embryos reported. As for *IVP* embryos transferred the order was the same. Brazil transferred 318,119 *IVP* embryos, Panama 4081, Uruguay 924, and Argentina had 33 transfers in 2011. From Oceania Australia reported 4760 *IVP* embryos which was down substantially from 2010 (12,000). New Zealand increased their *IVP* production from 3012 in 2010 to 4436 embryos in 2011. Those 4436 embryos represent 41% of the total embryo production for N Zealand combining *IVP* and *IVD* production.

It does appear that the data in this report indicates that *in vitro* embryo production is fast approaching that of *in vivo*. However, Brazil alone produces 86% of the world's *IVP* embryos. Table 6 shows the top ten *IVP* countries based on the number of *IVP* transfers in 2011.

Table 6. Top 10 Countries ranked by number of *In Vitro* transfers in 2011

Country	Number embryos produced	Number embryos transferred
Brazil	318,116	318,119
US	40,602	30,427
Japan	61,780	9,021
Australia	4760	4,935
Korea	577	4,111
Panama	6282	4,081
The Netherlands	3,814	3,269
N Zealand	4,436	2,934
Mexico	2693	2,693
Canada	5176	1,707

The reported total number of bovine *In Vivo* Derived and *In Vitro* Produced embryos transferred in 2011 worldwide was 936,660 which was an increase of 5727 transfers from the 2010 total of 930,993. That is a modest 0.6% increase over the 2010 data.

3. The overall activity of ET in other species in 2011

In this report, statistics are recorded for three species of small ruminants; sheep, goats, and deer. The reported number of viable sheep embryos flushed in 2011 (19,724 embryos) was 40% less than the 32,614 reported in 2010 (see Table 7). Ovine embryo transfers were also down in 2011 compared to 2010 (13,819 and 29,078 respectfully). The following countries reported transferring sheep embryos in 2011; Australia (11,000), N Zealand (2458), Mexico (1272), S Africa (760), Argentina (1139), Uruguay (505), Canada 146, Turkey 216, Hungary (68), Czech Republic (16), UK (13), Bosnia & Herzegovina (2), Sweden (67), Chile (10), and the US (40).

Table 7. Small ruminant ET activity in 2011

Species	Transferrable Embryos	Number of Transferred Embryos		
		FRESH	FROZEN	TOTALS
Sheep Total	16,573	13,383	436	13,819
Goat Total	3,099	2,157	0	2,157
Cervids Total	52	52	0	52
2011 Totals	19,724	15,592	436	16,028
2010 Totals	33,153	28,099	2,696	63,948
Per Cent	-40.51%	-	-83.83%	-74.94%

Decline

	44.51%		
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Caprine ET activity was up in 2011. Countries reporting the number of transfers were Australia leading the pack with 815. New Zealand was second with 757. Mexico was just behind with 603 transfers followed by the US with 30. A total of 2157 goat embryos were reported as transferred worldwide in 2011. Caprine ET work in the US is grossly underreported.

Only two countries reported cervid embryo transfers in 2011 – Canada with 45 transfers and N Zealand with 7 transfers.

The total number of global **equine flushes** (Table 8) decreased slightly from 41,652 in 2010 to 40,833 in 2011. However, it must be noted that the US did not report collection data for the second consecutive year, so their data is estimated to be the same as 2010 and 2009. The equine data collector (P McCue) for the US has been dealing with a catastrophic fire that burned the Colorado State University equine breeding facility which has robbed him of time to devote to the task. Based on embryos transferred the top three countries that performed equine transfers in 2011 are Brazil (13,600), Argentina (7500), and the US (6100) in that order assuming the US data is close to accurate. Brazil increased its flush numbers by about 1600 in 2011, and Argentina declined by 831. Canada was up from 42 mares flushed in 2010 to 73 in 2011. Mexico reported 11 flushes and 8 transfers in 2011. Uruguay did report 3 mares flushed, but no transfers. Those embryos were exported. From Oceania N Zealand reported 50 flushes and 50 transfers (all fresh). Australia reported 1356 flushes and 950 transfers in 2011. Europe reported 385 equine flushes in 2010, but an increase to 556 in 2011. Europe reported 1216 flushes three years ago (2008). France was the European leader in 2011 with 376 equine embryo transfers followed by Italy with 168, and the UK with 110 transfers. Hungary and Portugal transferred 5 and 8 embryos respectively. For the second consecutive year there was no equine activity reported from Asia. Africa had no equine data to report in 2011. The only country to report frozen equine transfers in 2011 was Brazil with 25 transfers.

Table 8. Equine ET Activity in 2011

COUNTRIES	Flushes	Transferrable Embryos	Number of Transferred Embryos			
			FRESH	FROZEN	TOTAL & PERCENTAGE	
ARGENTINA	11824	7390	7500	0	7500	26.19%
BRAZIL	16800	13600	13575	25	13600	47.49%
URUGUAY	3	2	2	0	2	0.01%
CANADA	73	46	46	0	46	0.16%
EUROPE	694	694	110	0	110	0.38%
NEW ZEALAND	50	40	40	0	40	0.14%
AUSTRALIA	1600	1230	1230	0	1230	4.30%
MEXICO	11	8	8	0	8	0.03%
USA	9916	6122	6100	0	6100	21.30%
2011 Totals	40833	29132	28611	25	28636	100.00%
2010 Totals	41652	27497	27077	1747	28824	

There was no swine ET activity reported in 2010, but the committee has swine data for 2011. Ireland led the world in swine ET with 17 flushes and 518 transfers. This work was performed by Canadian practitioners and reported by Mapletoft. Canada also reported 36 flushes and 479 transfers within their borders. The Republic of Korea reported 384 fresh transfers in 2011. It's unclear if swine ET activity is actually up or the data is finally being reported. This committee is in need of regional data collectors of swine ET data.

4. Exports

Exports represent a very important function for the committee, the IETS, and cattle breeders throughout the world. These data represent a culmination of science and commerce allowing for the movement of animal germ plasm free of pathogens from continent to continent and country to country.

Worldwide there were 21,681 dairy exports in 2011 (19,878 in 2010) which is a 10% increase. As for beef cattle there were 18,189 embryos exported in 2011 compared to 16,819 in 2010, which is an 8% increase. The largest exporter, including all species, was Australia. R Pashen reported 570 dairy, 6570 beef, and 11,000 sheep embryo exports for a total of 16,250 embryos. The US was second reporting 15,586 total exports. All of those were bovine divided by dairy (10,510) and beef (5,076). Canada exported 10,079 dairy and 3658 beef embryos (total 13,737). Canada also reported 37 ovine embryo exports in 2011. New Zealand was very active on the export front. Linwood reported 495 *IVD* bovine exports (196 dairy and 299 beef) in addition to

143 *IVP* bovine embryos. She also reported 195 ovine and 78 caprine exports. All species totaled N Zealand exported 911 embryos in 2011. Uruguay also reported 50 ovine embryo exports. It appears that sheep embryos are beginning to move internationally. In 2011 there were 13,163 ovine exports worldwide compared to 2744 in 2010. There caprine exports remained stable with 534 exports in 2011 vs. 621 exported in 2010. S Africa (de la Rey) exported 753 beef embryos in 2010, but only 409 in 2011. S Africa also exported 1744 sheep and 456 caprine embryos in 2011. All species combined they were busy exporting 2212 embryos in 2011. Argentina (Bo) reported export activity in 2011. He recorded 197 dairy and 2417 beef embryos exported, but no small ruminant activity. Uruguay (Banales) also moved some embryos across their borders; 129 dairy and 169 beef *IVD* embryos plus an additional 2700 *IVP* bovine embryo exports. Also they exported 50 sheep embryos which give them a total of 3048 exports in 2011. Neither Asia nor Europe reported any embryo exports in 2009, 2010, or 2011. Considering all species there were 56,735 total embryos exported in 2011. That's up from 40,062 in 2010

5. Global maps of ET activity

For a quick visual reference, maps of continents/regions have been created to indicate those countries that reported ET activity in 2010. Yellow means that the country has a regional data collector and actually reported ET activity by a practitioner from within the country. Light blue means the country had ET activity performed but reported by an ET team from a different country in 2011.

Definition of regions: the main regions/continents of the world are, in alphabetical order Africa, Asia, Europe, North America, Oceania, and South America. For the purposes of this report North America consists of Canada, Mexico, and the United States. South America also includes countries of Central America, and the Caribbean Islands.

The Americas, other than Central America, along with Europe and Oceania are global regions that are largely represented by ET activity. However, Asia is likely underrepresented probably because of the lack of organization by the member countries. Hopefully, this report and the maps herein will entice cattle breeders, ET technicians, and intergovernmental organization officials like FAO/UN, World Animal Health Organization - OIE serving in those countries that are not currently reporting ET activity to contact the IETS and volunteer their time to collect data from other practitioners in their areas. **Not being a reporting (yellow) country could be costing those countries commercial opportunities since this report is available to breed associations, livestock breeders, embryo transfer organizations, government health organizations, and veterinarians worldwide who could be seeking to do business with countries already involved in embryo transfer.**



Africa lost 2 countries (Botswana and Zimbabwe) in 2011.



Asia changed its colors in 2011 by adding India as a blue country. Thailand and Korea has their own regional collectors, so they are now yellow along with Japan just like in 2010. China and Russia remained blue by importing embryos from the US. India now has a regional data collector (A Misra), but he was unable to acquire any ET data this year. We strongly encourage those countries to get their own regional/country data collector to begin reporting to the IETS annually.



Europe gained three yellow countries in 2011; Austria, Romania, and Sweden.

South America



In

2011 South America lost the following yellow countries; Ecuador, Columbia, and Peru. However, they gained these blue countries; Dominican Republic, Paraguay, Ecuador, Costa Rica, St Martinique, and Nicaragua.

Oceania



Oceania remained stable with both Australia and New Zealand reporting data again for 2011.

6. Countries and their regional data collectors in table format

Tables 10 – 15 are included in this report as a reference to continents and their regional and local data collectors. Anyone wishing to contribute ET stats in these geographical areas can contact these collectors through the IETS at www.iets.org.

Table 10

African Countries (53)	ET Activity	Collector
	Kenya	M. de la Rey
	Namibia	M. de la Rey
	Rep S Africa	M. de la Rey

3 of 53 countries reported ET data in 2011

Table 11

ASIA (44)	ET Activity	Collector
	China	Wehrman
	Japan	Dochi
	Korea	Sun Ho CHOI
	Russia	Wehrman
	Thailand	R. Parnpai

5 of 44 Asian countries reported ET activity in 2011.

Table 12**Europe 25 of 47 Countries Reported in 2011**

Country	Country Collector
Austria	Dr. G Wetchy
Belgium	Drs. P Vercauteren
Bosnia & Herzegovina	Dr. T Markovic
Croatia	Dr. M Matkovic
Czech Republic	Dr. P Bucek
Denmark	Dr. Henrik Callesen
Estonia	Dr J Kurykin
Finland	Dr. Marja Mikkola
France	Dr. C Ponsart
Germany	Dr. H Cramer
Greece	Dr. S Foteini
Hungary	Dr. F Flink
Ireland	Dr. P Lonergan
Israel	Dr. A Shiffmanr
Italy	Dr. G Lazzari
Luxembourg	Dr. J Westphal
Netherlands	Dr. JG Derksen
Norway	Dr. E Kummen
Poland	Dr. J Jaskowski
Portugal	Dr. J Chagas e Silva
Romania	Dr. S Zamfirescu
Spain	Dr. J de la Fuente
Sweden	Dr. A Tidstrom
Switzerland	Dr. R Saner
Turkey	Prof. E Emsen
UK	Dr. A Meacock

Table 13

N America (3)	ET Activity	Collector
	Canada	R Mapleoft
	Mexico	S Romo
	United States	M Wehrman

3 of 3 countries reported in 2011

Table 14

S America (12)	ET Activity	Collector
	Argentina	G Bo bovine L Losinno equine
	Bahamas	L Nassar
	Brazil	M Alvarenga equine Joao H M Viana bovine
	Dominican Rep	Wehrman
	Ecuador	Wehrman
	Peru	R Mancheno
	Uruguay	P Bañales
	St Martinique	Wehrman

8 of 12 countries reported in 2011

Table 15

Oceania (14)	ET Activity	Collector
	Australia	R Pashen
2 of 14 countries reported in 2011	New Zealand	R Linwood

7. New ET Technologies

This is a new section for the committee. We don't ask our data collectors to report this data, at least at this point in time, but perhaps affirmative in the future. It gives readers some insight into the future of applied embryo technologies.

The first technology would be the use of sex sorted sperm for superovulated cows. The US (Wehrman) reported 587 beef flushes that produced a mean of 4.6 transferrable embryos per flush compared to non-sorted flushes (6.8 embryos). The US also reported 483 dairy donor flushes with sorted semen. The result was a mean of 4.1 embryos per flush (6.3 non-sorted). Manipulated (bisected or biopsied) data was also provided by the US, Canada, and Europe. Mapletoft from Canada reported the most numbers of split and biopsied embryos in 2011. Canadian practitioners transferred 1244 demi (split) embryos, plus 3865 biopsied embryos for sex determination. He also reported 253 biopsied for genetic testing and 5 for diagnostic testing. The US reported 643 biopsied and 164 bisected beef embryos, plus 222 biopsied and

336 bisected dairy embryos in 2011. Europe (Knijn) reported that France biopsied 160 embryos for sex determination and The Netherlands biopsied 269 embryos for genotyping.).

Late ovine data from Australia: After this report was written R Pashen sent late sheep ET data from a large ET group in that country. The data is as follows; 6000 flushes, 34,500 transfers, and 2000 frozen embryo exports all done in 2011. There was not enough time to incorporate this data with what had already been included in the report. To do so would have required a complete rewrite of the report. This data is in addition to what is included in this report.

8. Conclusion

The ET data included in this reports suggests that the ET industry is growing and healthy on a worldwide scale. As always some country's data is up and others are down, but fortunately most are up from a year ago. Anyone reading this report should take into consideration that it does not include every country's statistics, and very few, if any, country has 100% of its activity represented.

9. Acknowledgments

The chairman would like to publically thank all the regional and country collectors that spend a considerable portion of their personal time each year calling and emailing their fellow practitioners for all their data. Their names are listed in this report, some multiple times. For 21 consecutive years the data has been gathered, assimilated, and published for the world to see. The data is extremely important for governmental agencies, academic institutions, and those involved directly in the commercial animal industry to see how widespread the use of applied reproductive biotechnologies is progressing worldwide from year-to-year. As far as the committee chairman is concerned this will be his last written report. It's time for someone else to carry the torch for the committee and the IETS. It has been an honor to serve the industry that has provided so much for my family and me. Lastly, the author would like to thank Dr. Michel Thibier, the author's predecessor and mentor, for his help editing this report for accuracy and completeness. Good bye.