Recent trends in mastitis and fertility indicators in the United States and reasons for change

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Mastitis indicators

Source: Dairy Herd Management

Source: Purdue Dairy Clipart

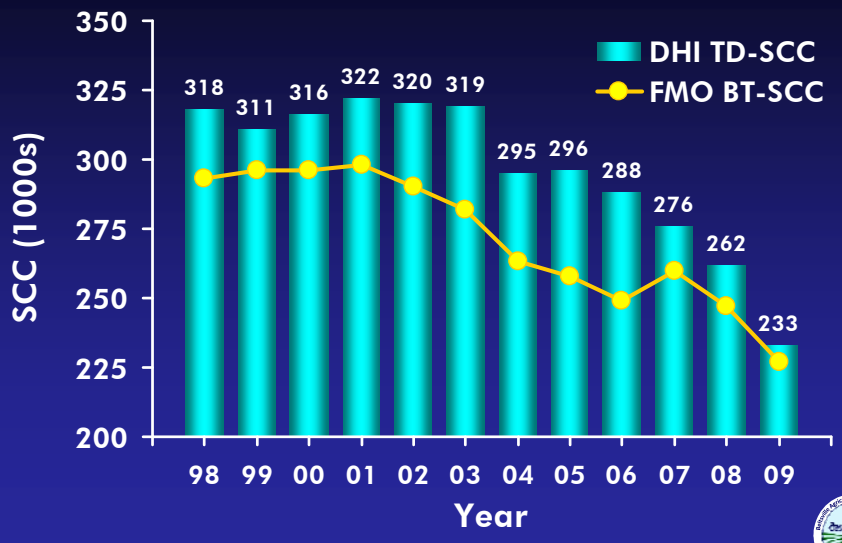
International BT-SCC limits

Country/group	Limit (cells/ml)
Australia	400,000
Canada	500,000
European Union	400,000
New Zealand	400,000
Norway	400,000
Switzerland	400,000
United States	750,000
California	600,000

U.S. milk quality measures

- Bulk tank somatic cell count (BT-SCC)
  - Monitored by U.S. Department of Agriculture
  - Data from 4 of 10 Federal Milk Marketing Orders (FMO)
  - Accounts for nearly 50% of US milk supply
- Herd test-day somatic cell count (TD-SCC)
  - Herds in Dairy Herd Improvement (DHI) somatic cell testing
  - Accounts for 97% of US DHI herds

U.S. SCC (all breeds)



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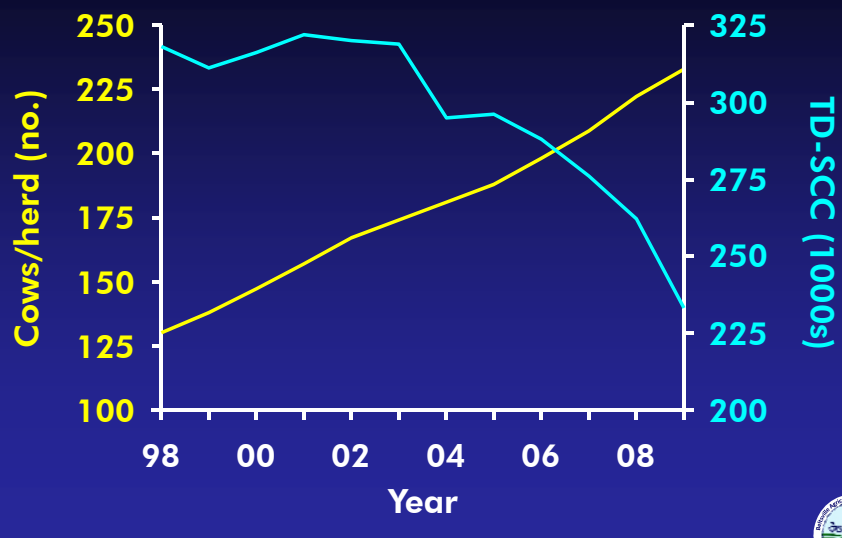
U.S. herd size and SCC



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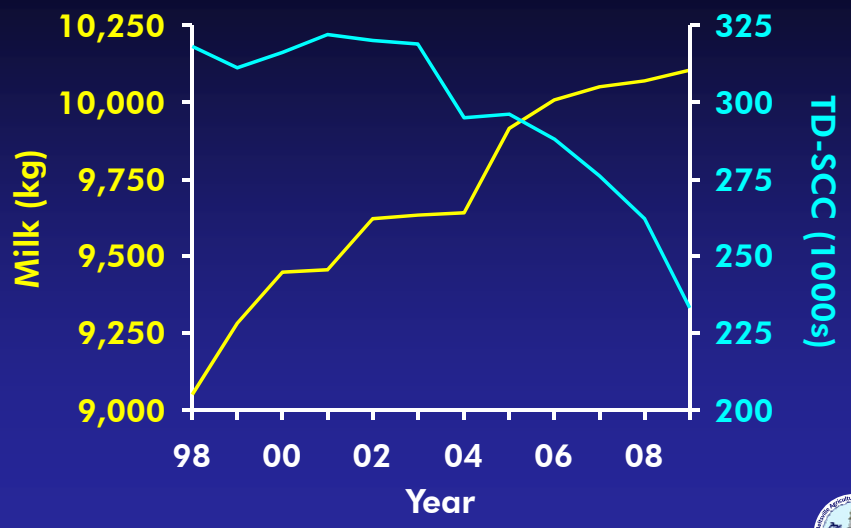
U.S. herd milk yield and SCC



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Somatic cell score (SCS)

- SCS used by U.S. DHI as a mastitis indicator
  - Simplicity
  - Desirable statistical properties (nearly normal distribution)
- Conversion equations
  - $SCS = \log_2(SCC/100{,}000) + 3$
  - $SCC = 2^{(SCS - 3)}(100{,}000)$

SCS	SCC (cells/ml)
0	12,500
1	25,000
2	50,000
3	100,000
4	200,000
5	400,000
6	800,000
7	1,600,000
8	3,200,000
9	6,400,000

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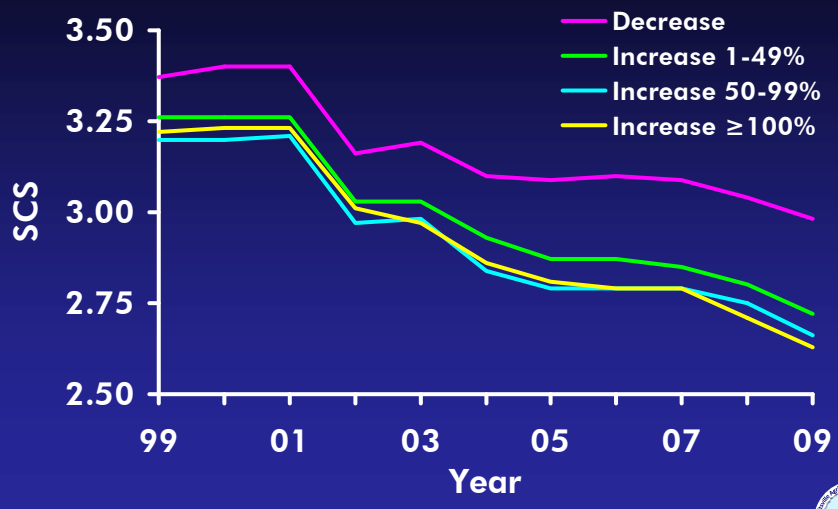
SCS and change in herd size



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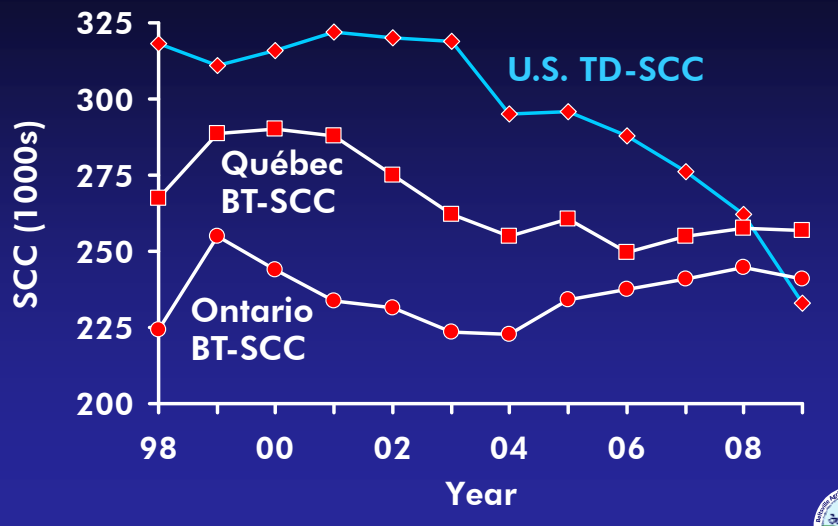
U.S. and Canadian SCC



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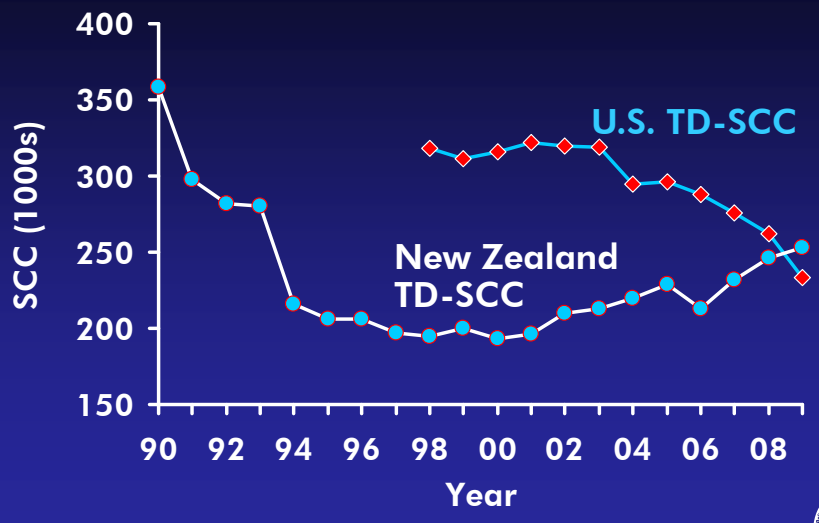
U.S. and New Zealand SCC



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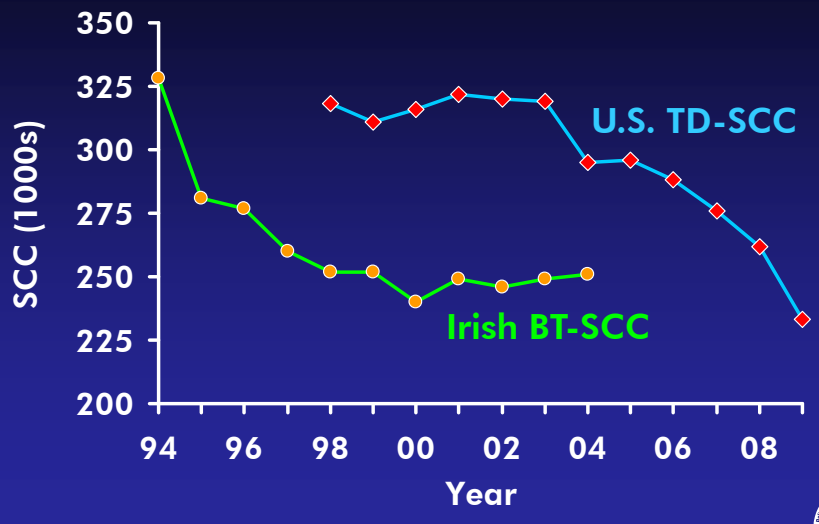
U.S. and Irish SCC



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German SCC

"No increase or decrease in SCC for German Holsteins across time"

– Reinhard Reents
(personal communication, 2010)

U.S. versus E.U. SCC monitoring

Program characteristic	U.S.	E.U.
SCC sample	Individual farm	Individual farm
BT-SCC limit	750,000 cells/ml	400,000 cells/ml
Value used	Consecutive monthly BT-SCC	Geometric mean of 3 monthly BT-SCC
Producer suspension	3 of 5 consecutive samples over limit	2 consecutive 3-month means over limit

Export concerns

- E.U. change in SCC sampling point from bulk truck or plant silo to individual farm (October 1, 2010, enforcement)
- 3-month mean (E.U.) used as single reference for period, which allows more time to reduce future SCC
- Geometric mean (E.U.) mathematically lower than arithmetic mean (U.S.) and requires recalculation

Geometric versus arithmetic means

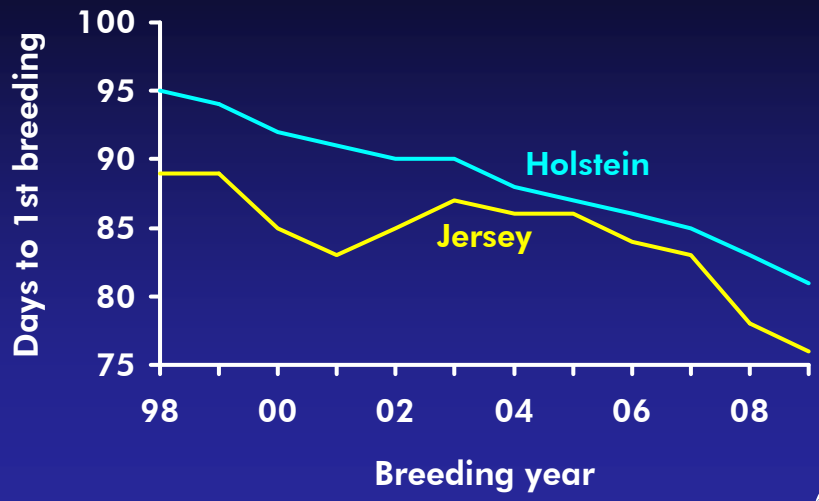
	SCC (cells/ml)	
	Example 1	Example 2
Month 1	400,000	300,000
Month 2	500,000	400,000
Month 3	600,000	700,000
Arithmetic mean	500,000	467,000
Geometric mean	493,000	438,000

Fertility indicators

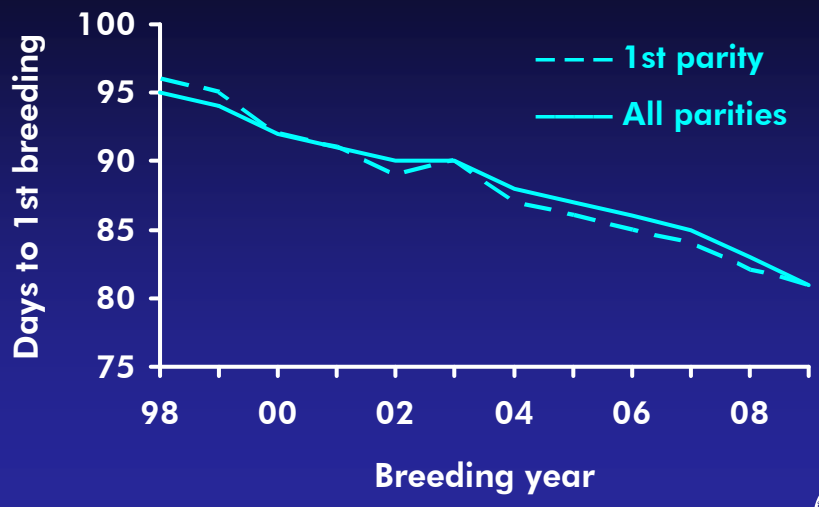
Source: BBC (Louise Cassidy)

Source: English Guernsey Cattle Society

U.S. days to 1st breeding



U.S. Holstein days to 1st breeding



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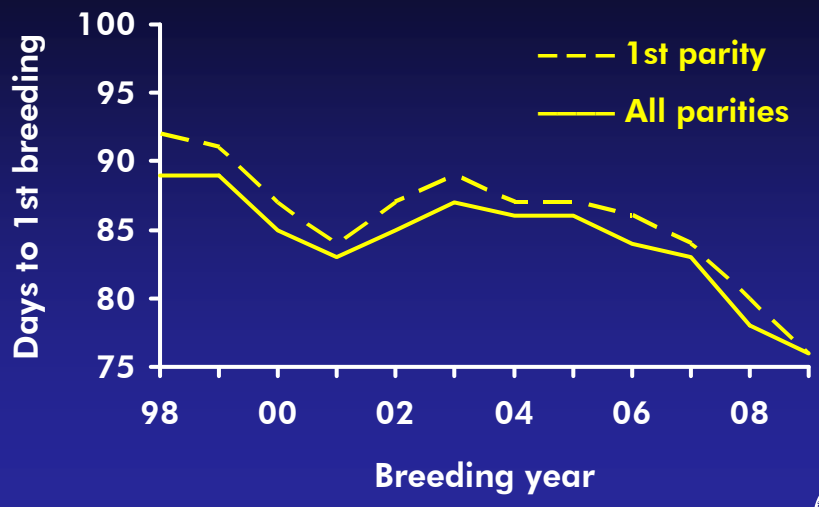
U.S. Jersey days to 1st breeding



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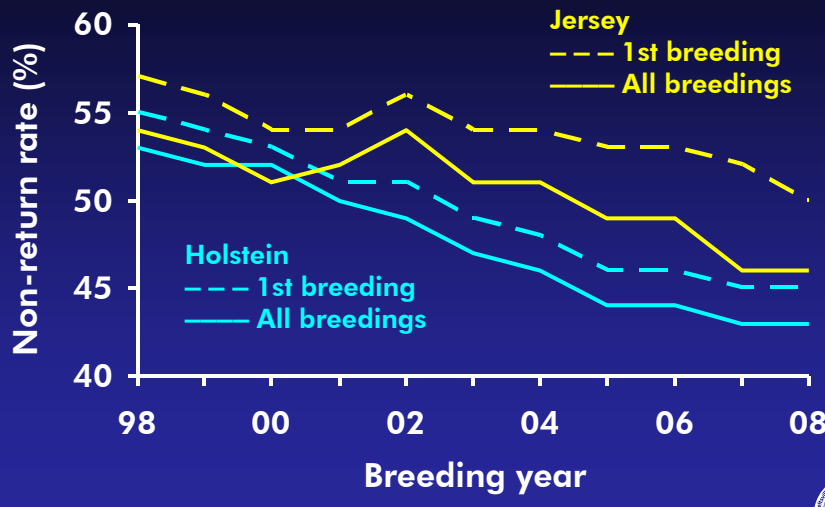
U.S. non-return rates (70 days)



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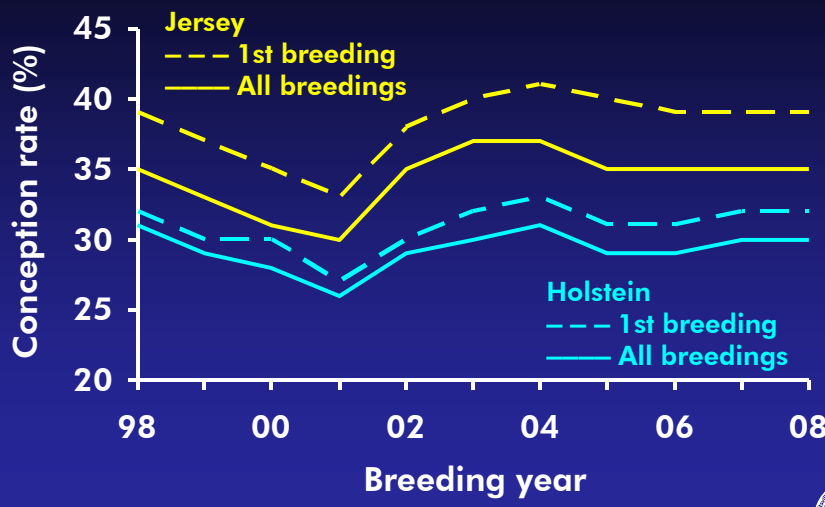
U.S. conception rates



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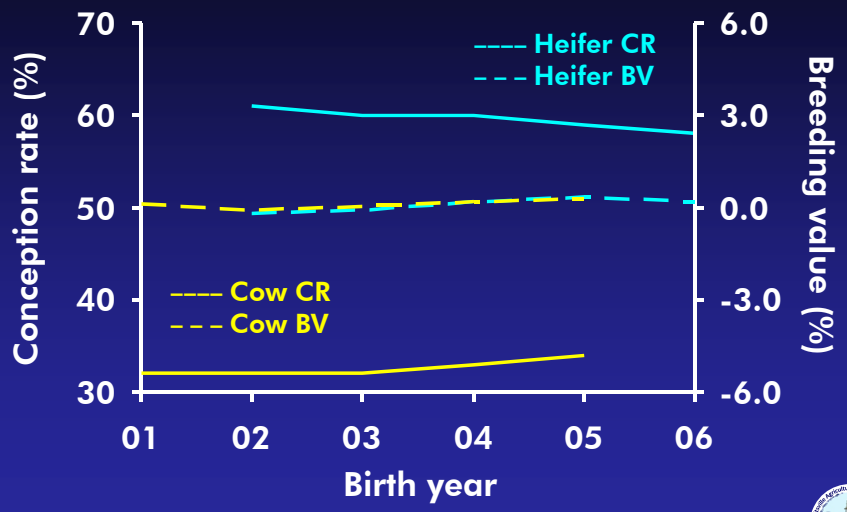
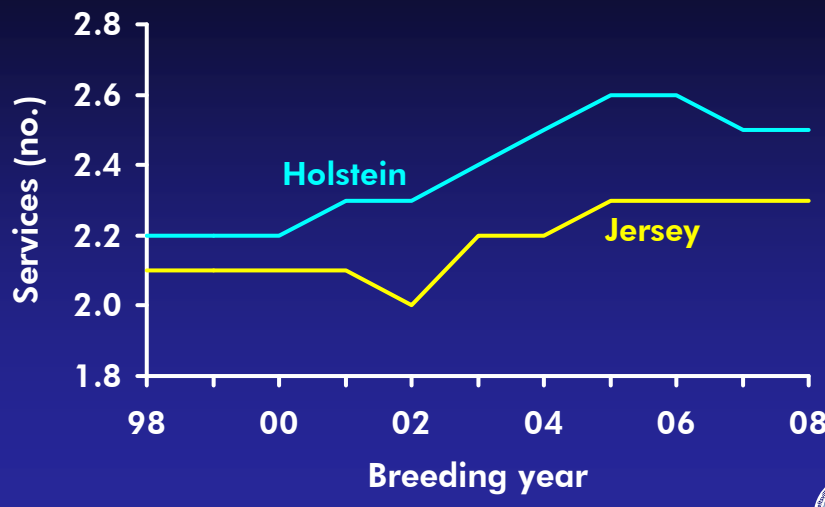
U.S. heifer and cow conception rates

- Genetic evaluations implemented
  - Bulls – January 2009
  - Cows – August 2010
- Single-trait BLUP evaluation within breed
- Data
  - Calvings during 2003 or later
  - Parities 1–5
  - Services 1–7
  - Age: Heifers 1 to <2.2 years
    Cows ≥2 years

U.S. Holstein conception rates



U.S. numbers of services



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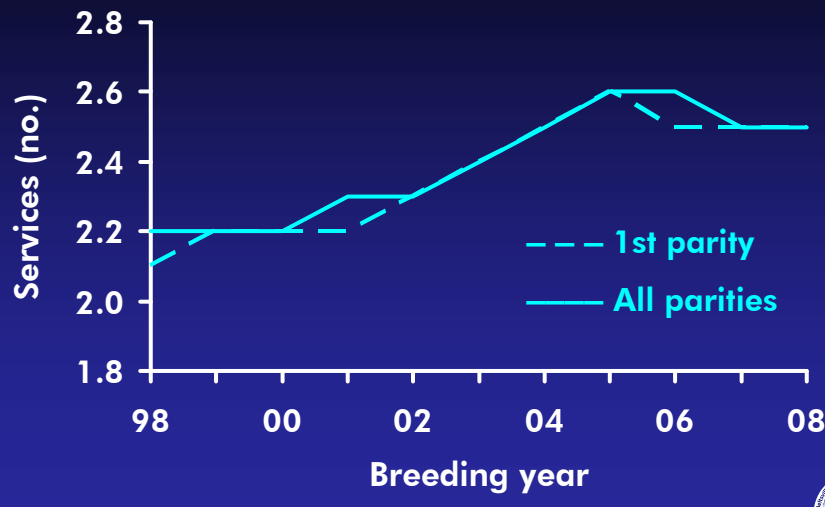
U.S. Holstein numbers of services



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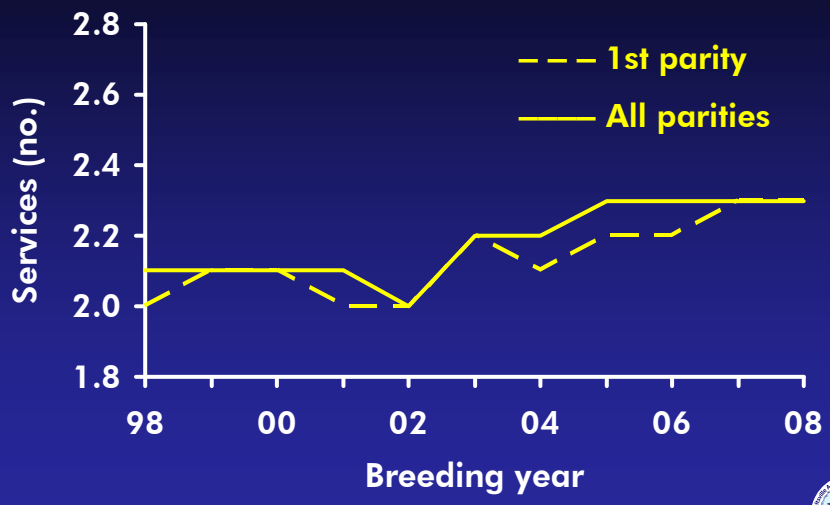
U.S. Jersey numbers of services



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Pregnancy rate

- Allows herd managers to measure how quickly their cows become pregnant again after having a calf
- Defined as percentage of nonpregnant cows that become pregnant during each 21-day period

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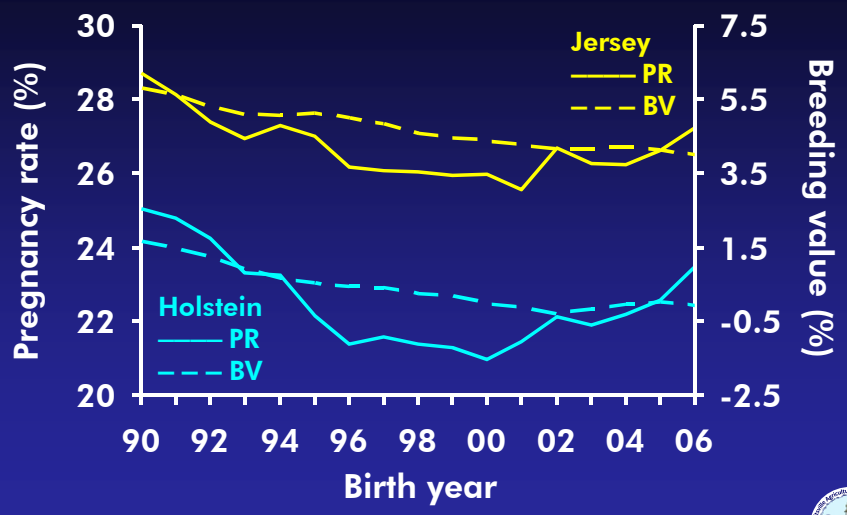
U.S. pregnancy rates



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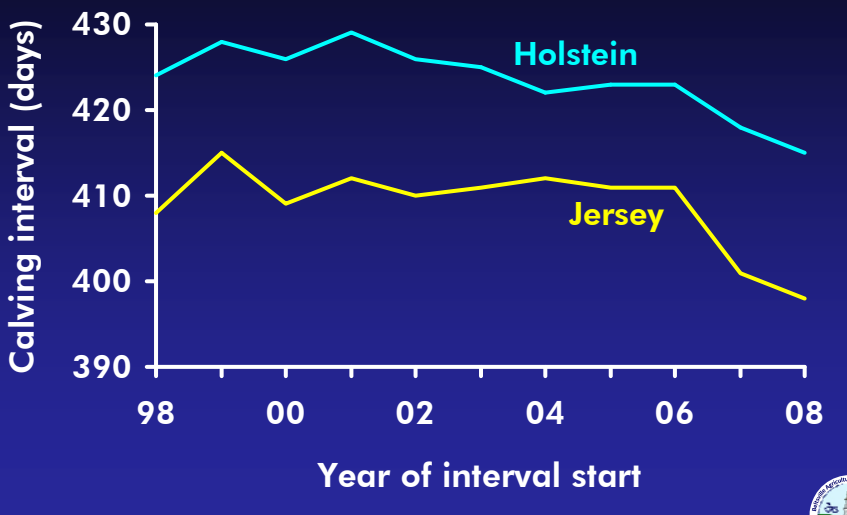
U.S. calving intervals



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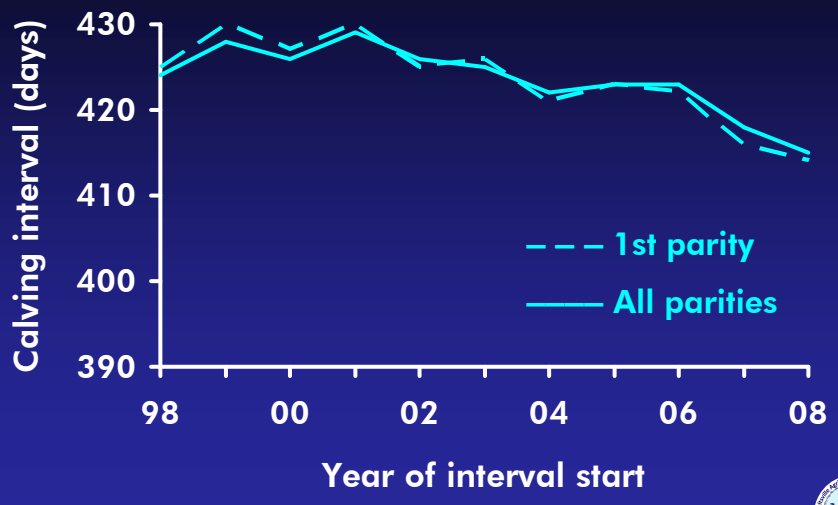
U.S. Holstein calving intervals



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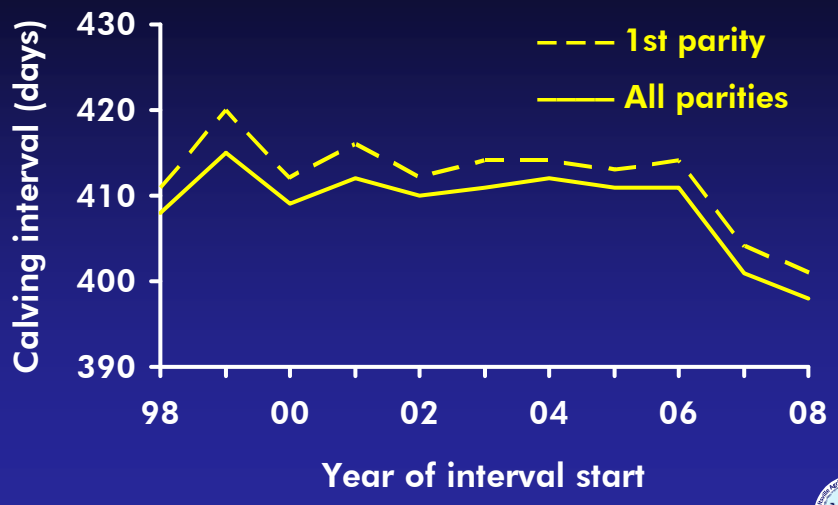
U.S. Jersey calving intervals



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Herd synchronization status

- Identified through $\chi 2$ analysis with herd size considered
  - Deviation of observed frequency of 1st inseminations by day of the week from expected equal frequency
  - Maximum percentage of cows inseminated on a particular day of the week
- Status categories
  - Not synchronized
  - Possibly synchronized
  - Probably synchronized
  - Synchronized

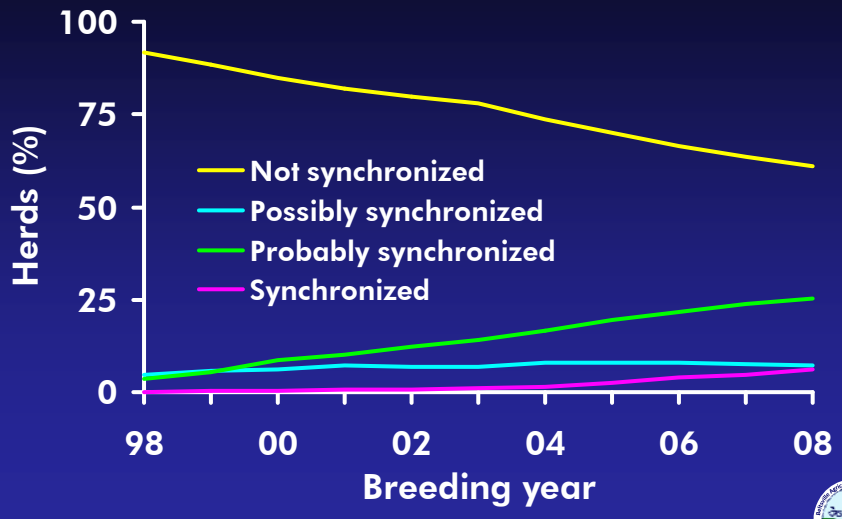
U.S. herd synchronization (no.)

Year	Not synchronized	Possibly synchronized	Probably synchronized	Synchronized
1998	6516	340	253	6
1999	6320	423	392	11
2000	6367	459	647	17
2001	6545	577	806	56
2002	6460	570	1001	58
2003	7111	633	1269	90
2004	6869	741	1558	147
2005	6493	740	1801	242
2006	5930	701	1935	340
2007	5840	701	2199	443
2008	5373	636	2232	549

U.S. herd synchronization (%)

Year	Not synchronized	Possibly synchronized	Probably synchronized	Synchronized
1998	92	5	4	<1
1999	88	6	6	<1
2000	85	6	9	<1
2001	82	7	10	1
2002	80	7	12	1
2003	78	7	14	1
2004	74	8	17	2
2005	70	8	19	3
2006	67	8	22	4
2007	64	8	24	5
2008	61	7	25	6

U.S. herd synchronization (%)



U.S. cows by herd synchronization (%)

Year	Not synchronized	Possibly synchronized	Probably synchronized	Synchronized
1998	91	5	4	<1
1999	85	7	7	<1
2000	80	8	12	<1
2001	75	9	14	1
2002	70	10	19	1
2003	65	9	24	2
2004	58	10	28	4
2005	52	9	33	5
2006	47	9	36	8
2007	45	9	37	8
2008	42	9	39	11

U.S. Holstein synchronization and reproduction*

Synchroni-zation status	Days to 1st breeding (days)	Concep-tion rate (%)	Services (no.)	Calving interval (days)
Not synchronized	88	31	2.4	419
Possibly synchronized	79	29	2.6	413
Probably synchronized	75	29	2.6	412
Synchronized	77	30	2.6	414

*2008 breedings

U.S. sexed-semen use

Population	Breeding year	Breedings (no.)	Percentage of total breedings
Heifers	2006	5,550	1.4
	2007	41,340	9.5
	2008	81,812	17.8
Cows	2006	1,962	0.1
	2007	7,779	0.2
	2008	16,169	0.4

U.S. sexed-semen conception rates

Population	Breeding year	Conception rate (%)	
		Conventional semen	Sexed semen
Heifers	2006	55	32
	2007	56	42
	2008	55	39
Cows	2006	30	30
	2007	30	26
	2008	31	24

Conclusions

- Large decline in U.S. SCC during last decade while herd size and milk yield increased
- In spite of less stringent legal standards, U.S. SCC comparable with SCC in other countries (probably because of incentives)
- U.S. days to 1st breeding declined partly because of adoption of ovulation synchronization and timed AI

Conclusions *(continued)*

- Units of semen per conception increased somewhat in the U.S.
- U.S. pregnancy rates decreased and calving intervals increased for decades but are improving
- Use of synchronized breeding has grown in the U.S.

Conclusions *(continued)*

- Use of sexed semen for heifers has grown in the U.S.
- Conception rate with sexed semen 20–30% less than with conventional semen in the U.S.

Thank you!

Animal Improvement Programs Laboratory staff – 2010