OPPORTUNITIES TO ENHANCE REPRODUCTION, COW HEALTH AND HERD LIFE WIHIN BREED

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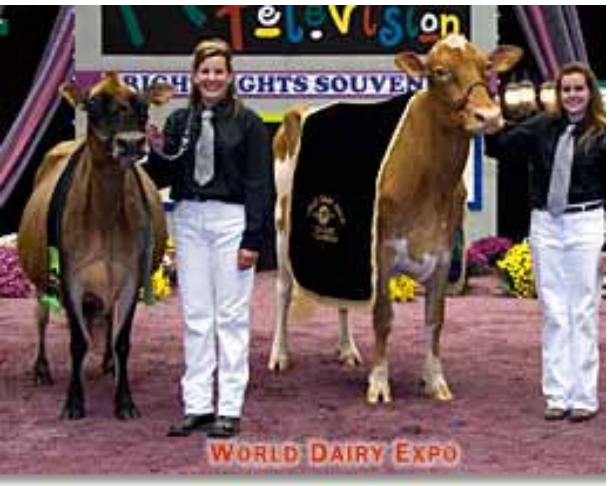
Matching G to E

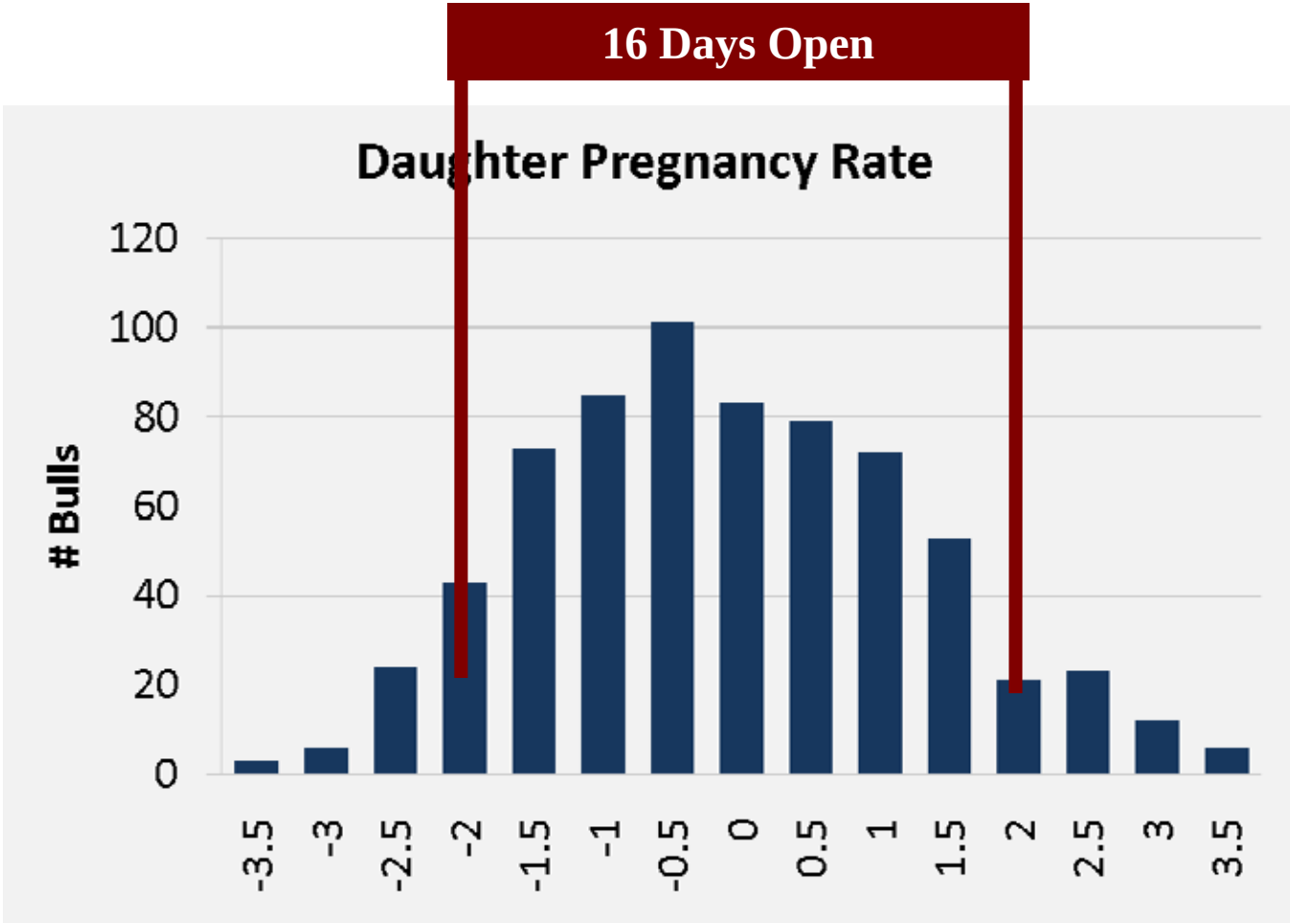
1. Maximize reproductive and health environments at extreme levels of production
2. Select within breed for cows that will perform in a “less optimal” environment
3. Crossbreed



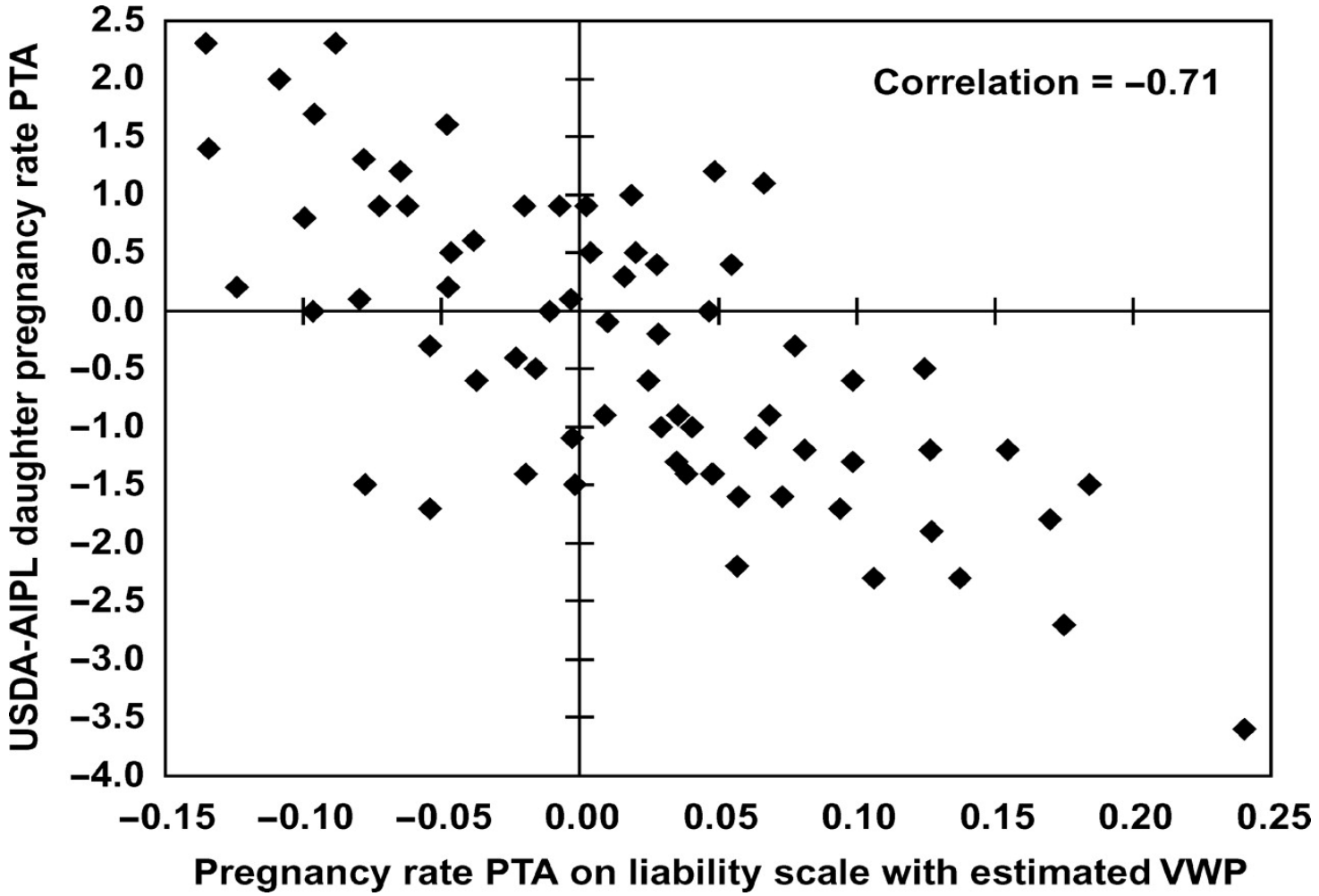
Fitness trait challenge: Low Heritability

- Why?
  - Vastly different herd management practices
  - Day-to-day variation on farms
    - Heat stress, different inseminator, nutritional status, semen quality would all impact DPR heritability
  - Sire misidentification
- Consequence of low h^2
  - Low reliability
  - Slower rate of genetic change

August 07 Holstein Evaluations

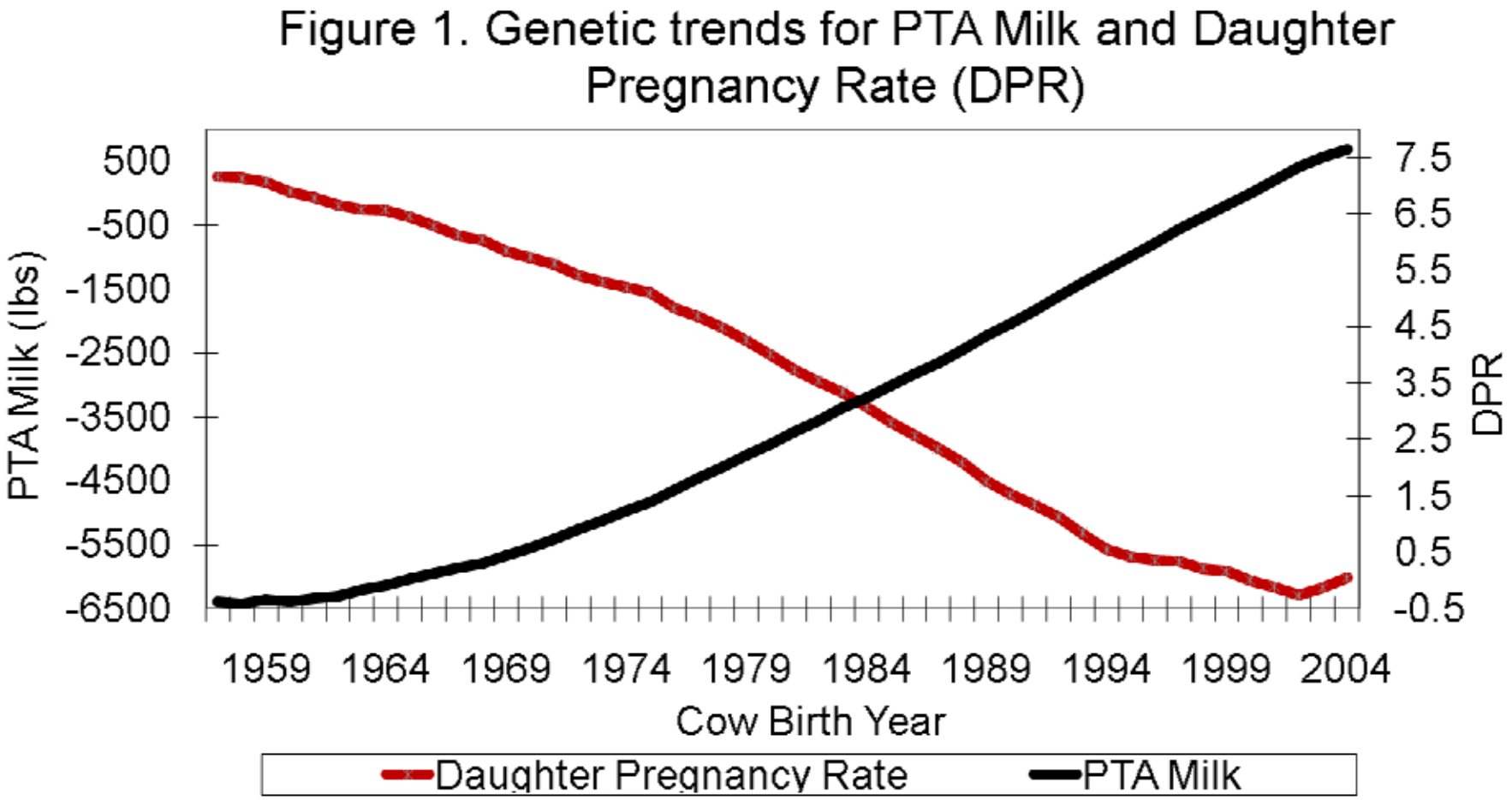


Genetic Analysis of 21-day Preg Rate



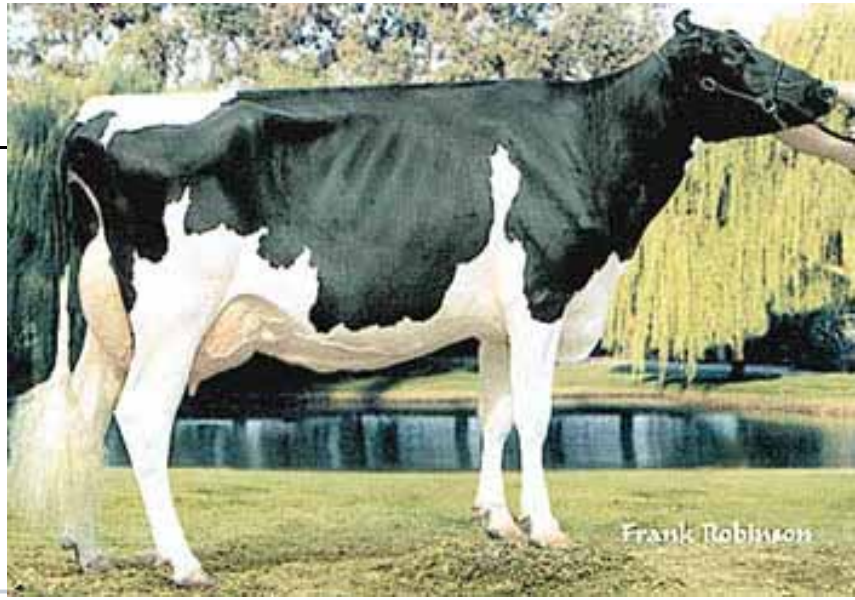
Chang et al., 2007

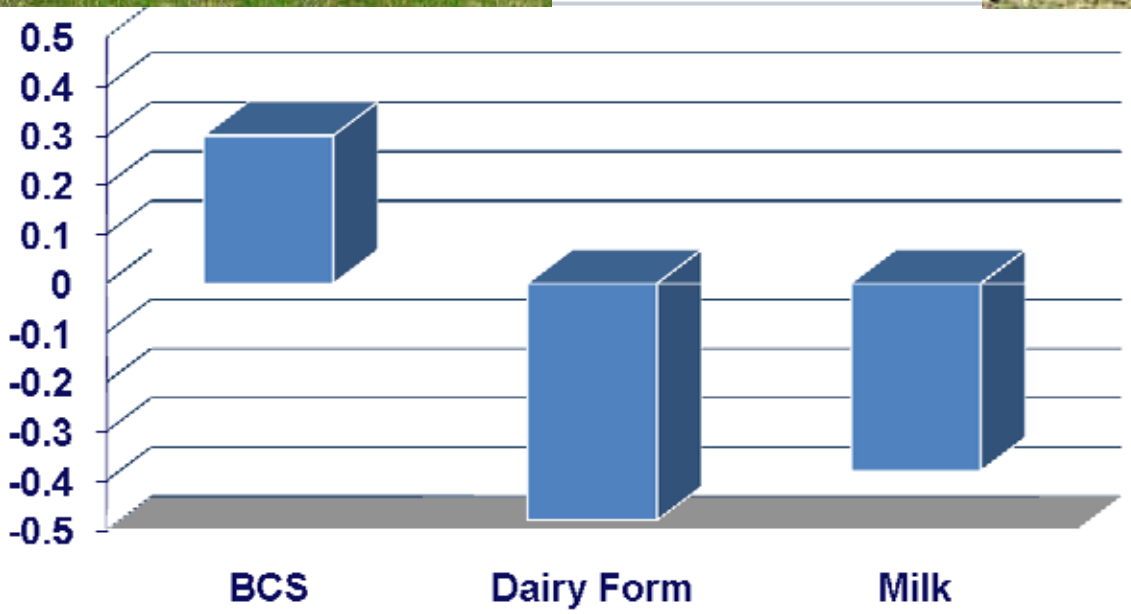
Why has Selection Reduced Fertility?



AIPL-USDA

Genetic Correlations with DPR





JDS 87: 3534-3541.

Opportunities to Select for Health Traits

- Indirect
  - Mastitis
  - Metabolic Health
- Direct
  - Scandinavia
- DNA Markers / Genes

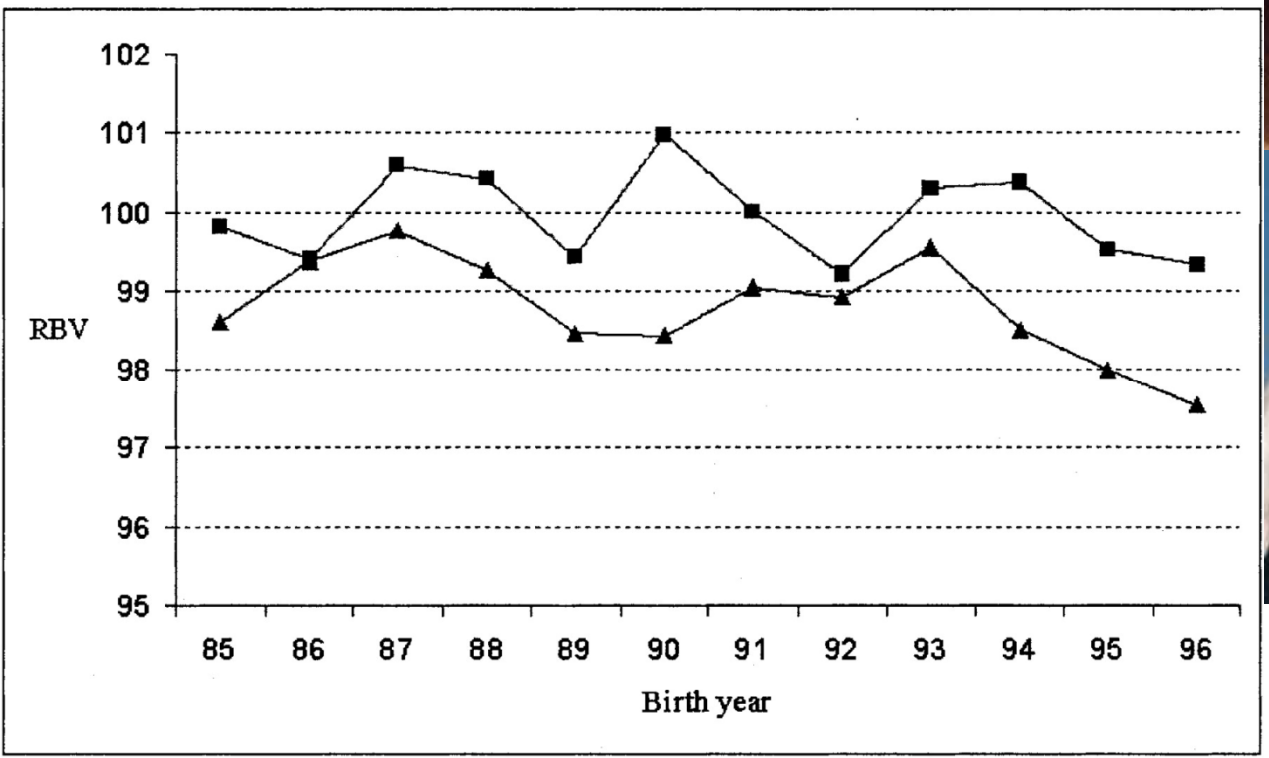
Mastitis Genetic Correlations

	Clinical Mastitis Incidence	
US Trait	**Denmark**	**Sweden**
SCS	0.66	0.49
Udder Depth	-0.45	-0.52
Udder Composite	-0.26	-0.47
Teat Placement	0.01	-0.19
Productive Life	-0.28	-0.59

JDS 81:1445-1453

Indirect Selection: Success

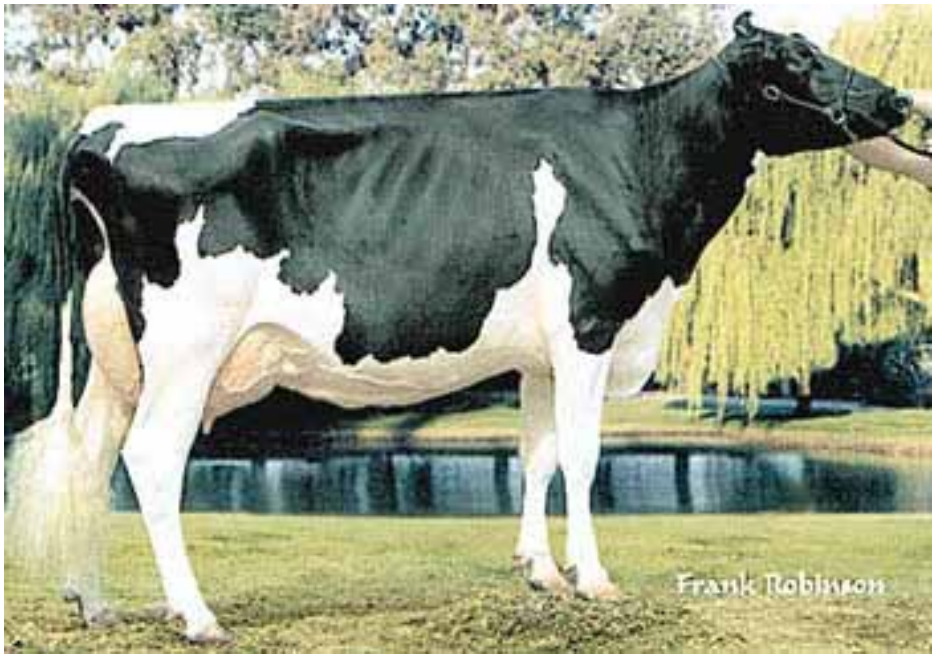
- Mastitis Resistance
  - Udder Depth / Fore Udder
  - SCS



J Dairy Sci 85:2384-2392

Indirect Selection: Unintentional

- High Dairy Form = Angular & Thin
  - Fat cows: may lack “will to milk”
- Have direct yield observations
  - PTA for DF unnecessary



Dairy Form Correlations

Trait	Productive Life	Dairy Character	
		US*	Denmark
Metabolic Disease	-0.25	0.65	…
Mastitis	-0.28	0.60	0.25
Other Disease	-0.25	…	0.42
All Disease	…	0.85	…

* Small Sample Size

JDS 81:1445-1453; JDS 85:445-452; JDS 86:3730-3735; JDS 87:3526-3533.

Other Disease Observations

- Foot and Leg
  - Higher foot angle
  - Smaller
  - Higher Prod. Life
  - Lower dairy form
  - Slight slope to rump
- Reproductive diseases
  - Some slope to rump
  - Less calving difficulty and stillbirths
  - Higher Prod Life
  - Lower dairy form

JDS 82: 1331-1338; JDS 81: 2264-2270.

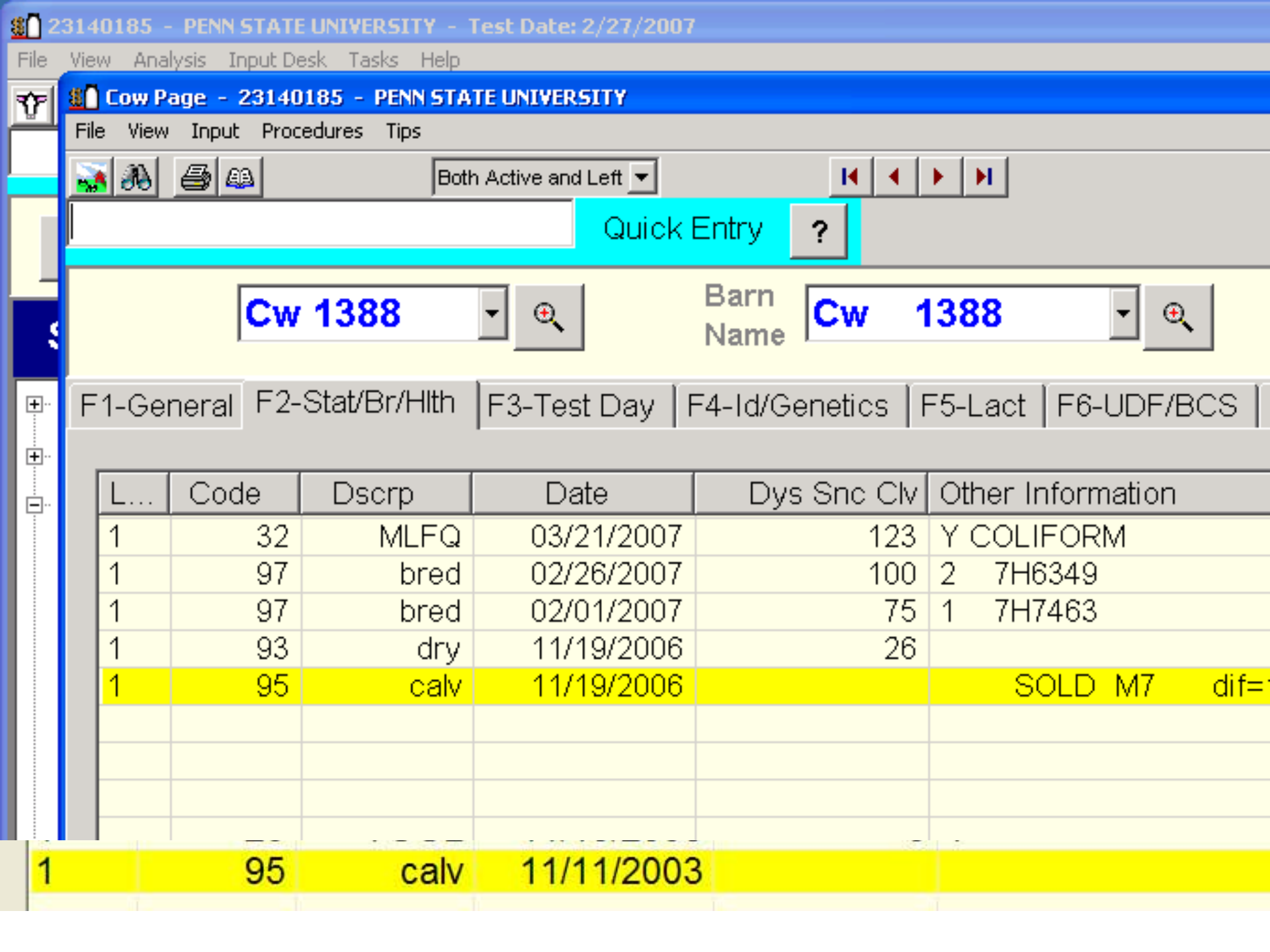
Indirect Selection

The “Holsteinization” of the Black and White cows in Sweden has, on average, led to a marked increase in production **without a change in the prevalence of mastitis**, despite the generally observed antagonistic relationship**.** A possible deterioration has probably been counteracted by correlated positive effects of simultaneously **improved udder conformation. However**, serious exceptions are available that definitely call for direct consideration of mastitis

JDS 77:3252-3261

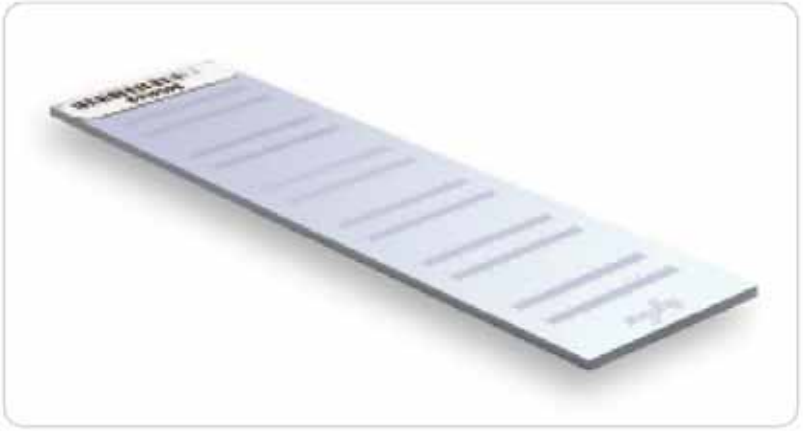
Direct Selection

- Need health observations
- DHI system not currently providing
- Many herds record health information
- Health data flows through DRPCs
  - Some DRPCs not willing to invest
  - Data Access Concerns


23140185 - PENN STATE UNIVERSITY - Test Date: 2/27/2007
File View Analysis Input Desk Tasks Help
Cow Page - 23140185 - PENN STATE UNIVERSITY
File View Input Procedures Tips
Both Active and Left
Quick Entry
?
Cw 1388
Barn Name
Cw 1388
F1-General
F2-Stat/Br/Hlth
F3-Test Day
F4-Id/Genetics
F5-Lact
F6-UDF/BCS
L... Code Dscrp Date Dys Snc Clv Other Information
1 32 MLFQ 03/21/2007 123 Y COLIFORM
1 97 bred 02/26/2007 100 2 7H6349
1 97 bred 02/01/2007 75 1 7H7463
1 93 dry 11/19/2006 26
1 95 calv 11/19/2006 SOLD M7 dif=
1 95 calv 11/11/2003

Dense SNP Mapping

- Illumina Bovine SNP50™ Chip
  - 58,000 genetic markers in 2007
  - 39,835 used in genomic predictions
  - Cost about $200 per animal
- Genes will remain unknown initially



Profile six individual samples in parallel, >46,000 transcripts apiece, on the Sentrix Human-6 Expression BeadChip.

Reliabilities comparing traditional parent averages to genomic predictions: VanRaden, 2008

Trait	Reliability		
	Traditional PA	Genomic Realized	Genomic Gain
Milk	38	54	16
Fat %	38	72	34
DPR	25	40	15
Prod Life	28	47	19
DCE	31	36	5
Final Score	28	37	9

Combining Sources

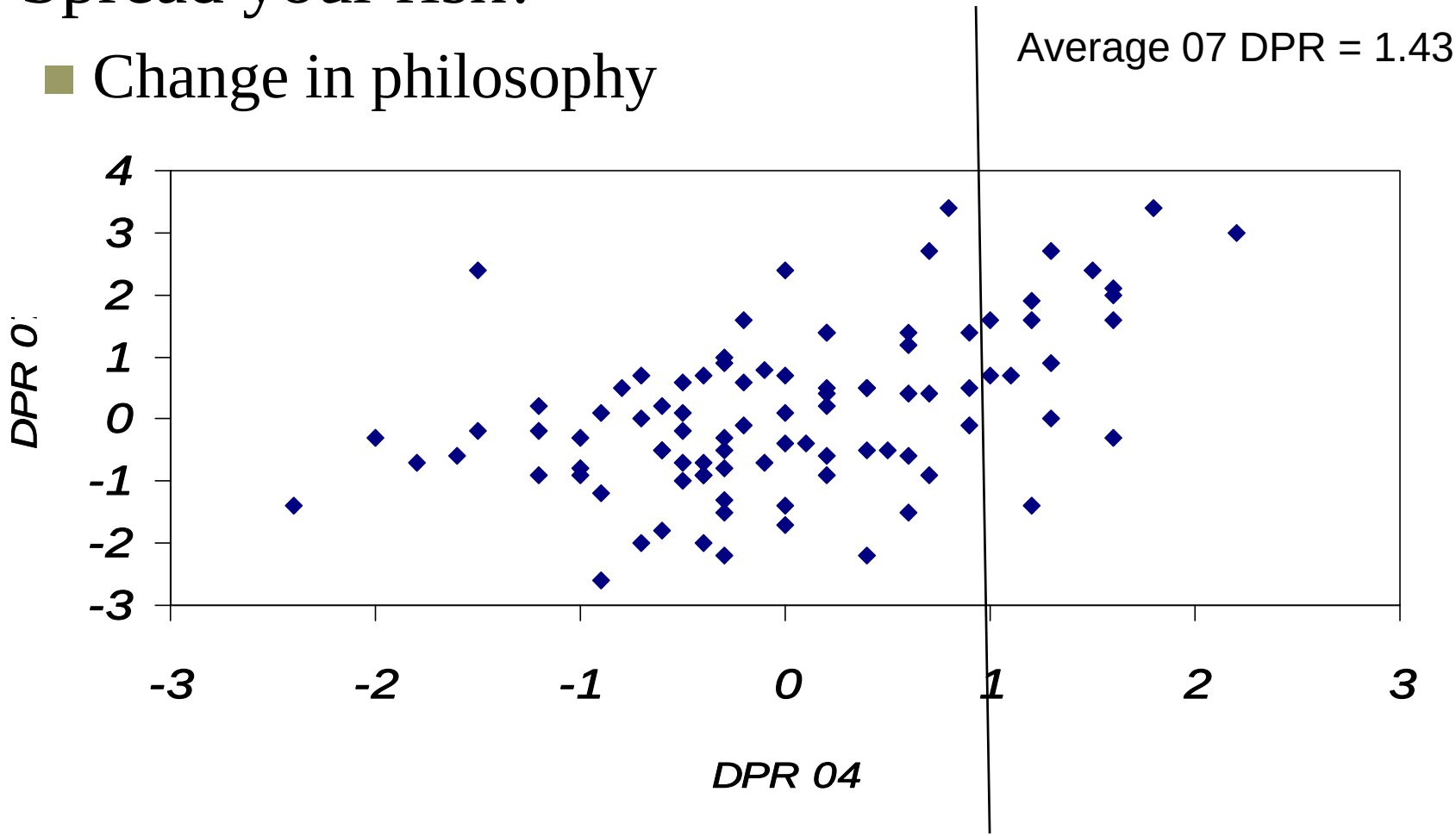
- Udder Health Index
  - Direct Mastitis Observations
  - Udder Morphology
  - Somatic Cell Score
  - Electrical Conductivity
  - Gene Markers

= PTA for Udder Health

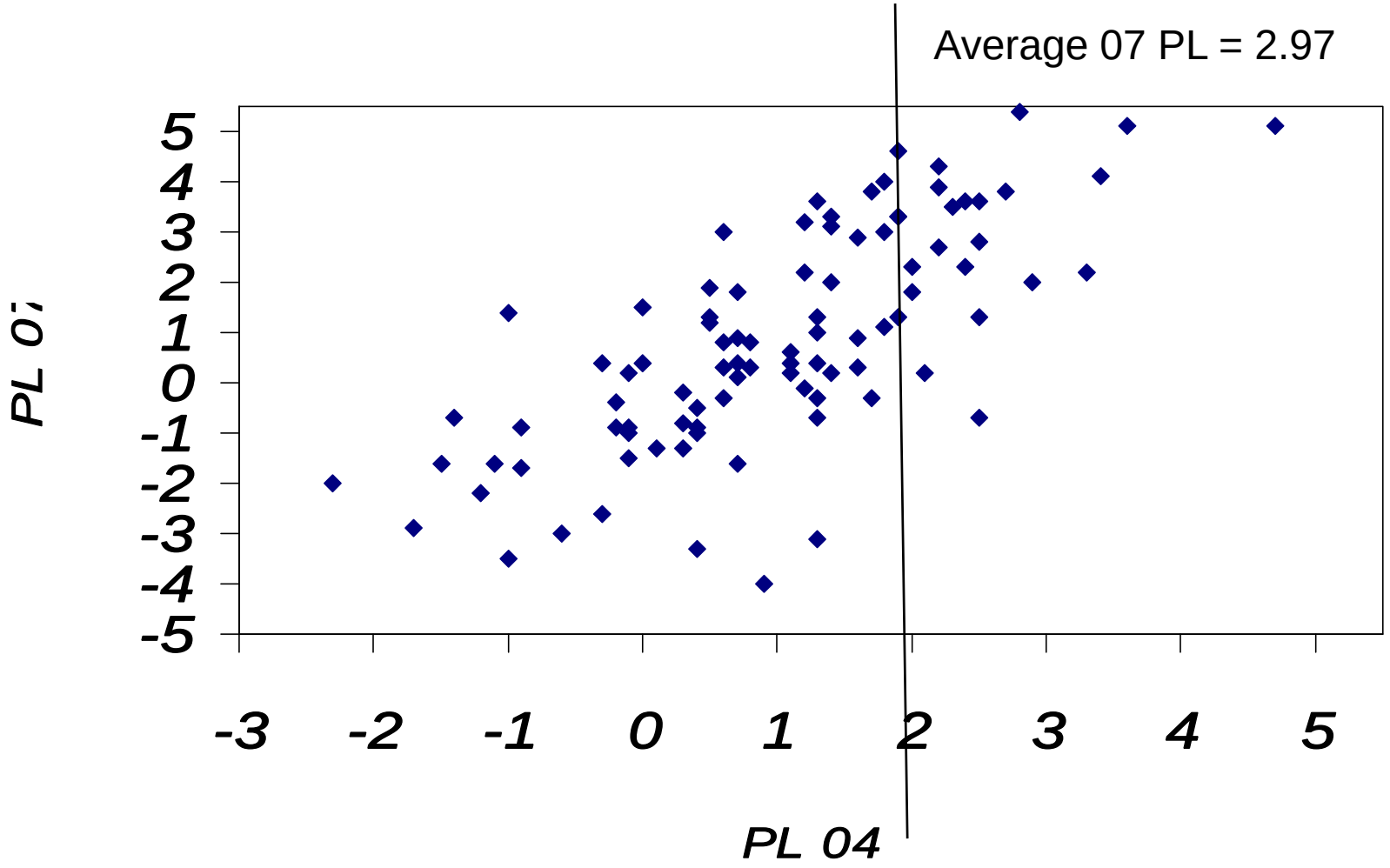
- As number of direct observations increase:
  - Indirect decreases
  - Marker influence decreases

Managing Low Reliability Selection

- Spread your risk?
  - Change in philosophy



Managing Low Reliability Selection



Too many numbers!

- Use a selection index to help identify the top tier bulls
- From those bulls, select those that best fit the specific herd goals
- Setting arbitrary cutoffs might eliminate the best bull

Economic Merit Indices	Relative value (%)		
	NM$	CM$	FM$
Protein	23	28	0
Fat	23	18	23
Milk	0	-12	24
Productive life	17	13	17
Somatic cell score	-9	-7	-9
Udder	6	5	6
Feet/legs	3	3	3
Body size	-4	-3	-4
Daughter pregnancy rate	9	7	8
Calving Ability	6	4	6

TPI

May 2007

Trait	Relative
Protein	28
Fat	17
Type	13
Dairy Form	-1
Udder Composite	10
Feet & Legs Comp.	5
Productive Life	10
Daughter Pregnancy Rate	8
Daughter Calving Ease	-2
Somatic Cell Score	-5
Daughter Still Birth	-1

How much should we pay for semen?

- Most semen is reasonably priced
- Some foreign bulls expensive
- Type Sells
  - Most expensive bulls have high PTAT
  - High TPI or $LNM with moderate type not expensive

ENR$

- $LNM adjusted for semen cost and bull fertility

Short Name	Bull Code Number	Smp Cd	Semen Price	ENRS Fluid Market	ENRS Component Market	ENRS Cheese Market	USDA Fluid Merit	USDA Net Merit
O MAN	7HO6417	S	40	97	**115**	126	686	781
PLANET	7HO8081	S	40	86	**80**	75	692	667
OZFEST	29HO11672	S	26	81	**77**	73	597	579
RIO	1HO6670	S	22	67	**76**	81	474	526
HESS	29HO10241	S	18	67	**70**	71	456	475
BOB	14HO3964	S	20	57	**69**	76	439	507
ACADEMY	536HO347	S	100	-73	**-76**	-78	182	173
ADOLPH	204HO1003	-	18	-57	**-76**	-88	-163	-255
DISTRIGENE-RED	94HO848	S	25	-82	**-86**	-89	-279	-293
ALLEGIANCE	76HO446	S	20	-96	**-91**	-88	-351	-323
JEWELMAKR	91HO4486	O	20	-108	**-95**	-86	-415	-340
KITE *RC	94HO10156	S	30	-99	**-101**	-102	-322	-326

http://animalscience.ag.utk.edu/ENR$

Selection Summary

- Majority of disease variation due to environment
  - Genetic variation significant
  - Effects will accumulate over generations
  - Sire selection important part of long term mastitis & herd health programs
- Selection for correlated traits effective
  - Direct evaluations needed for maximum accuracy
- Can spread risk for low reliability
- Need to balance health with production traits
  - Selection index