ALBERTA WEIGHTLIFTING ASSOCIATION

AFFILIATED WITH THE C.W.F.H.C. AND I.W.F.

Canadian Weightlifting Federation
Haltérophile Canadienne (CWFHC)

The Sinclair Coefficients for the Olympiad January 1, 2013 to December 31, 2016 For Men's and Women's Olympic Weightlifting

The Sinclair coefficients, derived statistically, are adjusted each Olympic year and are based on the World Record Totals in the various bodyweight categories as of the previous several years.

The Answer to the question "What would be the total of an athlete weighing *x* kg if he/she were an athlete in the heaviest category of the same level of ability?" is given by the formula:

Actual Total x Sinclair Coefficient = Sinclair Total

The Sinclair coefficient (abbreviated to S.C.) is given by:

$$S.C. = \begin{cases} 10^{AX^2} & (x \le b) \\ 1 & (x > b) \end{cases}$$

where $X = log_{10}\left(\frac{x}{b}\right)$

x = athlete bodyweight (kg)

	Men	Women
A	0.794358141	0.897260740
b	174.393 kg	148.026 kg

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Comments

I. The formulas given above are suitable for either a calculator or a computer. In words, they state that the Sinclair Coefficient is:

a) If his/her bodyweight of x kg is less than or equal to b kg then the Sinclair Coefficient is equal to *10* raised to the exponent A times X squared, where X equals the logarithm to the base *10* of the ratio of x to b.

b) If his/her bodyweight of x kg exceeds b kg then the Sinclair Coefficient is equal to *1*.

As an example, suppose a male athlete weighing 61.9 kg has a total of 320 kg. For him:

$A = 0.794358141$

$X = \log_{10}(61.9/174.393) = -0.449838400$

$AX^2 = 0.160742013$

$\text{S.C.} = 10^{AX^2} = 10^{0.160742013} = 1.447911485$

Sinclair Total = Actual Total x S.C.

Sinclair Total = 320 kg x 1.447911485 = 463.332 kg

II. In addition to the above, two tables are given, one for men and one for women. In each table, the athlete's bodyweight, x kg, appears in the first column and the Sinclair coefficient in the second. As noted above, the Sinclair Coefficients are derived statistically and are based on the World Record Totals of athletes in the prime of life, that is, mainly in their twenties, early thirties or late teens. This implies that the athlete's bodyweight, x kg, should not be too far below the upper limit for the lightest bodyweight category. Nevertheless, as a guideline for very young athletes who often are very light, the analytic curve 10^{AX^2} is extended to $x = 32.0$ for males and $x = 28.0$ for females.

III. Two graphs are appended, one for Men and one for Women. The branch of mathematics called Dimensional Analysis leads one to plotting, not the World Record Total y kg against the bodyweight category, x kg, but rather $Y = Log(y/240)$ against $X = log(x/52)$ for men and $Y = Log(y/140)$ against $X = log(x/44)$ for women. The "best-fit" parabola is then obtained statistically.

IV. An 8th data point (T. Kashirina) was required in the calculation of the Female Sinclair Bodyweight Correction Formula due to the present Female bodyweight categories consisting of too many lighter categories and not enough heavier categories.

V. Please see the document entitled "Sinclair Bodyweight Correction Formula (2013-2016)" for an in depth commentary as to how the Sinclair Bodyweight Correction Formula is derived.

Calculations for Men (August 31, 2012)

1.

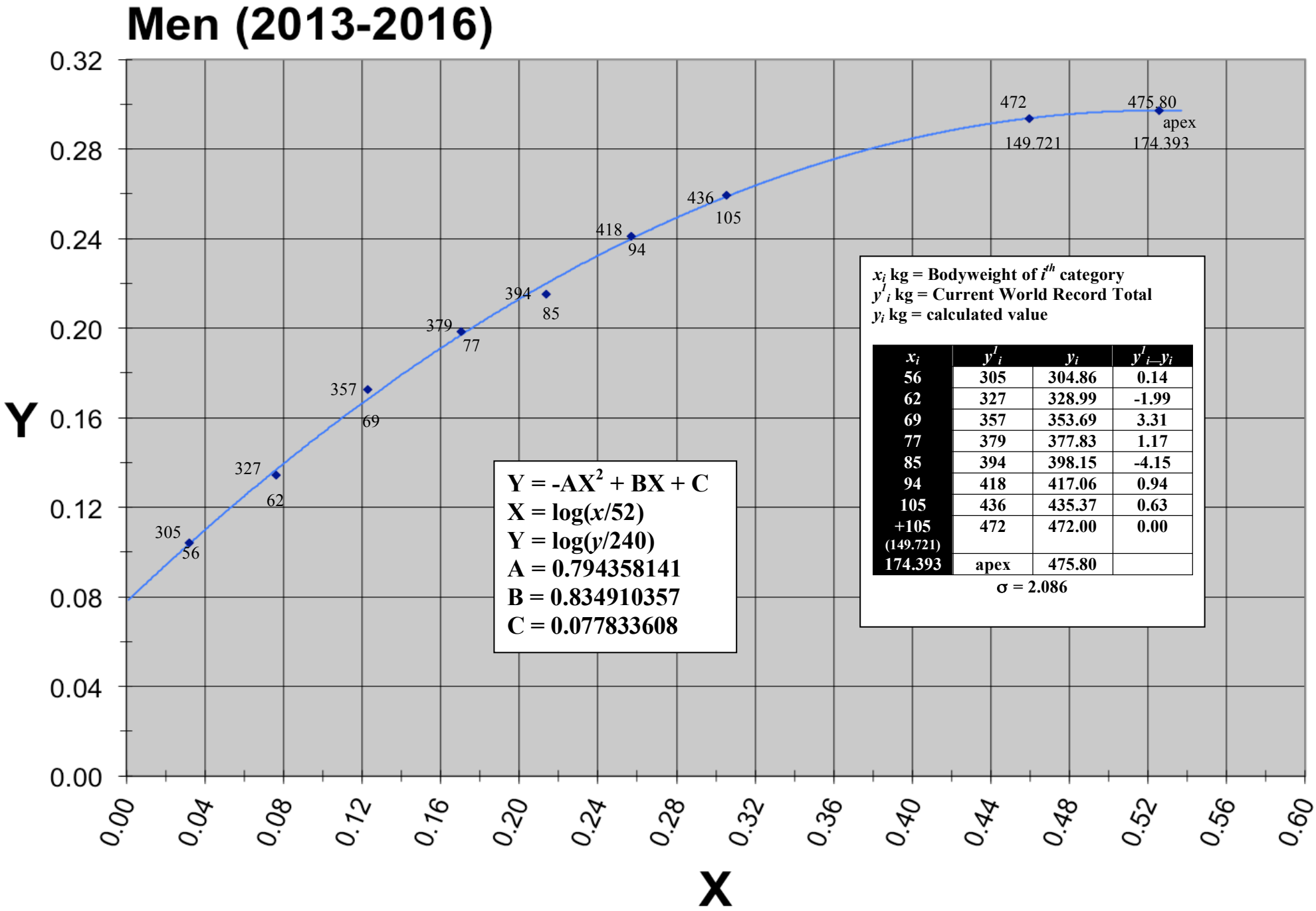
	ACTUAL			CALCULATED		
x_i	$X_i = Log\left({}^{x_i}/_{52}\right)$	y_i^1	$Y_i^1 = Log\left({}^{y_i}/_{240}\right)$	$Y_i = -AX_i^2 + BX_i + C$	y_i	$y_i^1 - y_i$
56	0.032184683371	305.0	0.104088597635	0.103882094881	304.86	0.14
62	0.076388345863	327.0	0.134336510949	0.136975807189	328.99	-1.99
69	0.122845747102	357.0	0.172456974401	0.168411074549	353.69	3.31
77	0.170487381538	379.0	0.198427968256	0.197086517055	377.83	1.17
85	0.213415582079	394.0	0.215284980114	0.219836484884	398.15	-4.15
94	0.257124509965	418.0	0.240965040063	0.239992114108	417.06	0.94
105	0.305185955435	436.0	0.259275247557	0.258651223485	435.37	0.63
+105	log(b/52)	472.0	0.293730756922	0.293730759746	472.00	0.00

2. For men we have as input 7 points (X_i, Y_i^1) plus Y_8^1 but not X_8. By choosing various values for the superheavyweight (b kg) and monitoring the value of the sum S of least squares resulting we have $b = 149.721$ and $S = 4.722\ 951\ 159 \times 10^{-5}$ for which

$A = 0.794\ 358\ 140\ 57$
$B = 0.834\ 910\ 356\ 73$
$C = 0.077\ 833\ 608\ 34$

3. For each bodyweight category X_i $(i = 1, 2, \ldots, 7, 8)$ we can now calculate y_i and compare it to the actual y_i^1. A measure of the goodness of fit is the standard deviation

$$\sigma = \left[\frac{1}{8}\sum_{i=1}^{8}(y_i^1 - y_i)^2\right]^{1/2} = 2.086$$



x_i	y^1_i	y_i	$y^1_i - y_i$
56	305	304.86	0.14
62	327	328.99	-1.99
69	357	353.69	3.31
77	379	377.83	1.17
85	394	398.15	-4.15
94	418	417.06	0.94
105	436	435.37	0.63
+105 (149.721)	472	472.00	0.00
174.393	apex	475.80	

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Calculations for Women (August 31, 2012)

1.

ACTUAL				CALCULATED		
x_i	$X_i = Log(x_i/44)$	y_i^1	$Y_i^1 = Log(y_i/140)$	$Y_i = -AX_i^2 + BX_i + C$	y_i	$y_i^1 - y_i$
48	0.037788560889	217.0	0.190331698170	0.185195715540	214.45	2.55
53	0.080823193115	230.0	0.215599800339	0.221305276962	233.04	-3.04
58	0.119975317077	251.0	0.253545685803	0.251269904632	249.69	1.31
63	0.155887872967	257.0	0.263805087653	0.276336362487	264.52	-7.52
69	0.195396414251	286.0	0.310237997451	0.301239130073	280.13	5.87
75	0.231608586906	296.0	0.325163675381	0.321603852630	293.58	2.42
102.31*	0.366465408180	332.0	0.375010048026	0.376743947965	333.33	-1.33
+75	log(b/44)	333.0	0.376316197828	0.376316000362	333.00	0.00

* NOTE: The result of T. Kashirina is incorporated into the analysis. Weighing 102.31 kg., she had a total of 332 kg.

2. For b = 101.962, the minimum for S = $3.178011711 \times 10^{-4}$ and

A = 0.897 260 739 69
B = 0.945 507 115 82
C = 0.150 747 628 53

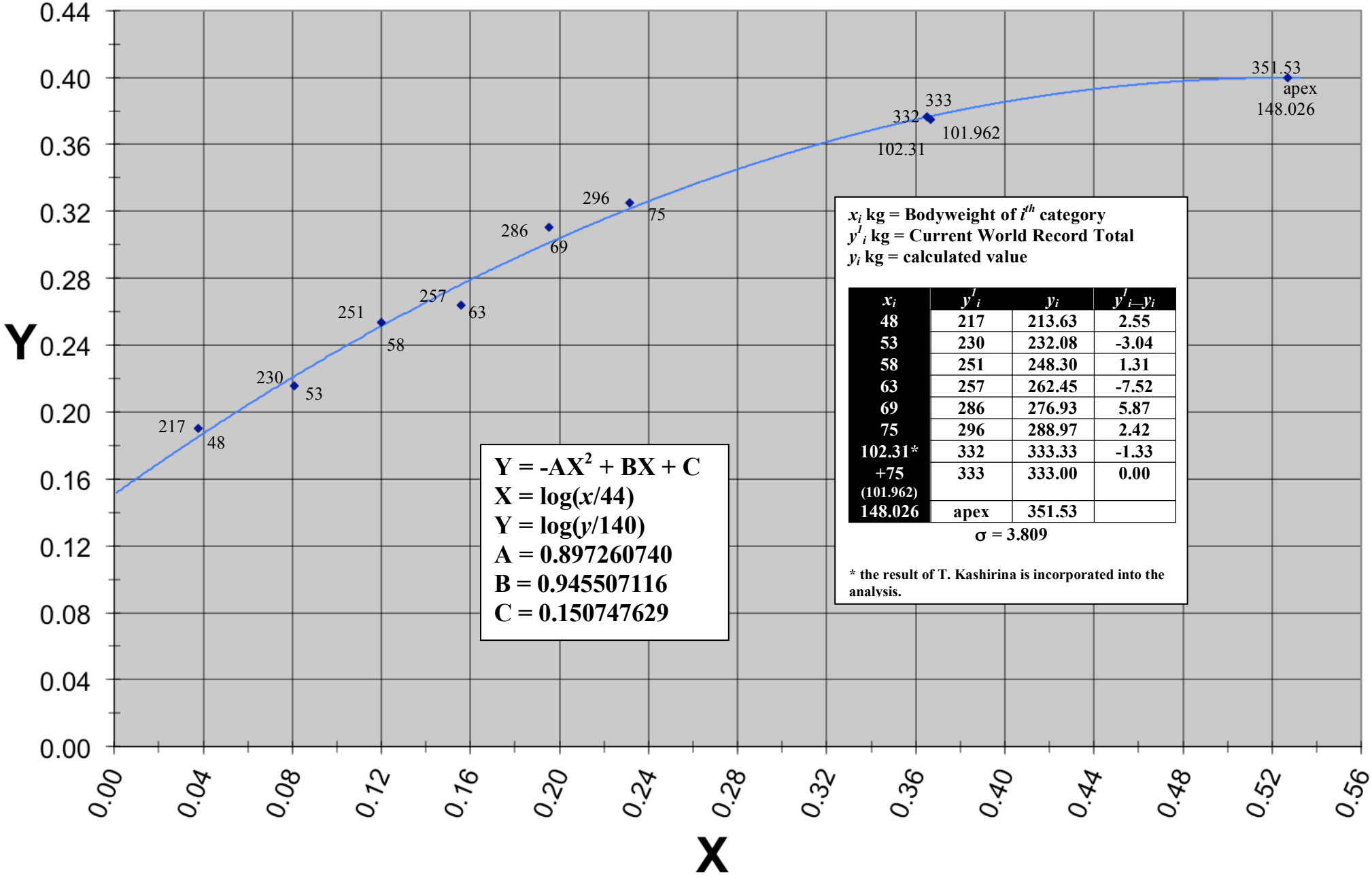
Also

$$\sigma = \left[\frac{1}{8}\sum_{i=1}^{8}(y_i^1 - y_i)^2\right]^{1/2} = 3.809$$

3. This graph shows very clearly that, even with the (unauthorized) addition of T. Kashirina's bodyweight and total, there are still too many lighter bodyweight categories and not enough heavier bodyweight categories.

4. Nevertheless, these results are more meaningful and acceptable.

Women (2013-2016)



$Y = -AX^2 + BX + C$
$X = \log(x/44)$
$Y = \log(y/140)$
$A = 0.897260740$
$B = 0.945507116$
$C = 0.150747629$

x_i kg = Bodyweight of i^{th} category
y^I_i kg = Current World Record Total
y_i kg = calculated value

x_i	y^I_i	y_i	$y^I_i - y_i$
48	217	213.63	2.55
53	230	232.08	-3.04
58	251	248.30	1.31
63	257	262.45	-7.52
69	286	276.93	5.87
75	296	288.97	2.42
102.31*	332	333.33	-1.33
+75 (101.962)	333	333.00	0.00
148.026	apex	351.53	

$\sigma = 3.809$

* the result of T. Kashirina is incorporated into the analysis.