ALBERTA WEIGHTLIFTING ASSOCIATION

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

Canadian Weightlifting Federation
Haltérophile Canadienne (CWFHC)

IWF

The Sinclair Coefficients for the Olympiad January 1, 2017 to December 31, 2020 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:

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

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

x = athlete bodyweight (kg)

	Men	Women
A	0.751945030	0.783497476
b	175.508 kg	153.655 kg

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 female athlete weighing 90.9 kg has a total of 303 kg. For her:

$A = 0.783497476$

$X = \log_{10}(90.9/153.655) = -0.227982814$

$AX^2 = 0.040723193$

$\text{S.C.} = 10^{AX^2} = 10^{0.040723193} = 1.098305587$

Sinclair Total = Actual Total x S.C.

Sinclair Total = 303 kg x 1.098305587 = 332.787 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. In September of 2016, the IWF Executive Board approved the technical rule modification adding an 8th body weight class for senior women brining gender equality to the sport. The 75+ kg weight category has been removed and in its place a 90 kg weight category and 90+ kg weight category have been added.

V. Please see the document entitled "Sinclair Bodyweight Correction Formula (2017-2020)" for an in-depth commentary as to how the Sinclair Bodyweight Correction Formula is derived.

Calculations for Men (December 31, 2016)

1.

ACTUAL				CALCULATED		
x_i	$X_i = \log(x_i / 52)$	y^1_i	$Y^1_i = \log(y^1_i / 240)$	$Y_i = -AX_i^2+BX_i+C$	y_i	$y^1_i - y_i$
56	0.032184683371	307.0	0.106927133766	0.109489887640	308.82	-1.82
62	0.076388345863	333.0	0.142232991795	0.141000670023	332.06	0.94
69	0.122845747102	359.0	0.174883206867	0.170950940061	355.76	3.24
77	0.170487381538	380.0	0.199572354905	0.198293670902	378.88	1.12
85	0.213415582079	396.0	0.217483944214	0.220007681318	398.31	-2.31
94	0.257124509965	412.0	0.234685974322	0.239269123007	416.37	-4.37
105	0.305185955435	437.0	0.260270195259	0.257132069990	433.85	3.15
+105	log(b/52)	473.0	0.294649899026	0.294561657211	472.90	0.10

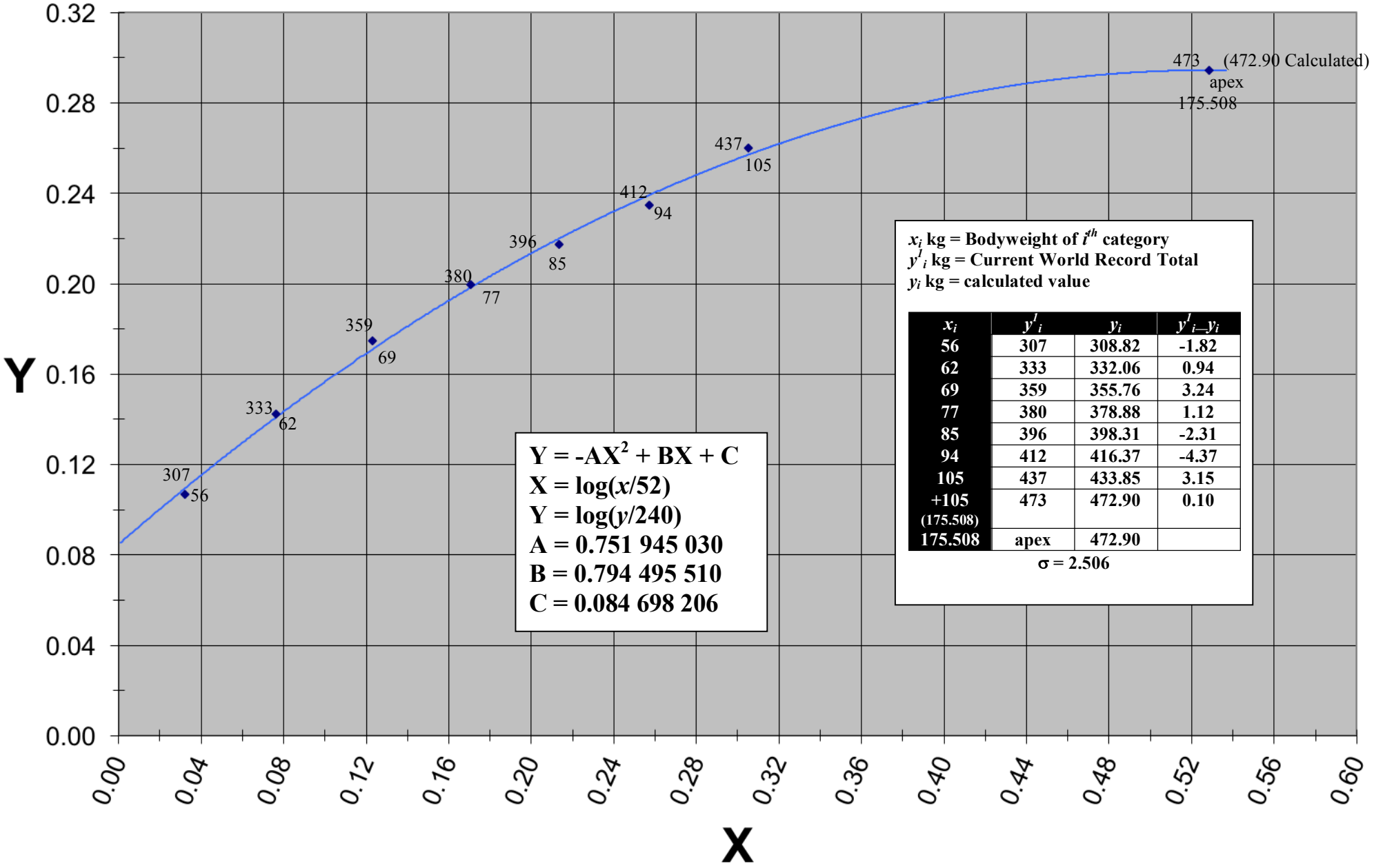
2. For men we have as input 7 points (X_i, Y_i^1) plus Y_8^1 but not X_8. By choosing various values for the superheavyweight (b kg) and monitoring the value of the sum S of least squares resulting we have $b = 175.508$ and $S = 6.241\ 419\ 704 \times 10^{-5}$ for which

$A = 0.751\ 945\ 029\ 76$
$B = 0.794\ 495\ 509\ 85$
$C = 0.084\ 698\ 206\ 37$

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

$$\sigma = \left[\frac{1}{8}\sum_{i=1}^{8}(y_i^1 - y_i)^2\right]^{1/2} = 2.506$$

Men (2017-2020)



$Y = -AX^2 + BX + C$
$X = \log(x/52)$
$Y = \log(y/240)$
$A = 0.751\ 945\ 030$
$B = 0.794\ 495\ 510$
$C = 0.084\ 698\ 206$

x_i kg = Bodyweight of i^{th} category
$y^1{}_i$ kg = Current World Record Total
y_i kg = calculated value

x_i	$y^1{}_i$	y_i	$y^1{}_i - y_i$
56	307	308.82	-1.82
62	333	332.06	0.94
69	359	355.76	3.24
77	380	378.88	1.12
85	396	398.31	-2.31
94	412	416.37	-4.37
105	437	433.85	3.15
+105 (175.508)	473	472.90	0.10
175.508	apex	472.90	

$\sigma = 2.506$

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Calculations for Women (December 31, 2016)

1.

ACTUAL				CALCULATED		
x_i	$X_i = \log(x_i / 44)$	y^1_i	$Y^1_i = \log(y^1_i / 140)$	$Y_i = -AX_i^2+BX_i+C$	y_i	$y^1_i - y_i$
48	0.037788560889	217.0	0.190331698170	0.192678500506	218.18	-1.18
53	0.080823193115	233.0	0.221227885348	0.225302758932	235.20	-2.20
58	0.119975317077	252.0	0.255272505103	0.252462587310	250.37	1.63
63	0.155887872967	262.0	0.272173255642	0.275263002628	263.87	-1.87
69	0.195396414251	286.0	0.310237997451	0.298011814193	278.06	7.94
75	0.231608586906	296.0	0.325163675381	0.316714234789	290.30	5.70
90.9*	0.315111206736	303.0	0.335314592824	0.352008416300	314.87	-11.87
+90	log(b/44)	348.0	0.395451208268	0.392731503529	345.83	2.17

* NOTE: The result of T. Kashirina is incorporated into the analysis. Weighing 90.90 kg., she had a total of 303 kg.

2. To better represent the 90 kg bodyweight WRT data point, the results (unauthorized) of T. Kashirina from 2009 with a bodyweight of 90.90 kg and a total of 303 kg were used instead of the assigned WRT of 283 kg.

3. for b = 153.65, and the minimum for S = $5.465073899 \times 10^{-4}$ and

A = 0.783 497 476 14
B = 0.851 025 125 58
C = 0.161 638 300 80

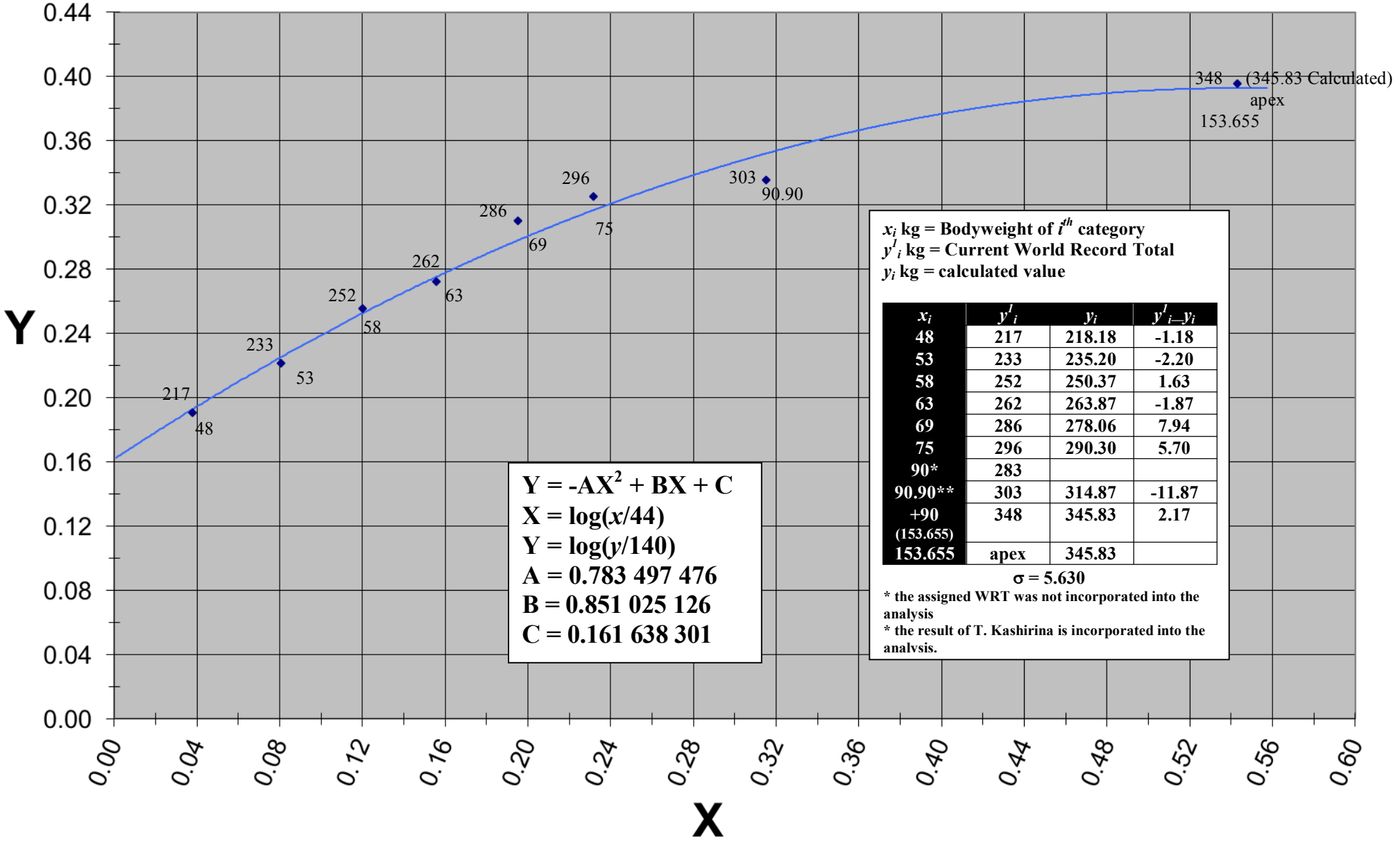
Also

$$\sigma = \left[\frac{1}{8}\sum_{i=1}^{8}(y_i^1 - y_i)^2\right]^{1/2} = 5.630$$

4. 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.

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

Women (2017-2020)



$Y = -AX^2 + BX + C$
$X = \log(x/44)$
$Y = \log(y/140)$
$A = 0.783\ 497\ 476$
$B = 0.851\ 025\ 126$
$C = 0.161\ 638\ 301$

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	218.18	-1.18
53	233	235.20	-2.20
58	252	250.37	1.63
63	262	263.87	-1.87
69	286	278.06	7.94
75	296	290.30	5.70
90*	283		
90.90**	303	314.87	-11.87
+90 (153.655)	348	345.83	2.17
153.655	apex	345.83	

$\sigma = 5.630$

* the assigned WRT was not incorporated into the analysis
* the result of T. Kashirina is incorporated into the analysis.