



International
Paralympic
Committee

World Para Swimming Points System

Description and Basic Procedure

28 February 2017

International Paralympic Committee

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World Para Swimming would like to inform you that we have introduced a points scoring system starting from the 2017 season. The development of the World Para Swimming points system follows a number of discussions with NPC and NF for the need for a standardised system. The model is derived from a work from Kevin Pei using the points system.

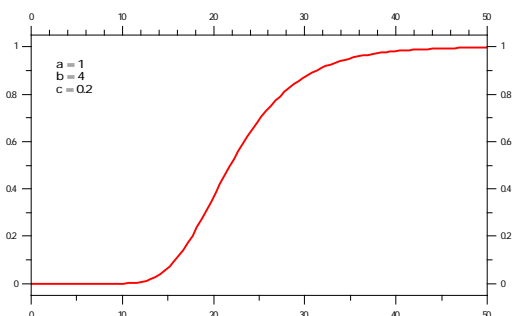
Basic procedure

- o Data from IPC World Rankings from 2009 and onwards has been used as the basic platform.
- o Each event and class had their own specific trend.
- o A common statistical model was used to map each event's trend
- o This statistical model was applied to all classes and converted into a reference performance of 1000 points for each combine class.
- o Every year, there will be a review and analysis of results and the point score table will be updated.
- o Compared to previous models for the point score table, new World Records and single outstanding performances will have very little impact (if any) to adjustments of the point score table.

Mathematical description

The development of the points system model used is the **Gompertz function**, a sigmoid function, a mathematical model for time series.

The general formula of the Gompertz function is $G(x) = ae^{-e^{b-cx}}$ with a, b, c being positive numbers and x being the performance value. In this case, as we wish for better performances to receive higher values, we use the reciprocal of the time as the performance x .



With help of this set of parameters for each gender, event, and class, points can be calculated and used for comparison in combined events. Key of



this process is the approach to have the current top performers at around 1000 points (not exactly!) but keep some freedom above this mark to allow new top performers achieving points beyond.

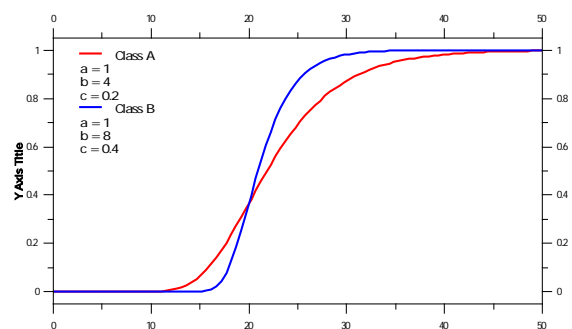
The three parameters can be interpreted as follows:

- a is the maximum of available points,
- b sets the displacement along the x-axis,
- c sets the growth rate along x .

Small adjustments have been applied to increase stability and comparability. The most important implementation is the concept of master equations to ensure a fair point system between different classes.

Within each class combination, the performances were converted in relation to each top performance in the data set, and the Gompertz function fitted against the resulting data.

This function is called the master equation and reflects the general distribution of performances within this class combination. Keeping the master equation parameters a and b fixed, the third parameter c was recalculated for each class by top performance factors used to combine the results for the various classes.



The intention of this master equation concept was to increase the comparability of curves within each combination of classes as individual analysis resulted in Gompertz curve with massive variations in the curve shapes. Especially if two curves of classes A and B had an intersection, this leads to logical inconsistencies. In the example, for high performers the point system says class B is most impaired and therefore lower performances is required to beat athletes from class A. But for weaker performers, this is reversed.

You will be able to find the points system with updated parameters and the scoring calculators via the World Para Swimming Website

<https://www.paralympic.org/swimming/world-series-2017>

Should you have any questions please don't hesitate to contact World Para Swimming.