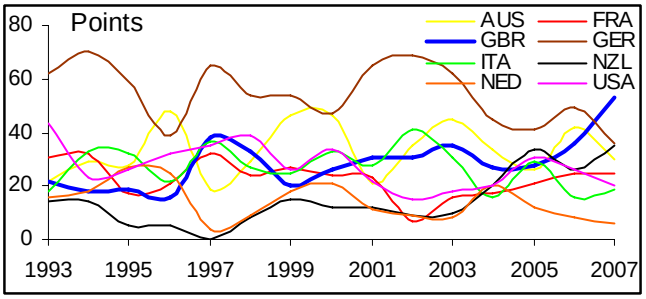
## News

The Rowing World Championship 2008 just finished in Munich, Germany. British rowers have shown great performances and achieved the highest team score. Well done!

The chart below shows the variations in performance of the best rowing countries in 14 Olympic boat types over the last 15 years.




## Q&A

**Q:** We have received very positive feedback on the latest Newsletter from a number of coaches and sport scientists. The correlation of the ergo score with the boat speed was found quite accurate. To make the tables more useful we regrouped them relative to the boat type instead of rower's weight (see Appendix 1 on http://www.biorow.com/RBN_en_2007_files/App2007RowBiomNews08.pdf ). We received a number of questions essentially as follows: "What sort of force, oar angles and stroke rate should be applied to achieve a target boat speed?"

**A:** To answer this question, we need to determine work per stroke ***Wps*** using rowing power ***P*** and duration of the stroke cycle ***T*** or stroke rate ***R***:

$$Wps = P * T = P\ (60 / R)$$

If the force applied to the handle is constant, then work per stroke ***Wpsc*** could be derived as a product of the average force ***Fav*** and length of stroke ***L***:

$$Wpsc = Fav * L$$

However, the force is always variable, so the real work applied to the handle equal to an integral:

$$Wps = \int F \cdot dL$$

We compared values of ***Wps*** determined using these two equations and found that they have very high correlation (r = 0.985), which is evidence of quite a low influence of the shape of the force curve. This allows us to replace one variable with another using their ratio ***K***, which was found from our database:

$$K = Wpsc / Wps = 83.2\%.$$

The average force ***Fav*** can be expressed as:

$$Fav = K * P\ (60 / R) / L$$

The power P in this equation can be related to the boat speed using the method described in the previous Newsletter 2007/07. For illustration purposes we will show the estimated values of the force, stroke length and rate required to achieve the current World best times.

In our model, we estimated average body weight ***W*** and height ***H*** as the most common values among international level rowers. The stroke length ***L*** was estimated using its average ratio 85% to the rower's body height ***H***.

Oar angles ***A*** were derived from the stroke length ***L*** using actual inboard ***Inb*** from the data of the 2006 FISA rigging survey (RBN 2006/11).

$$A = L / (Inb\ (\pi /180))$$

Racing stroke rates in various boat types were obtained from the average of our measurements during 2000-2004 (RBN 2005/02). Maximal force ***Fmax*** was derived using statistical average of the ratio of ***Fav*** to ***Fmax*** equal to 52%.

| Boat | Time | W (kg) | H (m) | P (W) | Rate (1/min) | Angle (deg) | Fmax (kgF) | Fav (kgF) |
|---|---|---|---|---|---|---|---|---|
| W1x | 7:07.7 | 85 | 1.85 | 410 | 34.1 | 107 | 74.8 | 38.9 |
| W2x | 6:38.8 | 80 | 1.85 | 390 | 35.9 | 107 | 67.6 | 35.1 |
| W4x | 6:10.8 | 80 | 1.85 | 392 | 37.4 | 110 | 65.4 | 34.0 |
| W2- | 6:53.8 | 85 | 1.85 | 394 | 37.4 | 87 | 65.6 | 34.1 |
| W8+ | 5:55.5 | 80 | 1.85 | 397 | 39.1 | 89 | 63.3 | 32.9 |
| M1x | 6:35.4 | 95 | 1.95 | 544 | 36.3 | 112 | 88.4 | 46.0 |
| M2x | 6:03.3 | 90 | 1.95 | 541 | 38.2 | 113 | 83.7 | 43.5 |
| M4x | 5:37.3 | 90 | 1.95 | 547 | 39.3 | 113 | 82.2 | 42.8 |
| M2- | 6:14.3 | 95 | 1.95 | 558 | 38.8 | 92 | 84.9 | 44.1 |
| M4- | 5:41.3 | 95 | 1.95 | 553 | 40.5 | 93 | 80.6 | 41.9 |
| M8+ | 5:19.9 | 95 | 1.95 | 586 | 40.0 | 94 | 86.6 | 45.0 |
| LW2x | 6:49.8 | 60 | 1.70 | 324 | 36.1 | 99 | 60.7 | 31.6 |
| LM2x | 6:10.0 | 70 | 1.80 | 464 | 38.8 | 104 | 76.5 | 39.8 |
| LM4- | 5:45.6 | 70 | 1.80 | 471 | 40.6 | 86 | 74.4 | 38.7 |

The common maximal and average forces in men are respectively 80-88 and 42-46kgF; in women, 63-74 and 32-38kgF; in lightweight men, 75 and 39kgF; in lightweight women, 60 and 31kgF. As we discussed in RBN 2006/05 these values of average force are equal to the weight in strength training and can be used for testing/training purposes. Don't forget that these variables are in balance: if one of them is lower (e.g. stroke rate), then others must be higher (stroke length or forces) if you want to achieve requited boat speed.

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