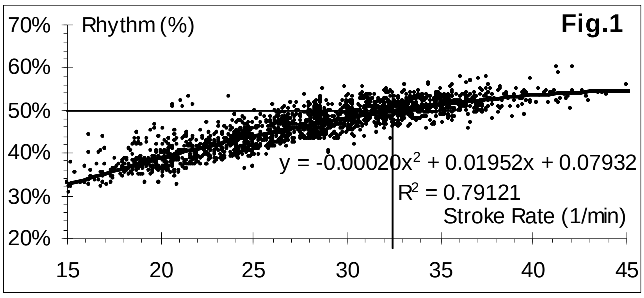
Rowing rhythm, stroke length and effectiveness

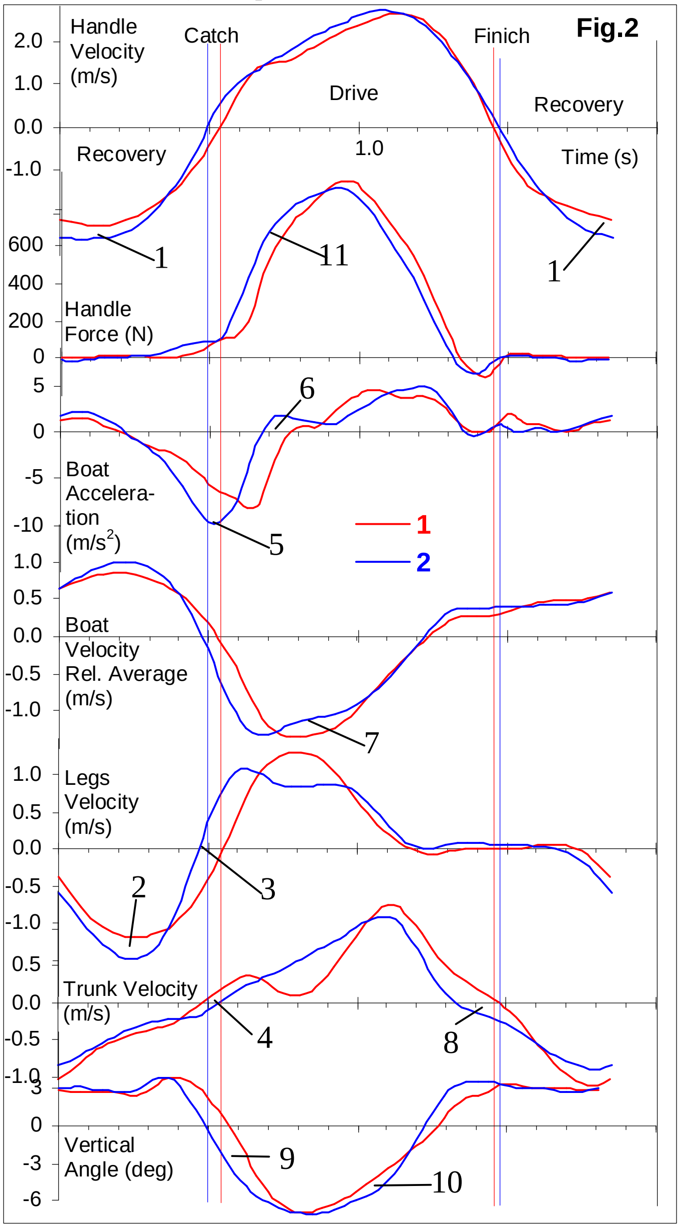
We have briefly discussed time variables of the stroke cycle: times of the drive and recovery, and rhythm (RBN 2003/03). Let's remember that the definition of rhythm is the ratio of the drive time to the total time of the stroke cycle (50% means a 1/1 ratio of the drive to recovery times). It was found that the rhythm has a strong positive correlation (r=0.89) with the stroke rate because possibilities to shorten the drive are limited. However, the stroke rate only explains 79% of the rhythm variation (Fig.1) and 21% depends on other factors.



The standard deviation of residuals from the trend (n=2881) was σ=2.5%, which means that at the same stroke rate the rhythm may vary within ±7.5% (±3σ) in various crews. E.g., at the stroke rate 32.5 str/min the average rhythm based on the above trend is 50%, but it could be between 42.5% and 57.5%.

What other factors affect the rhythm and **<u>is it better to have the rowing rhythm higher or lower?</u>** Many coaches believe that a lower rhythm is more efficient and ask their crews to shorten the drive time, but does that make sense? To answer, we analysed biomechanical variables of two M1x at the same stroke rate 32.5 str/min (Fig.2). Sculler 1 (red) had a rhythm of 49.5% or 0.91s drive time compared to sculler 2's (blue) 52.5% and 0.97s correspondingly; i.e. the last one had a 3% higher rhythm and 0.06s longer drive time. The reason for this difference was quite simple: sculler 1 had a total oar angle of 107.5 deg, while sculler 2 had 116 deg; i.e. he had an 8.5 deg longer stroke length. This reason fully explains the difference in rhythm and drive time since the average handle velocity during the drive (= drive length / time) had the same value of 1.73 m/s in both scullers. This happened in spite of sculler 1 applying a 3.9% higher maximal force and 2.6% higher average force than sculler 2.

What other biomechanical features are related to this difference in rhythm and stroke length? During the recovery, sculler 2 has to move the handle much faster (Fig.2, 1) to cover a longer distance in a shorter time, so his average handle speed was 11.7% higher. This was impossible without faster seat/leg movement (2). At the catch, sculler 2 changes direction of the seat movement much quicker than sculler 1, slightly before his handles change direction (3). Contrarily, sculler 1 uses his trunk even before the catch (4). Consequently, the boat acceleration of sculler 2 has an earlier and deeper negative peak (5), but higher first positive peak (6), so his boat and stretcher move relatively faster (7), creating a better platform for acceleration of sculler's 2 mass ("trampoline effect", RBN 2006.02).



Other technical advantages of sculler 2 were:

- More effective return of the trunk at the finish (8);
- Better blade work at the catch (9) and finish (10);
- Faster force increase up to 70% of max. (11);
- 1.5% lower variation of the boat speed (0.5s gain over 2k);
- 3.3% higher rowing power because of longer drive.

As a result, the boat speed of sculler 2 was 5.9% higher (6:34 for 2k) than sculler 1 (6:57) as well as his performance (Worlds medallist compared to third finalist for sculler 1).

Conclusion: **<u>The rhythm and drive time can not be changed voluntary as they depend on the stroke rate, length and boat speed. The stroke length should be maintained as the first priority.</u>** There are other factors, which may affect rhythm (shape of the force curve and depth of the blade) which we may study in the future.