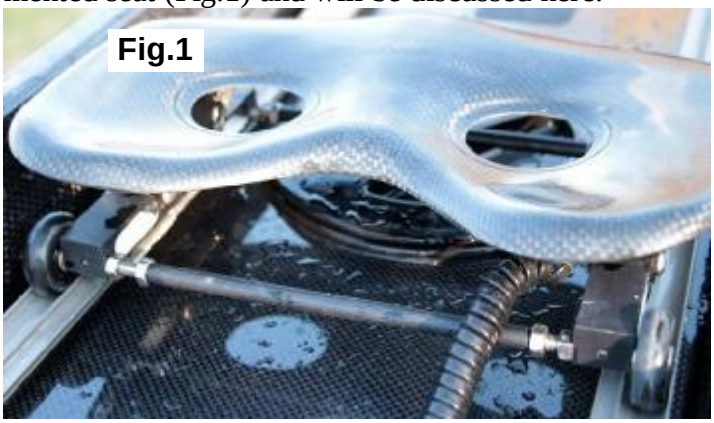
Vertical seat force

We already discussed the vertical seat force before (RBN 2002/05, 2011/03), but recently new data was obtained with a new design of ***BioRowTel*** instrumented seat (Fig.1) and will be discussed here.



Three lightweight single scullers of similar body weight performed a step test in the instrumented boat in similar tail wind weather conditions. Fig. 2 shows the comparison of the main biomechanical variables at the stroke rates 32.5 – 33.4 str/min, synchronised at the catch time (the longest oar angle).

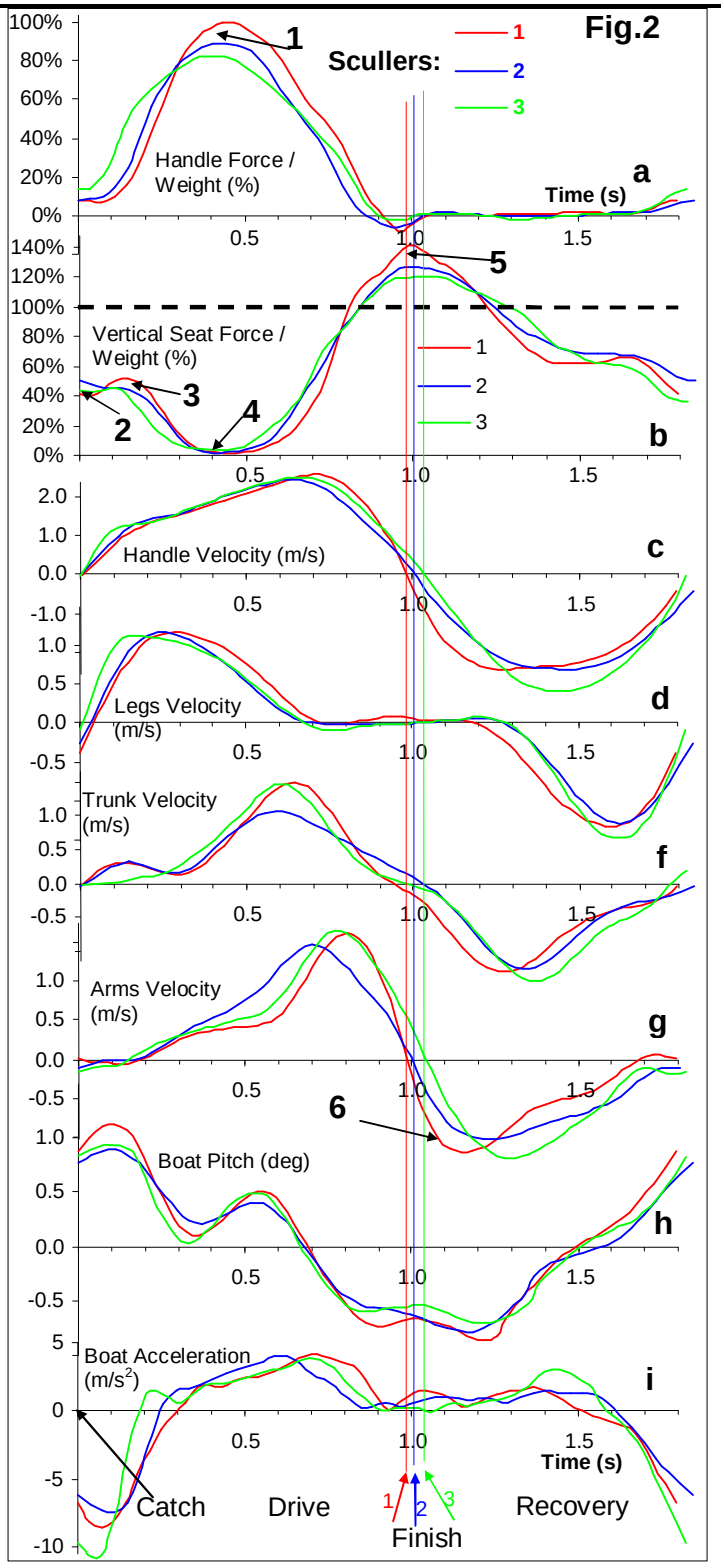
The first sculler has shown the highest maximal handle force (1) – near 100% of his body weight, while other scullers achieved only 80-85% of it. The rowing power of sculler 1 was 15% higher than of sculler 2 and 12% higher than of sculler 3.

At the catch, only 40-50% of the rower's weight remains on the seat (2), which is explained by transfer of the weight to the stretcher. It was expected, that the weights will be lifted from the seat more and more together with force increasing. However, it does not always happen: sculler 1 increased his seat force up to 60% first (3), and then lifted it again. We could speculate that this phenomenon is related to a slow legs movement and slow growth of the handle force.

After the handle force increased up to 70% of its maximum, only 2-4% of the body weight was left on the seat (4). No significant difference in the minimal seat force was found between scullers, but sculler 3 with a faster legs and steeper force curve lifted his weight earlier.

During the second half of the drive the seat force is increasing and achieving 100% of the body weight, when the handle force drops down to about 20% of its maximum. Sculler 1 with a later peak of the trunk velocity maintained suspension longer, but then put his weight on the seat much quicker. At the finish, he achieved the maximal seat force of 150% of his body weight (5), while it was only 120% for sculler 3. This difference is also related to much faster trunk return at the beginning of recovery of sculler 1 (6).

As a result, sculler 1 had the amplitude of the boat pitch (Fig.2, h) was 2.2 deg and the vertical movement of the hull 4.2cm, while for sculler 3 they were only 1.6 deg and 2.5cm. Together with a more efficient boat acceleration profile (RBN 2012/11) and longer angles, it allows sculler 3 to achieve the same boat speed as sculler 1 at 12% lower average force and power. Sculler 2 achieved 4% lower boat speed at similar force and power to sculler 3.



- **At the catch, up to 60% of the rower's weight is transferred onto the stretcher and only 40% is left of the seat.**
- **Fast and early legs movement allows achieving smoother weight suspension during the drive, lower amplitude of the pitch movement of the hull and higher rowing efficiency.**
- **Long and late trunk work at the drive and too fast return to recovery creates a significant increase of the seat pressure (up to 150% of rower's weight) and decrease rowing efficiency.**