



The weekly recap of what is going on in the world of biomechanics.

This week we return to more applied Biomechanics and present to you two exciting papers concerning board sports. First off, a novel fin design for surf boards has been tested in an interesting field study and secondly, the in-shoe kinetics of an Ollie (jumping with a skateboard) were assessed. It is attractive to see which steps other researchers did in order to bring methods and technology into the environment of board-sports athletes. We hope you enjoy the read as much as we did!

1. [Performance evaluation of humpback whale-inspired shortboard surfing fins based on ocean wave fieldwork](#)
2. [Bipedal in-shoe kinetics of skateboarding – the ollie](#)

Performance evaluation of humpback whale-inspired shortboard surfing fins based on ocean wave fieldwork:

The novel fin design “Real Whale” (RW) aims to mimic some of the humpback whale’s flow control mechanisms. The humpback flipper has an eye-catching structure, and its tubercles are assumed to play a major role in the flipper’s mechanics. Have a look at the pictures below to compare the humpback’s flippers, the RW-fins (A), and common surfboard fins (B). However, the humpback whales use their flippers mainly for two purposes, one is generating lift and the other one is maneuvering. Surfboard fins serve in a similar way, as they also provide a lift force during turning maneuvers.

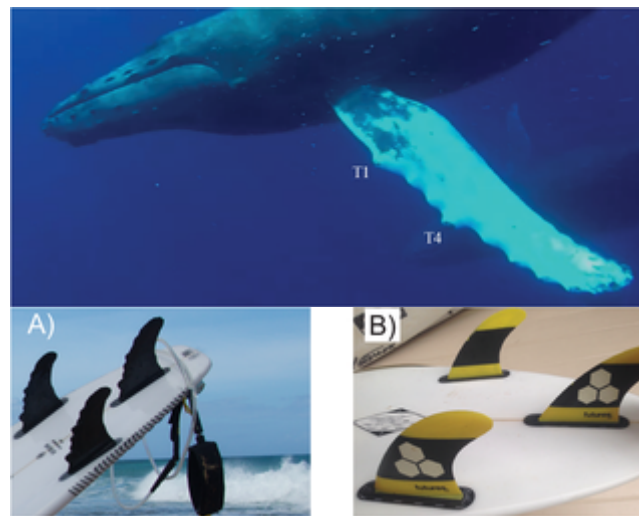


Image credit: David E Shormann.

<https://doi.org/10.1371/journal.pone.0232035.g003>

To gather data, the researchers Shormann and Panhuis attached GPS and 9-axis motion sensors onto surfboards and let four surfers of different levels perform “Cutback-Maneuvers” (that is a turn on the upper part of the wave) on a total of almost 2000 ocean waves. The dataset consisted of board angles (yaw, pitch, and roll), linear speed, rotational speed, and power magnitude (that is a dimensionless number from 0 -10) during surfing maneuvers. A total of 18 turn performance values were measured and calculated. The surfers switched monthly between using the RW-prototype and the regular control-fins. All of the outcomes were compared using ANOVA.

In the results, a significant improvement in power generation when using RW-fins could be seen. Also, the turn rates improved, yet not significantly.

We think this an awesome approach because apart from the novel fin-design, the methods are very interesting. Taking instruments into the ocean brings its complications, and normalizing a natural factor as diverse as ocean waves is a difficult task. It is probably impossible to not let the surfers know which fins they are using during testing, given the distinct differences in design. If you are interested in this topic, we recommend reading the full paper here (<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0232035#ack>). However, check out the drone footage below that was published along with the paper – That’s how we



like our Biomechanics!

Shormann DE, in het Panhuis M (2020) Performance evaluation of humpback whale-inspired shortboard surfing fins based on ocean wave fieldwork. PLoS ONE 15(4): e0232035.

<https://doi.org/10.1371/journal.pone.0232035>

Bipedal in-shoe kinetics of skateboarding – the ollie:

In a brief pilot study, two researchers from Dover, USA, had a look at the in-field kinetics of skateboarding. The challenge and purpose of this study were, similar to the article above, to take the methods and technology in the athlete's environment. The four participants in the study wore identical footwear with wireless sensoric insoles recording underfoot forces with 13 pressure sensors per sole. Each participant then performed Ollies in three conditions: Standing, rolling and jumping down a 36-cm platform. Previous literature on skateboarding used force plates to assess these conditions which might be not ideal, since the board, wheels, and footwear may have dampening effects. Especially in the Ollie down a platform, the researchers saw average forces as high as 3.15 times the body weight. But more interesting than the absolute force acting upon the skateboarder, the method of data collection here is worthwhile and might allow interesting future research regarding outdoor- and nature sports. Let's see where this goes!

Leuchanka, A., Ewen, J., & Cooper, B. (2017). Bipedal in-shoe kinetics of skateboarding—the ollie. *Footwear Science*, 9(sup1), S122-S124.

<https://doi.org/10.1080/19424280.2017.1314373>