AP-11

# Diving depth decreases heart rate in the Common Bottlenose Dolphin (*Tursiops truncatus*)


**Filipa C. Oliveira[1,2], Natalia Martínez[2,3], Loreto Rodríguez[2], Angelo G. Torrente[4] and Andreas Fahlman[1,2,5]**

[1] Linköping University, Sweden, [2] Fundación Oceanogràfic de la Comunidad Valenciana, Spain, [3] Católica de Valencia San Vicente Mártir University, Spain, [4] Institut de Génomique Fonctionnelle, Université de Montpellier, CNRS, INSERM, Montpellier, France and [5] Global Diving Research SL, Spain.


## 1. *Introduction*

The **dive response**, which includes **bradycardia**, is crucial for managing limited oxygen storage during diving and extend dive duration, thereby enhancing foraging efficiency. It has been suggested that **lung compression**, caused by **increased dive depth**, could reduce heart rate. In addition, previous studies indicated that longer dives result in **lower diving heart rate**, but they did not account for the confounding effect of dive depth (as longer dives are generally deeper).

## 2. *Aim of the study and Material*

We measured **diving heart rate** and **body acceleration** using a non-invasive physio-logging device (Figure 1) in seven bottlenose dolphins to evaluate the effect of dive depth on cardiac function when **controlling** dive **duration** and **activity**.

**Figure 1.** ECG physio-logger incorporated in a single suction cup attached to the sternum of a dolphin.

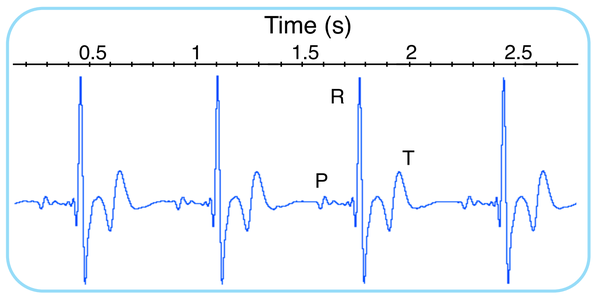


**Figure 2.** High-quality ECG data recorded in a bottlenose dolphin and showing the P waves (atrial depolarization), R waves (ventricular depolarization), and T waves (ventricular repolarization).

## 3. *Protocol and Results*

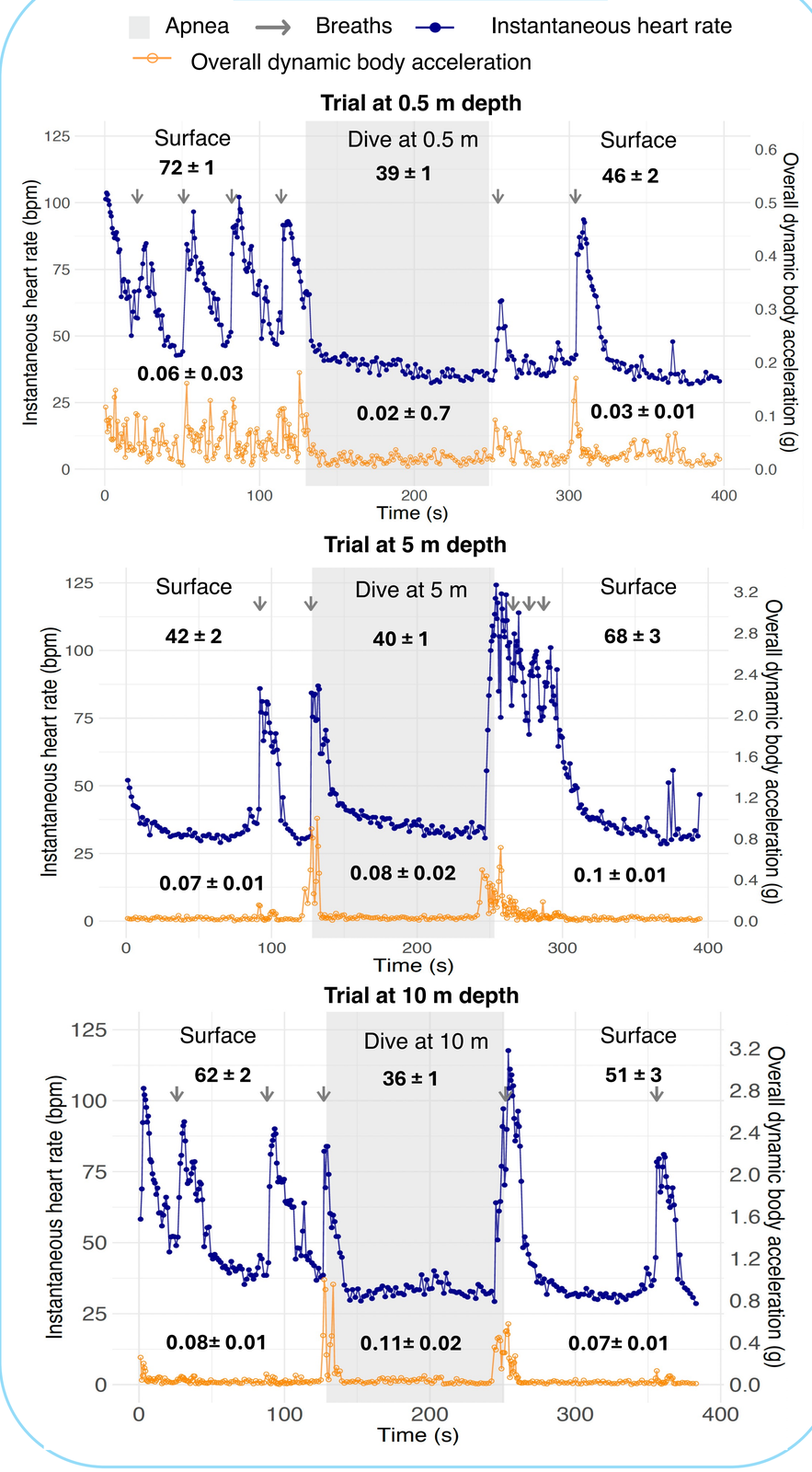


**Figure 3.** Representative data for breath-hold dives to 0.5, 5, and 10 m depth, showing **instantaneous heart rate** and **overall dynamic body acceleration**.

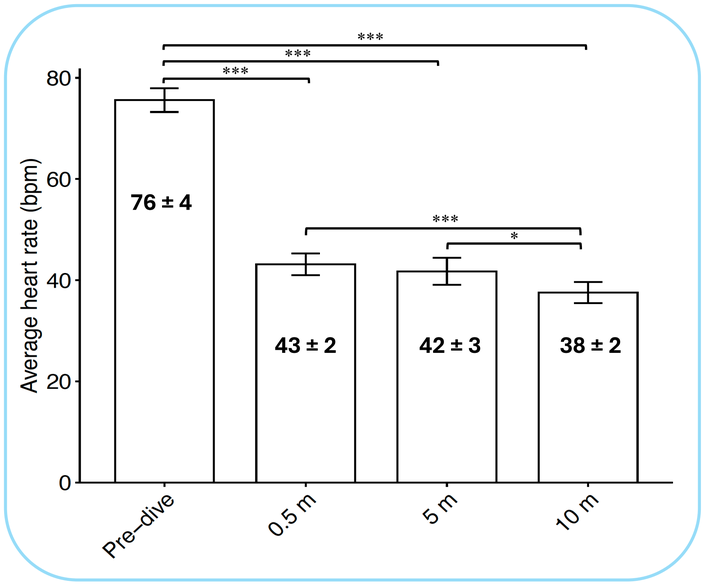


**Figure 4.** Average heart rate (± SE) decreased significantly from surface to all depths ($p \leq 0.001$, one-way ANOVA), being lower at 10 m than at 0.5 and 5 m ($p \leq 0.001$ and $p = 0.028$, respectively; post-hoc Tukey's HSD test). * $p < 0.005$, *** $p < 0.001$

**Figure 5.** Dolphin performing an apnea at 5 m depth.

## 4. *Conclusion*

- **Dive depth directly influenced heart rate** in common bottlenose dolphins;
- **Deeper dives** resulted in a **greater reduction in heart rate** compared to shallower dives;
- These data support the hypothesis that **hydrostatic pressure** influences cardiovascular regulation through **lung volume** changes;
- Variation in cardiac function with depth may enhance **oxygen conservation** during dives.

## 5. *Acknowledgments*


I would like to thank the animals that participated in this study and the dedicated husbandry staff whose work made this project possible. Travel support to attend this conference was provided by Fundación Oceanogràfic.