Influence of plastic on the warming of sand

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Introduction

The goal of this research is to discover if microplastics in and on the sand has an impact on its temperature and to apply that to the theoretical ratio of newborn male and female turtles, *Trachemysscripta elegans*, which gender is determined by the sand temperature in which the eggs are incubated.

Research questions and hypothesis

Research questions :

- How does the temperature of sand change depending on the presence of plastic on/in it?
- How does the presence of microplastic in/on sand impact pH value and infiltration?

It is hypothesised that:

- The temperature of the sand with microplastic will be higher than the temperature of sand without any microplastic while being exposed to the same amount and power of IR and UV radiation
- The pH value of the control group will be higher compared to the pH values of sand with microplastics and sand with microplastic and plastic on the surface, while it is presumed that the control group will have the lowest infiltration.

Research methods and materials

Groups are set in 5 glass containers in 3 systems, 3 heaters.
Groups: 3 with only sand (control groups), microplastic in sand, microplastic in and on sand
Three lamps heat its systems and keeps the temperature of sand below 28,8°C, because in those temperatures female individuals would not hatch.
Using GLOBE protocols for soil analysis we measured infiltration for all groups.
The pH value was also measured.

Picture 1. Experimental setup during the process of system calibration to the same input of heat

Picture 2. Experimental setup during the research (label 1- control group, label 4- the group with microplastic in the sand, label 5- the group with microplastics in the sand and plastic on the surface)

Results

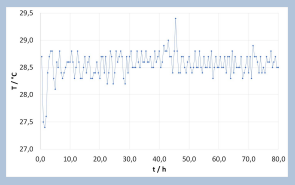

Figure 3. Sand temperature in control groups during experimental week period

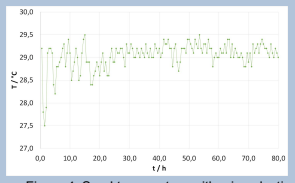

Figure 4. Sand temperature with microplastic mixture during experimental week period

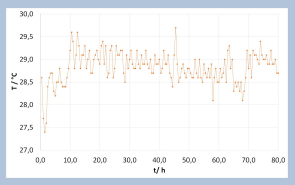

Figure 5. Soil temperature of a sand with microplastic mixture and plastic pieces on top of it mixture during experimental week period

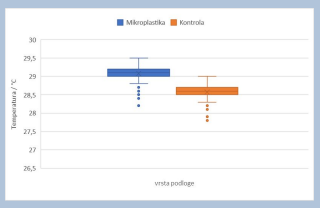

Figure 6. Comparison of sand temperature with microplastic mixture and control group; the box shows the standard deviations, horizontal line presents average value, and the vertical line the minimum and maximum values, with a dot display of extreme values.

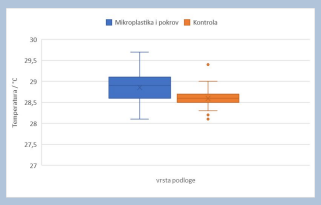

Figure 7. Comparison for soil temperature of sand with microplastic within and microplastic pieces on top and control group; the box shows the standard deviations, horizontal line presents average value, and the vertical line the minimum and maximum values, with a dot display of extreme values.

Discussion and conclusion

The results of the research match the set hypothesis. From the obtained results we can conclude that the presence of microplastic in sand and plastic on its surface increases temperature of sand by more than 0,5°C. The higher the temperature there will be more female newborns, the lower the temperature there will be more male newborns.
Obtained results of pH value and infiltration does not show big of a difference, but sand with microplastic is slightly more acidic and sand with microplastic in it and plastic on it has higher infiltration than others.

Biggest methodological limitation we had were lamps with unequal heating intensity which made calibration longer and a whole method harder to do. While spraying water some water drops were kept on the surface by plastic cover which kept sand away from getting targeted amount of moisture.
The research can be upgraded by having another way of watering sand, having turtle eggs and more replicas of glass substrates.

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