The specific aim of my research was to answer a simple question “What are the effects of plastic ingestion on loggerhead turtle’s biology and ecology?”. The overall aim was to provide new insights into biology and ecology of this protected migratory species.

I focused on the processes important for the life cycle and ecology (growth, maturation, and reproduction). My methods included using the collected experimental and literature data, developing a life cycle model based on the Dynamic Energy Budget (DEB) theory, and using the model to compare North Atlantic and Mediterranean populations, and to study the environmental (food density and temperature) and anthropogenic (plastic pollution) pressures on loggerhead turtles.

By far the most shocking result was the effect of plastic ingestion on the energy budget of loggerhead turtles, however several other results deserve attention as they provide valuable insight into the biology and ecology of loggerhead turtles. The analyses of the three life stages and two neighbouring North Atlantic subpopulations resulted in recommended carapace conversion formulae (for specific life stages as well as the whole size span) and highlighted in which cases the discovered morphological differences between life stages might play an important role. Comparison of individuals from Mediterranean and North Atlantic populations explored the effect of the environment and the effect of population-specific physiological traits (reflected as population-specific parameter values) on various life history traits, growth, maturation, and reproduction of loggerhead turtles. Analysis of the estimated (population-specific) DEB parameters and their implied properties, as well as analysis of the cases when model predictions deviate from the measured data, suggest posthatchlings might maximize their growth during the first several weeks, individuals might allocate energy to reproduction earlier than thought, and the ontogenetic habitat shift might be resulting in a bi-phasic growth curve. Finally, plastic ingestion affects the individuals similar to food dilution, resulting in small ultimate size and no reproduction when it occupies over 14% of the digestive system volume. When a several times longer residence time of ingested plastic than that of food is assumed, the effect is similar (small ultimate size and no reproduction) already when plastic occupies 3% of the digestive system volume.

Keywords: DEB, loggerhead turtle, mechanistic model, environmental changes, plastic ingestion, Mediterranean, North Atlantic