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WASTING TIME HANDLING WASTE: MICROPLASTICS IMPAIR THE FEEDING PERFORMANCE OF A MEDITERRANEAN CORAL

SPRECARE TEMPO CON I RIFIUTI: LE MICROPLASTICHE RIDUCONO LA PERFORMANCE ALIMENTARE DI UN CORALLO MEDITERRANEO

Abstract - *The Mediterranean Sea is highly affected by microplastics. This kind of pollutants is ubiquitous, and interacts with the marine biota at different levels: ingestion of microplastics was observed in an impressive number of marine species. The aim of this work is to verify if microplastics can produce a feeding impairment in* Astroides calycularis*, a shallow water coral species endemic to the Mediterranean Sea. Our findings suggest that microplastics can impair the feeding efficiency of* A. calycularis*, and therefore are likely to reduce its fitness.*

Key-words: *microplastic, foraging, handling, cnidarian, Mediterranean Sea.*

Introduction - The discard of plastics in the environment made this material one the most critical and ubiquitous sources of pollution for the oceans. In marine ecosystems plastic can be found as relatively large items, or as small fragments referred to as microplastics (diameter <5 mm). The Mediterranean Sea is largely affected by this kind of contaminants (Eriksen *et al*., 2014). The aim of this study was to investigate the effect of microplastics on the feeding behavior of *Astroides calycularis* (Pallas, 1766), a shallow water coral endemic to the Mediterranean. This species is a non-selective suspension feeder and is thought to prey on mesoplankton, and sometimes on megaplankton too, by mean of cooperative behaviour (Musco *et al*., 2016, 2018). Being a non-selective feeder, we have tested if its polyps were able to discriminate between food items and microplastic debris. We hypothesize that plastics ingestion would lead *A. calycularis* polyps to spend time and energy that might reduce the coral feeding performance and, ultimately, its fitness.

Materials and methods - Since detached colonies are often found especially in touristic areas (Musco *et al*., 2017), *A. calycularis* colonies lying on the sea bottom were collected along the Lo Zingaro coast (NW Sicily) between April and June 2016. In the laboratory, the colonies were glued to marble tiles using epoxy putty and left to acclimatize for 72 hours under starvation. During the experiment, the coral colonies were allocated in four experimental groups differing in the provided items: food (F, 20 dehydrated shrimps), microplastics (MP, 20 units), food in presence of microplastics [F(MP), 20+20 units], and microplastics in presence of food [MP(F), 20+20 units]. Units were released simultaneously, in F(MP) shrimp's ingestions were quantified, in MP(F) microplastic ones in order to get independent measurements. Eight trials were run in each group, involving a new, different colony at each trial. The experiment was video recorded. Three variables were quantified through *a posteriori* video analysis: (1) "Contact" - the number of times each item entered in contact with a polyp of the colony during 30 minutes trials; and "Ingestion" rate - the number of times each item was ingested by a polyp of the colony during 30 minutes trials. Moreover, "Handling" - the time between catch and expulsion of microplastics

was recorded in nine polyps, randomly chosen among those that caught microplastic particles at the beginning of the trial, for a maximum of 90 minutes. Colony surface areas were also measured.

Results - No differences in colony size as well as in contacts were found among treatment levels. The highest rate of ingestion was observed in the F experimental group [75.72±4.04 units (mean±1 SE)], and the lowest in MP (31.92±6.55). There was not significant difference between the ingestion rates in F(MP) (54.48±4.64) and MP(F) (58.36±5.18). Significant difference ($p<0.05$) was found between the ingestion rates of F and F(MP). The presence of microplastics decreased the food ingestion rate by 21.24% (specifically from 75.72% to 54.48%). Inversely, the presence of food items significantly increased ($p<0.05$) the microplastics ingestion rate by 26.44% (from 31.92% to 58.36%). Expulsion time of microplastics lasted on average 86.12±4.73 [minutes (mean±1 SE)]. The observation time ended with the conclusion of the trial time (90 min for this variable), not with the actual microplastics expulsion. In some cases, microplastics expulsion lasted longer. This implied an underestimation of the actual time wasted for catching, swallowing and regurgitating microplastics.

Conclusions - This study clearly reveals how *A. calycularis* catches and ingests microplastic particles, suggesting the lack of any avoidance mechanism allowing the polyps to discern between food items and non-edible microplastics. Moreover, it highlights that polyps spend a considerable amount of time to release microplastic particles once ingested. As a consequence, microplastics cause feeding impairment in *A. calycularis* since polyps are distracted for a relatively long time and may be not fully able to profit of the drifting plankton patches. Therefore, we can assume that microplastics cause a reduction of the fitness in *A. calycularis*, and presumably also in other coral species characterized by non-selective feeding strategy. Similar conclusions were reached for other coral species in different areas of the word (*e.g.* Chapron *et al*., 2018). This suggests that microplastics pollution at sea is likely to threat corals and other non-selective suspension feeders.

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