

***Chaetoceros*, the most diverse diatom genus in the global marine phytoplankton**

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Project Summary

Description of activity: *Chaetoceros* is arguably the most diverse, abundant and cosmopolitan planktonic diatom genus in the world's oceans. Its species exhibit widely contrasting morphologies and ecologies. Its blooms fuel the marine food web, and their remains rain down onto the sediment, thus forming a significant sink of CO₂. We propose to explore its biodiversity and species-specific ecological niches. Previous research uncovered a remarkably high diversity at the SZN's long-term sample stations in the Gulf of Naples, and many species in it still await taxonomic description. We will isolate specimens with unfamiliar morphology, grow them into culture strains and characterise them using DNA sequencing and electron microscopy. The sequences will be used for phylogenetic inference, and as reference barcodes to explore their occurrence in metabarcode datasets gathered over the seasonal cycles at Neapolitan stations as well as those gathered elsewhere (TARA Oceans, Malaspina, Ocean Sampling Day). Species occurring year-round in the Gulf, or exhibiting global distributions will be screened for evidence of them consisting of multiple distinct populations by means of a novel way of metabarcode exploration. How? By defining species *sensu lato* based on their dominant metabarcode haplotype and exploring their surrounding flocks of minor haplotypes for recurrent differentiation in space and time (over the annual cycles, and among distant sites).

Intellectual merit: the proposed use of metabarcode datasets to infer population differentiation at different temporal and spatial scales will revolutionise population genetic and biogeographic studies, eliminating the need for isolation and processing of hundreds of strains for microsatellite analysis. Species identification and molecular characterisation will enable translation of metabarcode data into occurrences and relative abundances of biologically meaningful species in this globally important diatom genus.

Broader impact: the societal benefits of the proposed project is in the development towards a taxonomically meaningful use of metabarcoding approaches in environmental monitoring programs globally. Metabarcoding can be done with a precision, accuracy and inter-compatibility across programs out of reach by means of screening in light microscopy (LM). It liberates taxonomically qualified staff from repetitive monitoring in LM towards more challenging scientific pursuits, and alleviates the scarcity of taxonomists in academia. Obtained strains will become available for blue-biotech. Last but not least, *Chaetoceros* species are stunningly beautiful rendering them ideal ambassadors.